

The Effects of Evaluative Feedback on Novel-Task Self-Efficacy and Future Performance

by

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## Abstract

There is a significant amount of research in the literature that has explored the effects of evaluative feedback on an individual's self-efficacy and performance on a familiar task, yet there is little that has investigated the extent to which feedback can also impact these variables on *novel* tasks. Therefore, this study endeavored to shed light on this. To do this, a procedure was utilized in which participants with little to no experience with logical reasoning activities learned how to play Sudoku and attempted to correctly fill in as many beginner-level 6 X 6 puzzle spaces as they could in a specified amount of time and then, after receiving a type of feedback (positive, normative, negative), did this again. In order to assess self-efficacy, these participants were asked to complete the Self-Efficacy Distance Scale before their first attempt at the Sudoku puzzles and again after they received their respective feedback. No significant differences were found for any of the feedback groups on the variable of performance. However, it was discovered that the positive feedback group experienced significant increases in self-efficacy in comparison with the normative group and that the negative feedback group experienced significant decreases in self-efficacy in comparison with it. As a result of carrying out this study and attaining these results from it, it can be concluded that individuals can become more efficacious about their ability to perform a novel task if they are exposed to the task in an encouraging environment.

*Keywords:* feedback, self-efficacy, performance, novel

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### The Effects of Evaluative Feedback on Novel-Task Self-Efficacy and Future Performance

The variable of evaluative feedback has long been a focus of psychological research. This is because evaluative feedback - feedback that judges actions but does not provide instruction for improvement - plays an integral role in determining outcomes in many different focus areas and contexts. However, its impact in the areas of performance and self-efficacy is to be the focus of this literature review. In regards to this impact, it may be possible that this type of feedback can serve as a reason for why there are times people may feel efficacious that they will perform their respective tasks or skills flawlessly and subsequently do perform them well, and others that they do not feel efficacious about their upcoming performances and then cannot even seem to execute the basics of the given skill. It may also be able to account for why there are varying levels of performance quality and self-efficacy among individuals of similar talent.

Much research has been conducted in the domain of this sub-topic in order to explore this, and has demonstrated that evaluative feedback is indeed a very influential factor in shaping how well one performs - and believes one can perform - on a subsequent performance of a given task. Feedback may impact individuals' subsequent performances and expectations because it causes them to subconsciously impose psychological limitations on themselves. It is often the case, however, that there is a significant discrepancy between their psychological and physical limitations. This explains why scientists' discouragement was the reason that no runner before Roger Bannister was able to run - or believed they were able to run - the mile in under four minutes (Mariano, 1999). The findings of a majority of the relevant empirical studies have generally followed along these lines. Although a few studies have had contrary findings (Kannappan, Yip, Lodhia, Morton, & Lau, 2012; Dusek & O'Connell, 1973; Podsakoff & Farh, 1989) it has generally been found that those who receive positive feedback enjoy greater success

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on a subsequent performance while those who receive negative feedback perform worse on their subsequent attempt. As well as this, it has also generally been found that those who receive positive feedback experience higher self-efficacy while those who receive negative feedback experience lower self-efficacy. Therefore, the present review will focus on discussing the studies that have attained these findings. Such studies have conducted their research in a variety of different contexts/settings. These contexts are education, employment, and sports/motor skills.

### **Context of Education**

A number of studies that have been conducted in the context of education have provided support for these feedback-self-efficacy and feedback-performance findings. Some of the studies have conducted correlational research on them, while others have attempted to identify causality through the use of an experiment. In regards to correlation, the studies that exist have primarily investigated the relationship between feedback and self-efficacy. Such a study is by Arslan (2012). In this one, 1049 middle school students self-reported on both the degree to which they had previously been verbally persuaded (or in other words, encouraged) and their self-efficacy. This researcher found that verbal persuasion was a significant positive predictor of self-efficacy.

Correlational studies are indeed revealing and pertinent, but to see if there are causal relationships it is necessary to examine research that has controlled for possibly-confounding variables. These studies have assessed the effects of different types of feedback through the use of a between-subjects, within-subjects, or mixed design. In regards to the impact of feedback on performance, the first study to discuss is the one carried out by Clair and Snyder (1979), in which college students were randomly assigned to groups and listened to audio-taped lectures that varied in the type of evaluative feedback given. After the lectures, the students took an exam on the material that they had just learned. It was found that exam scores were highest for the

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students who listened to the instructor that gave positive feedback. Another one, by Plakht, Shiyovich, Nusbaum, and Raizer (2013), provided nursing students with either positive or negative feedback during their clinical practice. Those that received favorable remarks from their teachers went on to obtain higher grades than those whose efforts were met with criticism.

There is also a supportive experiment that has measured self-efficacy. This is the one by Baron (1988). In this study, 106 undergraduates complete both a proofreading and a clerical task. After the first completion of these tasks, these participants were asked to self-report how efficacious they felt about performing them. They were subsequently given either constructive feedback, destructive feedback, or no feedback on their performances. After this, they were asked to self-report how efficacious they felt about the prospect of performing the two tasks again. It was found that the group that had been provided destructive feedback reported significantly lower levels of self-efficacy than did those in the other two groups.

### **Context of Employment**

Aside from the studies that have investigated how academic performance is affected, there are others that explore how feedback impacts work-related self-efficacy and performance. These include both correlational and experimental studies. A correlational study that supports the relationship between feedback and performance is that by Brown, Oubre, and Chakrabarty (2008). In it, salespeople self-reported the extent to which they believed that their supervisors behaved in a positive and encouraging manner towards them. Participants' survey responses were then matched up and compared with their sales performance at their companies. After assessing and analyzing their results, the researchers found that the degree to which supervisors acted in an encouraging manner did indeed positively correlate with their employees' performance.

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In regards to the studies that investigate how feedback and self-efficacy relate to each other, there is a particularly relevant one that was carried out by Maertz, Bauer, Mosley, Posthuma, and Campion (2005). These researchers wanted to see how well pass/fail feedback - among other variables - predicted the employment testing self-efficacy of 287 job applicants at a utility company. These applicants were assessed for self-efficacy before and after the testing, and again after receiving either pass or fail feedback. It was found that lower self-efficacy scores were reported by those that had been given "fail" feedback and that higher self-efficacy scores were reported by those that had been given "pass" feedback. Another study investigated how 12 elementary teachers' self-efficacy for teaching science related to positive verbal persuasion. The results suggest that this type of verbal persuasion did indeed correlate positively with teachers' efficacy for teaching science (Palmer, 2011).

As well as correlational studies, there is an experiment that has been carried out in this context of employment that lends support to the feedback-self-efficacy finding. This is the one by Reynolds (2006). In it, 296 employees completed a measure that measured their job-specific self-efficacy before and after receiving a type of feedback from their respective supervisors. Some received positive feedback, while others received negative feedback. Analyses revealed that positive feedback had a significant positive effect on self-efficacy and that negative feedback had a significant negative effect on self-efficacy.

Other research has instead investigated the impact of feedback on actual performance. This includes a study (Crawford, Thomas, & Fink, 1980) in which sailors on a navy ship were randomly divided into three groups. The sailors in all three groups were asked to perform their duties. One of these groups - the experimental group - received positive encouragement and

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affirmation every time they partook in a favorable behavior change. The researchers ultimately found that the experimental group had the greatest improvement differences.

### **Context of Sports and Motor Skills**

Beside from these studies that have assessed the effects of feedback on work-related self-efficacy and performance, there is also research that has investigated the effects of the variable in the context of sports and motor skills. The correlational studies that have been carried out in this context primarily investigate the strength and direction of the relationship between feedback and self-efficacy. One of these studies was performed by Valiante and Morris (2013). These researchers assessed the relationship between verbal persuasion from others and self-efficacy by interviewing 12 male golfers. They discovered that the two variables were positively correlated. In addition, Vargas-Tonsing (2009) assessed the impact of an emotionally-moving pre-game speech on 151 competitive soccer players' self-efficacy. In order to do this, the researcher had the participants complete a survey that measured their self-efficacy both before and after their respective coach gave them a speech. A repeated measures regression analysis indicated that there was a moderate positive correlation between speech positivity and players' self-efficacy.

There are also experimental studies within this context of sports and motor skills that must be considered. Looking at the ones that pertain to the feedback-performance finding, there are several that are noteworthy. Coffee and Rees (2011) asked participants to complete a dart-throwing task while blind-folded. Following participants' completion of the task, they were given false negative feedback and asked to complete the task again. The researchers found that they performed notably worse on their second try. In another study, 10-year-old children were asked to complete a throwing task and were then given either false positive feedback (the experimental group) or truthful feedback (the control group). It must be noted that the feedback

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was provided in the form of social-comparisons. Upon receiving their feedback, the participants performed the task again. After comparing and analyzing the performance scores of the two groups, the researchers discovered that the children in the positive condition were more accurate on their second attempt than those in the control condition were (Ávila, Chiviacowsky, Wulf, & Lewthwaite, 2012). The study performed by Saemi, Porter, Ghotbi-Varzaneh, Zarghami, and Maleki (2012) must also be discussed. The researchers in this one asked 24 young adults to complete a task that involved throwing a tennis ball with their non-dominant hand and trying to hit a target - all while wearing vision-distorting goggles. Each participant performed blocks of trials. Some were only provided with knowledge of their performance on a given trial when they had done well, and others were updated only if they had performed poorly. A day later, the participants from both groups completed the blocks for a second time. This time, however, they were not provided with knowledge of their results. The researchers ultimately found that the positive feedback group performed better on the second attempt and that the negative feedback group performed worse on it.

There is evidence that supports the feedback-self-efficacy finding as well. This comes from the aforementioned study by Saemi et al. (2012). The 24 young adults who completed blocks of trials of throwing a tennis ball were asked to complete the Self-Efficacy Scale before and after receiving either positive or negative feedback on their performances. The researchers found that those who were provided with knowledge of their performance quality only after successful trials had significantly higher levels of self-efficacy than did those who were provided with knowledge of it only after unsuccessful trials.

### **Focus of the Present Study**



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In a great number of these studies, however, participants were at least somewhat familiar with the tasks they performed. However, it has still not been *thoroughly* investigated whether or not evaluative feedback has an effect on their ability and perception of their ability to perform a completely *new* task. Obviously, when people have performed particular tasks many times, they get a sense of their own abilities on them. This influences how successful they are and believe they are going to be in subsequent performances. However, if people are new to a task and are given feedback, it is intuitive to think that the feedback would not substantially impact their self-efficacy and subsequent performance on a task because they would not yet have a definite sense of their aptitude. In other words, they 1) could potentially be more open-minded about their true potential and feel that it is too early in the learning process to draw any absolute conclusions and 2) could lack an accumulation of past experiences that would facilitate their affirmation of a particular type of feedback. However, it may be the case that individuals' self-efficacy and performance on a new task *is* significantly influenced by feedback. Were this to be the case, it would mean that feedback impacts these variables from even the earliest stage of learning. Although there are some studies that *have* investigated this, the tasks that have been utilized in their respective procedures have been somewhat related to activities that participants would have had experience with in the past. For example, in the study carried out by Ávila et al. (2012), children were asked to complete a novel type of throwing task. It is more than likely though that many of these children had thrown a ball before, especially if they had previously participated in sports such as baseball and football. As a result, the task could not have been completely novel for many of the participants. That there is a lack of construct validity in studies that explore the impact of feedback on *novel* tasks suggests that such research has not been able to accurately assess these relationships. Therefore, this study strived to accurately investigate this and thus

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make the literature on this topic more comprehensive. In line with the findings of many of the studies previously discussed, it was hypothesized that those who received positive feedback on their performance on a novel task would *indeed* experience significant increases in future performance quality and self-efficacy, and that those who received negative feedback would *indeed* experience significant decreases in future performance quality and self-efficacy.

### Method

#### Participants

This study utilized a sample size of 69 participants. This sample consisted of students from the University of Michigan-Dearborn that were enrolled in a psychology course. They were recruited through the University's research participation system. Of these participants, 39 (56.52%) were female and 30 (43.48%) were male. The purpose of utilizing an approximately equal number of females and males in this study was to control for the confounding variable of males having, on average, higher levels of self-efficacy than females. It is important to note that participants had been pre-screened to ensure that they did not have *any* prior experience with Sudoku puzzles and little to no prior experience with logical puzzles *in general*. To be pre-screened, participants were asked: "Have you ever done Sudoku puzzles?" and "Would you say that you have little to no experience with doing logic/mathematical puzzles (Fencing Numbers, Linking Bridges, etc.)?"

#### Materials and Measures

The materials used to carry out this study consisted of multiple beginner-level 6 X 6 Sudoku puzzles (see Appendix for an example puzzle), solutions to these puzzles, Sudoku puzzle instructions, a "bogus" chart of performance scores, an Apple iPhone, and an original 304.8-millimeter Self-Efficacy Distance Scale. This scale was simply a horizontal line that assessed the degree to which participants believed in their ability to perform well on future sets of Sudoku

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puzzles. The exact question used to assess this was: “How confident do you feel about your upcoming task attempt?” The left-hand endpoint of this line represented “Low self-efficacy” and was given a marking of “0” millimeters while the right-hand endpoint represented “High self-efficacy” and was given a marking of “304.8” millimeters.

### **Design**

In this study, the dependent variables were the total number of digits correctly filled in across *all* Sudoku puzzles attempted, as well as the scores on the measure of self-efficacy. The independent variables were: type of feedback (positive, normative, negative) and testing time (time 1, time 2). Type of feedback was a between-subjects variable, while testing time was a within-subjects variable. Therefore, this study utilized a 3 X 2 mixed design. This means that there were three feedback groups (positive, normative, negative) that were measured on their self-efficacy and performance at two different points in time: Before the feedback (time 1) and after the feedback (time 2).

### **Procedure**

Participants dedicated up to 1 hour of their time to participate in the study. First, they were allocated 2 minutes to read over and sign the informed consent form. It must be noted that they were also given the opportunity to ask any clarification questions at this time. Subsequently, participants were taught by the researcher how to play Sudoku. They were allocated *up to* 30 minutes to become comfortable with performing the task. This learning period consisted of 1) reading the rules of the game, 2) watching the researcher complete a puzzle while listening to him/her explain how it was being completed, and 3) completing a puzzle under the supervision of the researcher. This helped to make certain that participants knew how to perform the task correctly. And it is imperative that they did because they may otherwise have become stuck on

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the very first puzzle and/or filled in random numbers to make it look like they were making progress in their attempts. This would ultimately have led to the collection of nonsensical data. It must also be noted that the length of this learning period inevitably varied from person to person, as some were naturally more skilled than others. In order to make it difficult for participants to know how quickly they acquired the skill, the researcher did not tell the participants 1) how much time they were to be allocated to learn, 2) how long they actually took to learn, and 3) how long it took *other* participants to learn. This was important to do because the participants could not be allowed to get a real sense of how well they *actually* performed. If they had been able to, it would have rendered the false feedback that was to follow later in the procedure not-believable and meaningless. Following this learning period, participants were asked to indicate on the Self-Efficacy Distance Scale how confident they felt about their upcoming first attempt. They were allocated exactly 45 seconds to do this.

Next, they were told that their work was to be checked on both of their upcoming task attempts. At this point in the procedure, the researcher briefly showed the participants the solutions to the puzzles. This served to make them believe that their puzzles would indeed be checked for accuracy. It was important for participants to know that their work would be checked because it provided them with motivation to actually follow the directions and not simply fill in the puzzles with random numbers to get finished quickly.

After being shown the solutions to the puzzles, participants actually engaged in the task for the first time. Their objective was to *correctly* fill in as many spaces of ten 6 X 6 beginner-level Sudoku puzzles as they could in a 9-minute period. To correctly perform the game of Sudoku, participants had to write the numbers "1" through "6" in such a way that each number only appeared once in every grid, row, and column. The reason that they were given 10 puzzles

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was so that there was no way a given participant could actually complete the task. This was important because if participants had been able to complete the task, then they would have been able to objectively know that they had performed the task really well. This would have been problematic for feedback believability. Furthermore, these puzzles were beginner-level to ensure that even those who were having difficulty with Sudoku puzzles could at least have *some* success with them. And if they were enjoying some level of success, then it was much more likely that they would believe positive feedback. It is also necessary to note that all participants received the *same* set of Sudoku puzzles. This standardization facilitated more accurate comparisons of their performances.

In order to ensure that the participants were being allocated exactly 9 minutes, the researcher utilized the stopwatch feature on the Apple iPhone as a means to time this period. It must be noted that they were not able to see the iPhone as they worked, as the time countdown could potentially have been a source of distraction for them. Furthermore, these participants were not told at the end of the 9 minutes exactly how many spaces they correctly filled in. The reasoning behind doing this was to make sure that they could not be decisively sure about how well they did. This ultimately aided in making the false feedback that was to follow seem more believable and likely to be true.

Upon participants' completion of the first Sudoku task attempt, their scores were recorded. Subsequently, the researcher proceeded to check the puzzles participants had completed/were in the process of completing. The researcher took exactly 2 minutes to do this for *all* participants.

After this, participants were provided with a type of false feedback pertaining to the quality of their performances. Some ( $n = 23$ ) received positive feedback, some ( $n = 23$ ) received

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normative feedback, and others ( $n = 23$ ) received negative feedback. It must be noted that all of the participants were randomly assigned (within constraints) in regards to which type of feedback they received so that the variability due to individual differences would likely be roughly equal in each group. It is also relevant to note that each group contained 13 females and 10 males. If a given participant was designated to receive positive feedback then they were told: "You, as did everyone else who has been tested, had correct completion. Let's see how your score compares to those of other first-time Sudoku players tested so far." At this point, the bogus chart of scores was utilized for the purpose of making it appear as if other participants' scores were actually being accessed. Subsequently, the participant was told: "Quite incredible. You correctly filled in 8 more spaces than the average of the participants that have already been tested. You're a natural at Sudoku." The bogus chart was used in exactly the same way for the normative and negative feedback groups. However, the feedback following this was different for these groups. If a participant was designated to receive normative feedback then he or she was told: "Your score falls very close to the average of the participants that have already been tested. This means that you correctly filled in approximately the same number of spaces as many of the other first-time Sudoku players did. You're at about the same level as many of the participants." And finally, a participant who was designated to receive negative feedback was told: "I'm sorry, but you don't appear to have done very well. You correctly filled in 8 less spaces than the average of the participants that have already been tested. Maybe Sudoku just isn't your game." Thirty seconds were allocated for the delivery of the feedback.

After participants obtained their respective false feedback, they were asked to take a short 1-minute break. Participants were explicitly instructed to reflect on their feedback during this break. The point of doing this was to make it more likely that the feedback would sink in.

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After this brief period participants marked on the Self-Efficacy Distance Scale how efficacious they felt about their upcoming final task attempt. They were given 45 seconds to do this. The purpose of having participants complete the Self-Efficacy Distance Scale immediately after the 1-minute break was to ensure that any changes in self-efficacy were due to the introduction of the feedback *alone*. Subsequently, they completed the puzzles again. It is important to note that the second set of Sudoku puzzles that participants attempted to complete were slightly different from the first set, thus ensuring that the familiarity confound was minimized. Participants' puzzles on this second attempt were not checked *during* the procedure, however. The puzzles were checked and scored at a later time. The point of telling participants that their puzzles were going to be checked was solely to motivate them into following the rules of Sudoku on their second attempt. Finally, the participants were debriefed in writing that their feedback had been false. In addition, they were notified as to why it was imperative that it be as such, and that randomly assigning them into different groups was likely to help control for their individual differences and thus make the results more valid. They were also asked during debriefing not to tell potential participants about the true nature of the study, as giving them such knowledge would have greatly reduced the meaningfulness of the results. The duration of this debriefing period was 1 minute. See Table 1 for a timetable of procedural events.

### Results

A 2-way, repeated measures, factorial analysis of variance (ANOVA) with feedback type and testing time as independent variables was conducted on participants' performance and self-efficacy scores. It was discovered that the main effect for the within-subjects variable of testing time (time 1, time 2) on the self-efficacy scores was not significant,  $F(1, 66) = .12, p = .73$ . The main effect for testing time on the performance scores was also not significant,  $F(1, 66) = 2.48, p$

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= .12. The between-subjects variable of type of feedback (positive, normative, negative) was assessed for a main effect also. It was revealed that there was a marginally-significant difference for the self-efficacy scores,  $F(2, 66) = 2.69, p = .08$ , but a non-significant difference for the performance scores,  $F(2, 66) = 1.62, p = .21$ .

This analysis also included an assessment of the interactions between testing time and feedback type. The interaction between feedback type and time 2 for the performance scores revealed a non-significant difference,  $F(2, 66) = .65, p = .52$ . The group means and standard deviations for this analysis can be found in Table 2, while a graphical representation of the means can be found in Figure 1. However, the interaction between feedback type and time 2 for the self-efficacy scores was significant,  $F(2, 66) = 31.47, p < .001, h_p^2 = .49$ . In order to see where this effect occurred, paired samples t-tests were conducted to compare each feedback group's time 1 and time 2 self-efficacy scores. It was revealed that for those who received positive feedback, the scores on time 2 ( $M = 133.74, SD = 27.65$ ) were significantly higher than the scores on time 1 ( $M = 105.74, SD = 31.64$ ),  $t(22) = -7.35, p < .001$ . For those who received negative feedback, the time 2 scores ( $M = 87.48, SD = 29.60$ ) were significantly lower than the time 1 scores ( $M = 115.48, SD = 24.75$ ),  $t(22) = 5.38, p < .001$ . However, for those who received normative feedback, there was not a significant difference between the time 1 scores ( $M = 109.70, SD = 30.08$ ) and the time 2 scores ( $M = 112.65, SD = 31.33$ ),  $t(22) = -.51, p = .61$ . These findings appear to indicate that, as compared to the normative (control) group, positive feedback significantly increased self-efficacy and negative feedback significantly decreased it. Furthermore, as is evidenced by the effect size of the interaction, the impact for both types of feedback was relatively large. A graphical representation of the group means can be found in Figure 2.



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### Discussion

#### Summary of Findings

It had been hypothesized in the introduction that positive evaluative feedback would increase participants' performance and self-efficacy and that negative evaluative feedback would decrease participants' performance and self-efficacy. Therefore, based on the above findings, the hypothesis was only partially supported: there was a significant effect for the self-efficacy scores but not for the performance scores. In regards to the impact of feedback on Sudoku performance, both positive and negative feedback did not produce any significant changes in performance quality. Clearly, these findings do not support the performance findings of many of the relevant studies that have been reviewed, as these have generally indicated that positive feedback increases performance and/or that negative feedback decreases it (Ávila et al., 2012; Crawford, Thomas, & Fink, 1980; Claire & Snyder, 1979) One possible reason to account for these findings could be that there was a flaw in the method used to measure this variable of performance. This flaw will be discussed as part of the study's limitations.

With respect to the impact of evaluative feedback on participants' self-efficacy, the findings confirmed the hypothesis in the sense that those who received positive feedback became significantly more efficacious (in comparison with the normative feedback group) and that those who received negative feedback became significantly less efficacious (in comparison with the normative feedback group). These findings were largely in line with those of many of the studies in the literature, of which provided evidence that positive feedback significantly increases self-efficacy and/or that negative feedback decreases the variable (Reynolds, 2006; Saemi et al., 2012; Maertz et al., 2005). A possible explanation for the findings of the present study concerning the positive feedback group is that the positive feedback influenced participants into

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experiencing a happier state of mind. This emotional positivity, in turn, could have produced in them a sense of optimism. Emotions may have also played a key part in accounting for the results of the negative feedback group: those who received negative feedback may have been induced into a sad and/or despondent emotional state that caused them to second-guess their Sudoku abilities and to experience feelings of pessimism.

### **Practical Implications**

It is necessary to explore the practical implications of this study's findings. Because it was affirmed that evaluative feedback significantly impacts individuals' self-efficacy on a novel task, teachers, supervisors, and coaches who are responsible for introducing individuals to a task need to utilize feedback in a productive way. Specifically, they should most likely praise individuals when they perform an aspect of a new task well (giving them positive feedback) and not be overly critical when they do not (**by** giving them negative feedback). If individuals are made to feel that they have potential to perform well on a task, they are generally more likely to keep practicing it. If they lack this belief, however, they will likely become despondent and not attempt it again. Thus, even though this study failed to affirm that feedback impacts novel-task *performance*, if individuals become efficacious through feedback then they are likely going to keep practicing to the point that they end up improving their skill.

### **Strengths and Limitations**

These findings must be considered in light of the study's strengths and limitations. First, the strengths will be discussed. A major one is that this study had the ability to demonstrate whether positive or negative feedback was more impactful than simply receiving a neutral form of feedback. This is because unlike some studies (Plakht et al., 2013; Saemi et al., 2012), it utilized a control group that could be used as a comparison. The inclusion of a control group also

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provided the added benefit of controlling for the fact that people may inevitably experience performance improvement simply as a result of having more practice with a task. This confound of the practice effect would certainly have influenced the results of the study by Saemi et al. (2012), of which only utilized positive and negative feedback groups in its repeated measures design. Another strength of the present study is that participants most likely perceived the false feedback to be legitimate. This can be asserted with some confidence because the feedback was able to effect a significant change in self-efficacy. If the feedback had not been perceived as believable, then participants likely would not have been impacted by it. A final strength is the utilization of the Self-Efficacy Distance Scale. Because the scale merely consisted of a line that did not contain any numbers to specify different levels of self-efficacy, when participants assessed their self-efficacy on time 2 it was very difficult for them to simply use their marking on time 1 as a reference point. As a result, it was possible to attain time 2 ratings of self-efficacy that were more accurate and honest.

There are also limitations to consider, however. As briefly mentioned above, there may have been a flaw in the methodology. Specifically, the assessment of performance may have been compromised because Sudoku was selected as the task. This is because there were instances in which participants were not able to comprehend how to correctly complete the puzzles (despite the fact that these puzzles were only beginner-level). It was wrongly assumed that college students would not have difficulty in this respect. It had been thought that they would merely differ on the *speed* at which they correctly completed the puzzles. Another issue arose out of the fact that one mistake on the task became detrimental to participants' chances for performance success. When participants made a mistake and did not recognize that they had done so, they effectively guaranteed that most of their subsequent spaces would be incorrect.

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And making these mistakes may have been facilitated by the fact that they were trying to complete the puzzle spaces as fast as they could. Ultimately, this caused some participants who *did* understand the task to not perform well on it. Both of these drawbacks concerning Sudoku increased - to some degree - the amount of random error in the data set. Another limitation is that the findings regarding the impact of positive and negative feedback on self-efficacy are not completely generalizable. This is because much of the data was collected from college freshman. Teenagers, who are more sensitive to feedback from others (Arnett, 2013) than are other age groups, are more likely to react to evaluation in a more extreme manner. Therefore, it may be that many of the participants in this study were affected by the feedback in a way that is not representative of the population at large. A final limitation is that the present study was not able to take full advantage of the fact that there were approximately equal numbers of males and females in each feedback group. It was realized in hindsight that gender could have been used as an independent variable to assess if there are significant gender differences in the way feedback impacts performance and self-efficacy.

### **Directions for Future Research**

Future research could potentially build on the present study by addressing these limitations. To accurately assess novel-task performance, researchers should adopt a task that: 1) is more straightforward and 2) does not make it a possibility that one can attain a detrimental result through making one or two mistakes. Research should also strive to replicate the present study's self-efficacy findings using samples consisting of children or fully-developed adults. This would serve to affirm the findings as well as provide an understanding of the ways in which different groups of individuals perceive feedback. Finally, future research should systematically

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assess how gender might influence the impact that evaluative feedback has on performance and self-efficacy.

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Table 1

*Timetable of Procedural Events*

Event	Allocated Time
Informed consent	2 minutes
Learning how to play Sudoku	up to 30 minutes
Self-efficacy measure at Time 1	45 seconds
Task attempt 1	9 minutes
Puzzle check	2 minutes
Feedback	30 seconds
Break	1 minute
Self-efficacy measure at Time 2	45 seconds
Task attempt 2	9 minutes
Debriefing	1 minute

## EFFECTS OF FEEDBACK ON SELF-EFFICACY AND PERFORMANCE

Table 2

*Mean Performance Scores as a Function of Type of Feedback and Testing Time*


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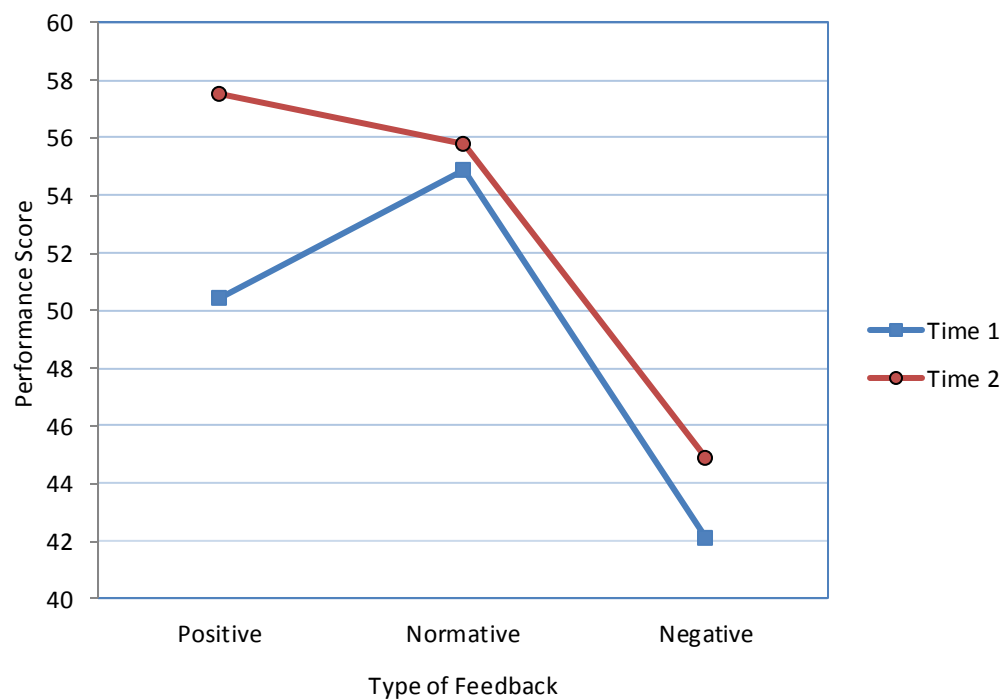
Testing Time	Type of Feedback		
	Positive	Normative	Negative
Time 1	50.44 (29.35)	54.91 (23.31)	42.09 (11.68)
Time 2	57.52 (38.57)	55.78 (29.03)	44.87 (15.93)

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*Note.* Numbers in parentheses represent standard deviations. Higher scores represent greater performance success.

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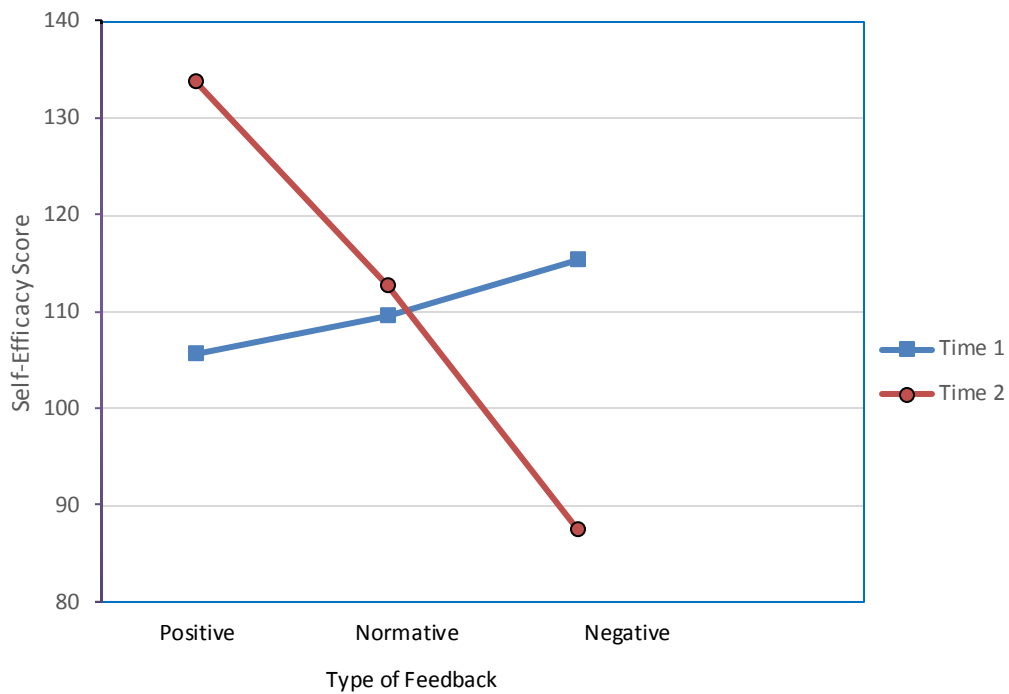
Figure 1

*Mean Performance Scores as a Function of Type of Feedback and Testing Time*

## EFFECTS OF FEEDBACK ON SELF-EFFICACY AND PERFORMANCE

Figure 2

*Mean Self-Efficacy Scores as a Function of Type of Feedback and Testing Time*



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## Appendix

*Beginner-level 6 X 6 Sudoku Puzzle*

	<b>6</b>			<b>5</b>	
					<b>1</b>
		<b>4</b>	<b>6</b>		<b>5</b>
<b>5</b>		<b>6</b>	<b>2</b>		
<b>6</b>					
	<b>1</b>			<b>2</b>	