Influences of Task Expectations and Failure Feedback on Learning from Subsequent Tasks

Sebahat Gok (sebgok@iu.edu)
Program in Cognitive Science & Department of Instructional Systems Technology, Indiana University
1101 E. 10th Street, Bloomington, IN 47405 USA

Emily R. Fyfe (efyfe@indiana.edu)
Department of Psychological and Brain Sciences, Indiana University
1101 E. 10th Street, Bloomington, IN 47405 USA

Abstract

Previous research suggests that negative emotions invoked by failure feedback might lead people to tune out from the task, which is detrimental to their learning. However, failure feedback is pervasive in the real world and we need to identify ways we can learn from it optimally. In the current study, the participants' (n = 218) task expectations were randomly set to be easy or hard. Then, the participants solved a novel type of equation problems that involved manipulation of researcher-invented symbols, followed by either success ("You solved the equations CORRECTLY!") or failure feedback ("You solved the equations INCORRECTLY!"). Next, the participants were provided instruction about the rules of the equation tasks and solved posttest questions across two rounds. Across different learning outcomes, we identify the cases in which the influence of feedback is moderated by task difficulty expectations (on identical items), failure feedback results in similarly high performance with success feedback (on isomorphic items), and participants learn better when they receive failure than success feedback (at a new independent task). We conclude that the tune-out reactions to failure *during* feedback might be diminished, and even be reversed, *after* feedback.

Keywords: feedback; learning from failure; task difficulty expectations; learning from errors; failure feedback

Introduction

Failure feedback (also referred to as negative feedback) refers to the information which indicates that one's performance did not meet expectations (Thiel & Semrau, 2022). Failure feedback conveys the critical information that is necessary to close the gap between the learner's current level of performance and the desired performance (Hattie & Timperley, 2018; Kluger & DeNisi, 1996). However, negative emotional responses invoked by failure feedback might cause people to tune out from the task and undermine learning (Eskreis-Winkler & Fishbach, 2019).

Previous research identified various emotional and motivational factors that can influence learners' engagement with feedback such as expectations (Eva et al., 2012), performance goals (Grundmann et al., 2021), framing of feedback (Fong & Schallert, 2023), and reminding one of their abilities and skills (Eskreis-Winkler & Fisbach, 2022).

One controversial moderating factor in engagement with feedback has been the learner's expectations about how difficult the task is going to be. Some research indicated that expecting the task to be hard facilitates learning from feedback (Norem & Cantor, 1986; Sergeant et al., 2009; DePasque& Tricomi, 2014). Expecting the task to be hard minimizes the intensity of negative emotions in the case of failure and protects self-esteem, which frees cognitive resources to learn from feedback. On the contrary, the findings from other studies (Fyfe & Brown, 2020; Menget et al., 2012) suggest that expecting the task to be hard can lead one to believe the task is unachievable, dismiss feedback information, which, in return, hinders learning.

This apparent contradiction in the results could potentially be resolved by investigating whether the learner's expectations match or mismatch their actual performance. That is, the influence of the direction of the expectations (easy vs hard) might differ based on whether one actually succeeds or fails at the task. In order to investigate this possibility, in the current work, we set the participants' task difficulty expectations to ***easy vs hard*** at the beginning of the experiment and then ask them to solve equation problems with research-generated symbols. Based on their performance at this initial test, we provide them with either ***success feedback*** or ***failure feedback***. Then, we provide them with explicit instruction on how to solve the problems and measure their learning. Thus, the experiment investigates how task difficulty expectations and feedback prepare people to learn from future tasks.

The Current Study

The current study extends previous experiments (Eskreis-Winkler & Fishbach, 2019; Gok & Fyfe, 2022; 2023), at which researchers investigated how various factors influence learning from *success feedback* ("You answered this question correct!") vs *failure feedback* ("You answered this question incorrect!") in the context of symbol memorization tasks. Building upon these previous experiments, the current work investigates how task difficulty expectations and *success feedback* vs *failure feedback* influence learning from subsequent rule-based tasks.

In the current study, we randomly assigned the participants to one of the two expectation conditions (*expect-hard* and *expect easy*). After an initial test, the lower performers received failure feedback and the higher performers received success feedback. We measured how the *randomized task expectation* condition and the *valence of the feedback (success vs failure)* provided at the initial test influenced their learning from two subsequent rule-based tasks.

In M. Goldwater, F. K. Anggoro, B. K. Hayes, & D. C. Ong (Eds.), *Proceedings of the 45th Annual Conference of the Cognitive Science Society.*

Participants

Participants were 218 undergraduate students from the researchers' university who received credit in their psychology course. Their average age was 19.05 years (*SD* = 1.80). Most students reported their gender as female (55.04%), followed by male (44.49%) and transgender (1 participant); ethnicity as White (66.50%), followed by Asian or Asian American (12.38%), Black or African American (10.55%), Hispanic or Latino (7.33%), and Other (3.21%); and their year in college as Freshman (49.08%) followed by Sophomore (34.40%), Junior (10.09%), and Senior (6.42%).

Design

The study took place as a between-subjects randomized design with one factor at two levels (task expectation: expect-hard and expect-easy). 218 students were randomly assigned to one of the two conditions (expect-hard: n = 113, expect-easy: n = 105). There were no significant differences between the two conditions in terms of percent of female students, percent of white students, age, and years in college.

Procedures

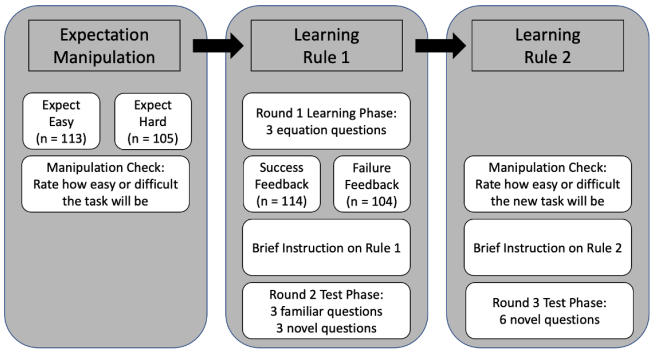


Figure 1. Schematic depiction of the procedures

The study took place as a single online session on Qualtrics. First, the participants were randomly assigned to receive the statement that most people find solving the equations extremely easy vs. extremely hard. Then, they solved three questions (Round 1) and based on their performance, they were categorized as low-performers who received failure feedback (n = 104) or high-performers who received success feedback (n = 114). This was followed by instruction on the underlying rule of the equations and then their learning was tested (Round 2). Next, participants were instructed and tested on a new rule (Round 3). This last round aimed to assess how success or failure feedback prepares people to learn from future task - not just the task on which they received feedback. We detail the procedures below by the order they appeared during the experiment (See Figure 1).

Expectation manipulation and measurement

The participants were randomly assigned to *expect-easy* and *expect-hard* conditions. The manipulation text was adapted from Fyfe and Brown (2020). The participants in *expect-easy* condition received the text: "One of the reasons we are studying these equations is because they are EXTREMELY EASY to solve. The vast majority of people solve these equations correctly and we expect solving these equations will be easy for you as well." The participants in *expect-hard* condition received the text: "One of the reasons we are studying these equations is because they are EXTREMELY DIFFICULT to solve. The vast majority of people don't solve these equations correctly and we expect solving these equations will be difficult for you as well."

A manipulation check was then administered in which the participants were asked to select how easy or difficult they expect the task to be on a 5-point Likert scale as a manipulation check.

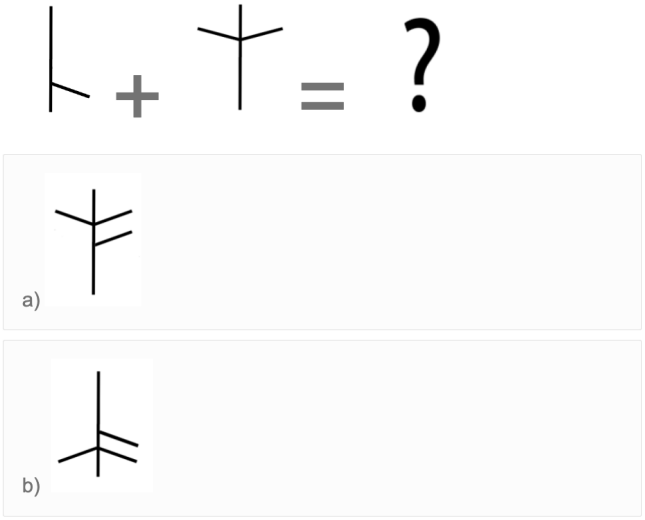


Figure 2. An example question about Rule 1.

Learning Rule 1

At **Round 1,** as in the previous experiments (Eskreis-Winkler & Fishbach, 2019; Authors, 2022; Authors, 2023), participants completed three questions, each with two options, and each followed by feedback that indicates whether the response was correct or incorrect. For these questions, participants needed to select the symbol that correctly satisfied the equation (See Figure 2 for an example question). In contrast to previous studies, the feedback was authentic. That is, the response was not randomly determined to be correct or incorrect. Instead, the correct response was predetermined based on the rules of the task, and the feedback indicated whether the participants' response was correct or not according to those rules.

This procedure meant that participants sometimes received a mix of success and failure feedback. To create a binary split of feedback valence, like in these previous experiments, the participants received an overall feedback message at the end of Round 1 that indicated success or failure. Those who scored at the lower half (scores of 0-1) received **failure feedback** ("You solved most/all the equations INCORRECTLY!") and the others who scored at the upper

half (scores of 2-3) received **success feedback** ("You solved most/all the equations CORRECTLY!").

At this point, the participants were also reminded the task expectations based on their condition ("Remember that the problems are EXTREMELY EASY/DIFFICULT to solve"), and they were told whether their performance aligned or misaligned with these expectations. For example, if a participant was told the task was difficult and received failure feedback (scores 0-1), they were told their performance aligns with most people who took the test (See Figure 3 for an example feedback statement).

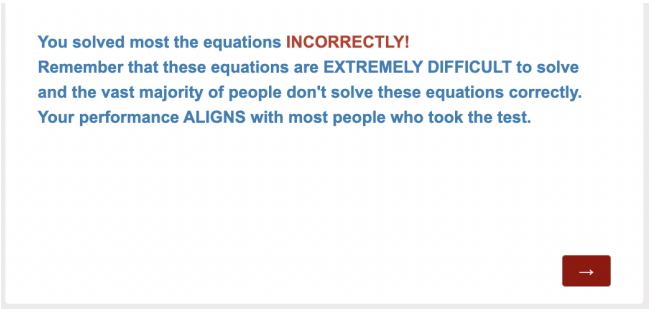


Figure 3. An example feedback statement from ***expect-hard*** and ***failure feedback*** group.

After Round 1 ended, all participants were given explicit instruction about the rule and how to apply the rule to solve the equations (See Figure 4).

At **Round 2,** a test with 6 questions was administered to assess how well participants learned the Rule 1. The first half were the same questions asked at Round 1 (**identical items**), and the latter half were novel symbols that followed the same rule (**isomorphic items**). Each question within each of the two types of items were randomly ordered.

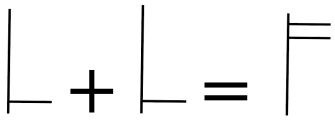
Learning Rule 2

After Round 2 ended, participants were informed that they were going to learn a new rule with a new set of equations. Our goal was to see if pre-existing expectations and pre-existing experience with success or failure feedback influenced their ability to learn a new set of information. First, the participants were asked to rate how easy or difficult they expected this second rule to be on a 5-point Likert scale. Then, all participants were explicitly given instructions about a new rule with a new set of symbols (See Figure 5). To test how much they learned from the instructions, the participants were asked 6 novel questions about this new rule, each with four options, all randomly ordered **(Round 3).**

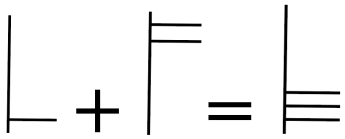
Finally, the participants were asked how difficult they found the experiment's task on a 5-point Likert scale. The experiment concluded with debriefing on the task and demographic questions.

To solve the equations, count the *sum* of the number of branches of two symbols:

- If the sum is an ***even*** number, the branches of the sum should start from the **top** of the trunk:



- If the sum is an ***odd*** number, the branches of the sum should start from the **bottom** of the trunk.

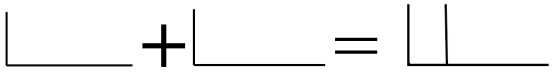


RULE 1

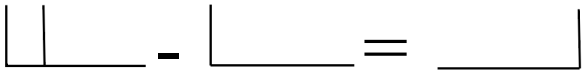
Figure 4. Rule 1

This time the critical dimension is the horizontal position of the branches to the trunk: Are they on the left or right?:

- If the operation is addition (+), place the branches of the sum at the same direction with that of the first symbol:



- If the operation is subtraction (-), place the branches of the difference at the opposite direction with that of the first symbol.



RULE 2

Figure 5. Rule 2

Results

We group the results under three subsections. First, we report on several initial manipulation checks we conducted to ensure that our manipulations worked as we intended. Second, we report on outcomes at Learning Rule 1 (that is, Round 2 performance on identical test items, and isomorphic test items, separately). Third, we report on outcomes at Learning Rule 2 (that is, measured task expectations and Round 3 performance), and perceived difficulty of the overall task. We also report the descriptive statistics on learning outcomes for each objective score *(0-3)* at the initial test (See Table 1).

Manipulation Checks. As mentioned above, Round 1 questions each had two options (one correct, one incorrect) and participants had not yet learned the rule for how to solve these problems. Thus, we expected both options to be equally plausible. As we expected, one-sample t-tests revealed that both randomized groups (expect-easy vs expect-hard) performed at chance level at Round 1 ($M_{expect\text{-}easy}$ = 55.16%, $SD_{expect\text{-}easy}$ = 35.29%, p = 0.12; $M_{expect\text{-}hard}$ = 47.93%, $SD_{expect\text{-}hard}$ = 32.33%, ; p = .51).

We also checked whether the expectation manipulation worked. As we expected, the measured task expectation before any learning occurred was significantly different across randomized task-expectation conditions ($M_{expect\text{-}easy}$ = 2.30, $SD_{expect\text{-}easy}$ = 0.85; $M_{expect\text{-}hard}$ = 3.94, $SD_{expect\text{-}hard}$ = 0.8, p < 0.01), but not between feedback-type groups (p = .72), nor was the Round 1 objective performance was a significant predictor (p = .54). That is, participants who were told the task would be easy did in fact expect the task to be easier than those who were told the task would be difficult.

Findings at Rule 1. We analyzed **identical** and **isomorphic items** at Round 2 separately, which occurred after participants had received feedback on the initial items and after they had received instruction on the rules.[1] On the identical items, there was no significant main effect of randomized task-expectation condition (F = .77, p = .37) or assigned feedback type (F = .52, p = .46). However, there was an interaction effect of the two (F = *5.89*, p = 0.01, η^2 = .03). The participants who received *success feedback* performed better at *expect-easy* condition while participants who received *failure feedback* performed better at *expect-hard* condition (See Figure 6). The results suggest that the match between expectations and achievement leads to better learning. In other words, if a learner is told the task is going to be easy, they learn better if they actually succeed. If they are told that the task is going to be hard, they learn better if they actually fail.

On the isomorphic items, there was not a significant main effect of task-expectation condition, assigned feedback type, or the interaction of the two (Fs < 1, p > .5).

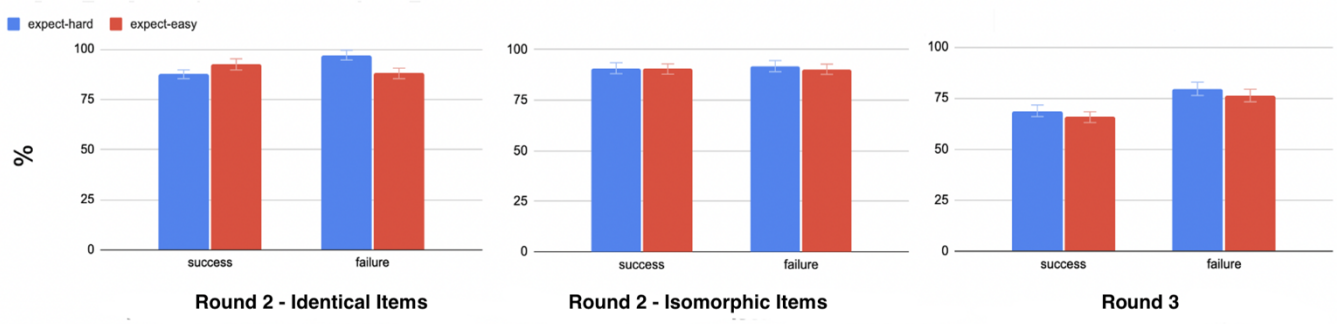


Figure 6. Posttest performances by feedback type and task expectation conditions

Findings at Rule 2. On the task expectation that was measured before Rule 2 instruction started, there was a main effect of randomized expectation condition (F = 15.32, p < 0.01) and assigned feedback type (F = 5.56, p = 0.01), but no interaction of the two (F <0.01, p = 0.96). The participants in expect-hard condition (M = 3.29, SD = 1.05) expected the second round to be more difficult than expect-easy condition (M = 2.72, SD = 0.93), and the participants who received failure feedback (M = 3.20, SD = 1.06) expected the task to be more difficult than success feedback group (M = 2.81, SD = 0.97).

At Round 3, there was a main effect of assigned feedback type (F = 7.50, p < 0.01, d = 0.39), but there was no main effect of randomized task expectation, and no interaction effect (Fs < 1, p > .5). Failure feedback group (M = 78.04%, SD = 27.50%) performed better than the success feedback group (M = 66.95%, SD = 29.24%) (See Figure 6 and Table 1).

Finally, we measured the perceived difficulty of the task across the conditions. No factors, or their interaction, were significant (Fs < 1, p > .5).

[1] Here, we report the results from 2x2 ANOVAs at which we used ***assigned feedback type*** and ***randomized task-expectation condition*** as factors on posttest scores. We also ran a secondary analysis of a linear regression with participants' ***objective initial test scores*** *entered* as a continuous predictor, ***randomized expectation condition*** as a dummy variable, with their interactions. Across the two types of tests, the results showed consistent patterns at all tests.

	Round 1 Objective Scores			
	0 (*n*=40)	**1** (*n*=64)	**2** (*n*=68)	**3** (*n*=46)
Round 2 Identical Items				
Expect-Hard	98.24 (1.75)	96.49 (2.09)	87.09 (3.68)	88.23 (6.96)
Expect-Easy	90.47 (5.21)	85.89 (5.89)	89.18 (4.29)	96.55 (1.91)
Round 2 Isomorphic Items				
Expect-Hard	91.22 (6.16)	92.10 (2.93)	91.39 (3.49)	88.23 (5.67)
Expect-Easy	95.23 (3.47)	87.17 (5.57)	91.89 (3.26)	88.40 (4.75)
Round 3				
Expect-Hard	78.07 (6.25)	80.26 (4.39)	72.04 (5.09)	62.74 (8.15)
Expect-Easy	78.57 (5.53)	74.35 (6.07)	64.41 (5.13)	67.24 (4.71)

Table 1. M(SE) of the test scores (Round 2: identical items, Round 2: Isomorphic items, Round 3) sorted by objective Round 1 performance and the task-expectation conditions. Note that Scores 0-1 were assigned ***failure feedback*** and Scores 2-3 were assigned ***success feedback.***

Discussion

The current study aimed to investigate the influences of expectations about task difficulty and feedback on learning from two subsequent rule-based tasks. First, we randomly set the participants' task difficulty expectations to easy vs hard. Then, the participants solved equation problems that involved manipulation of research-generated symbols. Based on their responses, they received either success or failure feedback (Round 1). Following feedback, they received instruction on how to solve equations and responded to test questions across two more rounds. In the second round, we found an interaction effect between manipulated task expectation and assigned feedback valence on the test items identical to the Round 1 items. In the third round, we measured learning at a new rule-based task, at which the participants who had received failure feedback at Round 1 outperformed those who had received success feedback at Round 1. We discuss the findings from each round in detail.

At Round 2 Identical Items, we retested the participants with the same questions they had answered at Round 1. We replicated the results from our previous experiment (Gok & Fyfe, 2023) which had shown that success feedback is more beneficial for learning when the task is expected to be easy in the context of a symbol memorization task. In the current study, we additionally found that failure feedback was more beneficial for learning when the task was expected to be hard. This result might shed light into the contradictory recommendations from the previous literature on whether learners should set their expectations to high levels of difficulty (e.g., Sergeant et al., 2009) or low levels of difficulty (e.g., Fyfe & Brown, 2020) before they start a task. The results suggest that the subsequent performance moderates the influence of the task expectations. More specifically, expectations should match with the subsequent performance for better learning. When followed by success, it is possible that expecting the task to be easy encourages learners that the task is achievable and exerts more effort in learning from instruction. In the case of failure, expected task difficulty might function as an ego-securing element that allows allocating more cognitive resources to learning from the instruction. It should be noted, however, that these effects were constrained to identical items and were not apparent when the learning outcome was changed to isomorphic items. All groups performed similarly high at Round 2 - Isomorphic Items (See Figure 6).

An even more interesting result is that those who initially received failure feedback surpassed those who received success feedback at the last test (Round 3), which was a more difficult test than the previous ones. These results suggest that *tune-out* reaction caused by failure feedback does not only vanish at learning from subsequent tasks, but failure feedback might even lead to more *tuning in* at later tasks. Though the rule structure at Round 3 was similar to the rule in the previous rounds, Round 3 test might have required more attentional resources for successful completion as there were four choices instead of only two. It is possible that failure feedback groups tuned in to the task better, and exerted more effort in the elimination among the distractor options, which resulted in a higher performance.

We did not find evidence that the randomized task difficulty condition had influence on the outcomes at Round 3, though. Does that mean that expectations did not matter in this task? This is a possible answer, however, it should be noted that we did not have a baseline condition without a task expectation manipulation. Therefore, it is not possible to rule out the explanation that both expect-easy and expect-hard conditions influenced the effort exerted, but in similar ways. Some theorists suggested that expected task difficulty has a U-shaped effect on performance (Shenhav et al., 2021). Accordingly, too low/high levels of expected difficulty lowers the efforts exerted during the task while the effort increases from low-to-moderate levels of expected difficulty. Future research should extend the current study by including more variation in the manipulated levels of task difficulty expectations for a more nuanced understanding of the

relationship between expectations and achievement on learning.

The experiments from previous studies (Eskreis-Winkler & Fishbach, 2019; Gok & Fyfe, 2022; Gok & Fyfe, 2023) consistently showed that failure feedback is *ego-threatening* and can cause people to *tune out* from the task, which is detrimental to their learning. All these studies, however, measured learning *during* the feedback. That is, information to be learned was mainly provided by the feedback, and the participants were not given a separate training later on. The current study, instead, tested participants' learning from the information that was presented to them *after* the feedback. That is, the participants were first given feedback to their responses to the questions about a novel task. Then, they were trained on the rules of the task. Within this paradigm, none of the current study's outcomes suggested a *tune-out* reaction influenced by failure feedback. The influence of feedback was moderated by task difficulty expectations (Round 2, Identical Items), or similarly high with that of success feedback (Round 2, Isomorphic Items), and even resulted in better performance than success feedback at an independent and a more difficult task (Round 3). In none of the outcomes did failure feedback have a main negative effect on learning. Overall, these results suggest that the emotional and motivational processes that influence learning *during* failure feedback may be distinguishable from the processes that influence learning *after* failure feedback, which imply that time of learning could be an important factor while considering the tune-out reactions to failure feedback.

Open Practices Statement

Pre-registration of the experiment can be accessed at https://osf.io/8e9jg

References

DePasque Swanson, S., & Tricomi, E. (2014). Goals and task difficulty expectations modulate striatal responses to feedback. *Cognitive, Affective, & Behavioral Neuroscience*, *14*, 610-620.

Eskreis-Winkler, L., & Fishbach, A. (2019). Not learning from failure—The greatest failure of all. *Psychological Science*, *30*(12), 1733-1744.

Eskreis-Winkler, L., & Fishbach, A. (2022). You think failure is hard? So is learning from it. *Perspectives on Psychological Science*, *17*(6), 1511-1524.

Eva, K. W., Armson, H., Holmboe, E., Lockyer, J., Loney, E., Mann, K., & Sargeant, J. (2012). Factors influencing responsiveness to feedback: On the interplay between fear, confidence, and reasoning processes. *Advances in Health Sciences Education*, *17*, 15-26.

Fong, C. J., & Schallert, D. L. (2022). "Feedback to the future": Advancing motivational and emotional perspectives in feedback research. *Educational Psychologist*, 1-16.

Fyfe, E. R., & Brown, S. A. (2020). This is easy, you can do it! Feedback during mathematics problem solving is more beneficial when students expect to succeed. *Instructional Science*, *48*, 23-44.

Gok, S., & Fyfe, E. R. (2022). Learning from failure through task- vs self-focused feedback. In J. Culbertson, A. Perfors, H. Rabagliati & V. Ramenzoni (Eds.), *Proceedings of the 44th Annual Conference of the Cognitive Science Society* (pp. 2236-2241). Toronto, Canada.

Gok, S., & Fyfe, E. R. (2023, April). Students' expectations about task difficulty influence learning from success feedback. Poster presented at 2023 American Educational Research Association Meeting. Chicago, IL.

Grundmann, F., Scheibe, S., & Epstude, K. (2021). When ignoring negative feedback is functional: Presenting a model of motivated feedback disengagement. *Current Directions in Psychological Science*, *30*(1), 3-10.

Hattie, J., & Timperley, H. (2007). The power of feedback. *Review of Educational Research*, *77*(1), 81-112.

Kluger, A. N., & DeNisi, A. (1996). The effects of feedback interventions on performance: a historical review, a meta-analysis, and a preliminary feedback intervention theory. *Psychological Bulletin*, *119*(2), 254-284.

Mangels, J. A., Good, C., Whiteman, R. C., Maniscalco, B., & Dweck, C. S. (2012). Emotion blocks the path to learning under stereotype threat. *Social Cognitive and Affective Neuroscience, 7,* 230–241

Norem, J. K., & Cantor, N. (1986). Defensive pessimism: Harnessing anxiety as motivation. *Journal of Personality and Social Psychology*, *51*(6), 1208.

Sargeant, J. M., Mann, K. V., Van der Vleuten, C. P., & Metsemakers, J. F. (2009). Reflection: a link between receiving and using assessment feedback. *Advances in Health Sciences Education, 14*(3), 399-410.

Shenhav, A., Prater Fahey, M., & Grahek, I. (2021). Decomposing the motivation to exert mental effort. *Current Directions in Psychological Science*, *30*(4), 307-314.

Thiel, K., & Semrau, T. (2022). Learning from failure feedback for subsequent task performance: A matter of personality? *Frontiers in Psychology*, *13*. 1-9.