Learning Disabilities: A Contemporary Journal 8(2), 43-52, 2010

Effects of Evaluative Feedback on Rate of Learning and Task Motivation: An Analogue Experiment

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The evaluative feedback teachers provide to learners may reference (a) individual learning progress (individual feedback), (b) social comparisons (social feedback), or (c) task criteria (criterial feedback). Various models have been proposed to explain the effects various forms of feedback have on learning and motivation with partly contradictory results. This study was designed to further examine which type of evaluative feedback best influences task performance, as defined (1) by the rate of learning and motivation and (2) by testing the hypothesis that feedback focusing on task completion (criterial feedback) is most beneficial, whereas individual and social feedback inhibits task performance. In this study, 140 university students were randomly assigned to four analogue experimental conditions: (1) individual, (2) social, (3) criterial and (4) no-feedback; furthermore, they were given a novel artificial language learning task to complete. Results showed that criterial feedback had the best results in task performance. Low-performing participants showed highest motivation in the criterial condition and lowest in social feedback, whereas their motivation in the individual feedback condition was average. Implications regarding the type of feedback that special education teachers provide are discussed.

Keywords: Evaluative Feedback; Task-Motivation; Social Comparison; Norm of Reference; University-Level, Special Education Teachers

Verbal or written evaluative feedback as an immediate and direct response to student academic performance is one of the most powerful classroom interventions that teachers use to foster learning and improve student motivation (Hattie & Timperley, 2007). Nonetheless, it is still unclear how feedback exerts its effect on student behavior and what kind of feedback is appropriate in specific situations. We know little about the effects that different kinds of feedback have on motivation and how these effects differ for students with learning disabilities as opposed to typically performing students.

Models of Evaluative Feedback

Several theories have been posed to explain the effect of feedback on learner motivation and learning outcomes. Feedback is defined at its most basic level as information provided to a student as a result of the outcome of an action. The most basic type of feedback is *knowledge of result*, which refers to the effect of an action in relation to the action goal (Adams, 1971). The knowledge of a particular result can

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have a positive effect on student learning outcomes when a goal has been successfully reached. Conversely, it can also have a negative effect, especially if there is still a discrepancy between the action goal and the current status. The *law of effect* (Thorndike, 1927) from behavioral psychology suggests that knowledge of a successful result acts as a positive reinforcer and should increase the probability of task persistence, while negative feedback reduces the probability (i.e., acts as a punisher). However, empirical research conducted by Kluger and DeNisi (1996) only partly corroborates this principle.

Kluger and DeNisi (1996) conducted a meta-analysis of 607 effect sizes related to the effects of evaluative feedback on learning and motivation. They found that in one-third of the studies reviewed, evaluative feedback had harmful effects on student outcomes regardless of whether it was positive or negative. As a result, Kluger and DeNisi proposed an alternative explanation on the effects of feedback interacting with both the self-concept and learning goals of a student. The core assumption of their *feedback intervention theory* (FIT) was that every instance of evaluative feedback focuses the attention of the learner on (1) a social comparison, (2) task fulfillment, or (3) task details. Feedback based on social comparisons (e.g., "You did well compared to most of your classmates") directs attention to aspects of social position and self-worth whereas criterial feedback (e.g., "You completed 12 out of 15 tasks correctly") draws attention to the task. Attention is a "limited capacity" characteristic that is crucially needed for cognitive operations. Therefore, Kluger and DeNisi concluded that a detrimental effect on student learning outcomes is likely to occur when feedback is based on social comparisons as any redirection of attention away from the task itself will inhibit learning processes. Likewise, Kluger and DeNisi suggested a facilitating effect is likely to occur when feedback is based on aspects of the task itself.

The connection between attentional focus and motivation was addressed in earlier research by Butler (1987). She stressed that the attentional focus sets a spot on different goals that individuals track in a specific situation. Following the work of Nicholls (1984), social comparison feedback is thought to strengthen ego-involvement, which in turn activates the motive to maintain or improve self-worth, whereas task related feedback activates task-involvement and intensifies motivation to fulfill a task.

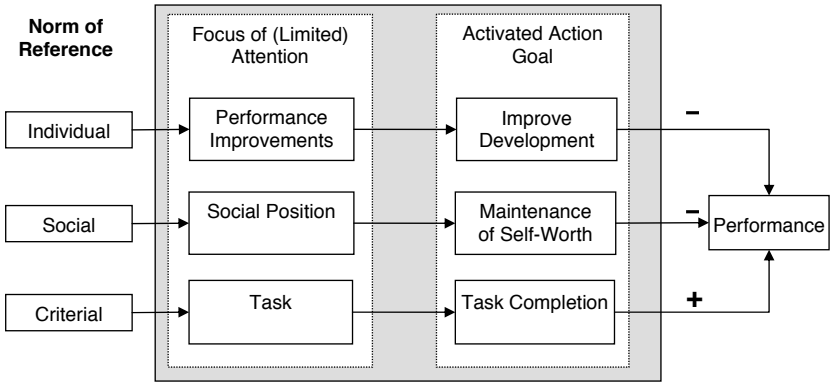
Rheinberg (1980) developed another account attempting to explain the effects of evaluative feedback on student motivation. Following Heckhausen (1974), Rheinberg distinguishes between three types of feedback based on the *norm of reference* used for evaluating student achievement: (a) social, (b) individual, and (c) criterial norm of reference. A social norm of reference obtains when learner achievement is evaluated in comparison to the achievement of others. The individual norm of reference is based on the previous performance of the individual. The criterial norm of reference uses task inherent properties as a standard of comparison. From Rheinberg's perspective, the individual norm of reference is the most appropriate type of evaluative feedback in learning situations as it stresses the connection between effort and outcome. The social norm of reference fosters a static achievement self-concept as social ranking in class performance rarely changes and thus requires more effort of a learner in order to improve. Following the "big fish-little pond effect" (Marsh & Hau, 2003), the usage of a social norm of reference is especially detrimental for slow

learners, as they show the worst achievement in their class and typically receive negative evaluative feedback. The criterial norm of reference has rarely been addressed in the research literature though the model of Kluger and DeNisi (1996) as well as Butlers' theory (1987) suggests its usage in evaluative feedback. On the other hand, neither model takes evaluative feedback based on individual norms of reference explicitly into consideration.

An Alternative Framework

To better integrate these theories, we suggest an alternative framework linking the different norms of reference with performance and motivational outcomes (see Figure 1). This model illustrates how the type of evaluative feedback provided and their respective norms of reference interact with attention and action goals to influence learner performance. Based on this framework, criterial feedback focuses the attention on task fulfillment and activates the goal to complete the task. Therefore, criterial feedback should increase performance and task-related motivation (a higher-task-involvement). In contrast, individual feedback redirects attention away from the task toward the learner's own performance improvements and thereby activates the goal to improve one's own development. Because this goal is directed toward the self, task-related motivation and task performance may decrease since attention is focused on the self. Likewise, social feedback focuses learner attention on the social position the learner has relative to his or her peers and activates the maintenance of self-worth (ego-involvement), leading to a decrease in task related motivation and performance.

Figure 1. Framework to explain the impact of different norms of reference used in feedback on goal setting and performance.



Purpose and Research Questions

The purpose of this study was to examine the effects of evaluative feedback on task motivation using three different types of feedback (i.e., individual, social, and criterial) based on the conceptual framework described in Figure 1. We made three

achievement-related hypotheses: (1) individual feedback inhibits learning processes; (2) social feedback inhibits learning processes, and (3) criterial feedback fosters learning processes. Furthermore, we have three motivation related hypotheses: (1) individual feedback decreases task motivation for all students; (2) social feedback decreases task motivation in low achieving students; and (3) criterial feedback has a positive impact on task motivation for all learners.

To avoid ethical problems (inducing negative effects of feedback to students with learning disabilities) and to gain high internal validity, we decided to implement a pilot study in an analogue setting with college students before conducting a study with students with learning disabilities. The most prevalent problem that students with learning disabilities have is mastering a novel task. To mimic this problem, we conducted an analogue experiment, in which university-level students were provided with evaluative feedback in a novel artificial task. The results were analyzed with regard to the effects the evaluative feedback had on rate of learning and task motivation for low- and high-achieving students.

Method

Participants and Setting

One hundred and forty undergraduate special education students from the University of Cologne in Germany participated in the study (M_{Age} = 23.3; SD_{Age} = 2.7; 73% female). The college students participated for course credits. They were randomly assigned to one of the four experimental conditions: (1) individual (n = 33), (2) social (n = 38), (3) criterial (n = 31), and (4) no-feedback (n = 38).

Procedures

At the beginning of the experiment, participants were informed that the goal of the investigation was to measure cognitive processes when learning an unknown artificial new language. This task was selected because it controlled for background knowledge making measurement of learning outcomes more accurate. During the learning task, participants were confronted with 30 pictures and word pairs, each containing a *target word* and a *distractor word* (e.g., "Pito—Wize" for the picture "elephant"). Participants were supposed to learn the target word for the picture. They had to choose the target word by pressing the left or the right control-key of the keyboard. The only chance to learn the right target words was to memorize after each trial the correct word for this picture. After each trial, knowledge of the result was displayed for three seconds (i.e., whether they remembered the target word correctly).

The complete task consisted of 15 blocks with 30 trials (i.e., each of the 30 word pairs was shown 15 times). For each trial, participants could receive up to three points based on the correctness and speed of their responses. After 30 trials, a line chart displaying learner performance in the last and preceding blocks was presented. The chart was different for the four experimental conditions depending on the type of evaluative feedback provided. The chart of the *individual-feedback condition* displayed the individual improvements for each block in relation to the first block. The caption was "Improvement of achievement throughout the blocks." The *social-feedback condition* displayed the percentile rank for each block compared to a sample of

50 persons who accomplished the task before the present experiment was conducted. The caption was "Percent of players who did worse." The chart of the *criteria-feedback condition* displayed the percent of possible points for each block. The caption was "Percent of possible points." Participants of the *control condition* received no chart and were told that they could take a short rest.

Dependent Measures

We took two achievement related measures into account: the *points reached per block* and the *rate of learning* of each participant computed on the basis of the beta-weight of the regression of the achievement across the last 12 blocks. Upon completion of the learning task, participants completed the *flow short scale* "Flow Kurzskala" (Rheinberg, Vollmeyer, & Engeser, 2003) as a measurement for implicit task related motivation. The *flow short scale* contained 10 items and used a 7 point Likert scale in order to evaluate flow experiences.

Design and Data Analysis

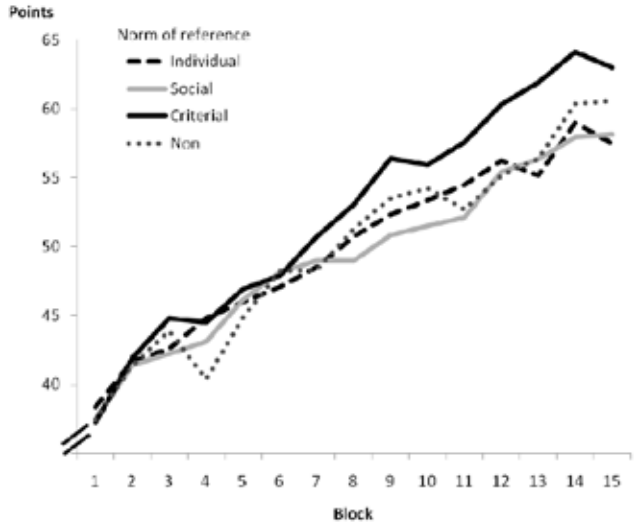
The first independent between-subjects variable is the *feedback condition* (individual vs. social vs. criterial vs. no-feedback). The second independent variable is the *practice block* of the learning task varied within-subjects (during block 1 to 3 participants had to get familiar with the task, and performance is more the result of guessing, so these blocks are excluded and the remaining 12 blocks are used for analyzes). The two achievement-related dependent variables are the perceived *points per block* and the *rate of learning* of each participant. The dependent variable regarding motivation was the score on the *flow short scale.*

We expected the highest increase in points per block, the highest learning rate, and the highest ratings on the *flow short scale* in the criterial feedback condition. Concerning individual and social feedback, we expected both to be detrimental for motivation. Both conditions should show lower ratings on the *flow short scale* compared to the criterial and no-feedback condition, and they should have no positive effect on learning for both learning rates and points per block when compared to the criterial condition as well as no difference when compared to the no-feedback condition.

Results

A 4 (condition) x 12 (block) mixed model ANOVA was used to analyze the effect of the condition on *points reached per block.* The main effect of block was significant ($F[11, 1496] = 103.9$; $MSE = 39.64$; $p < .001$; $\eta_p^2 = .433$) signaling the overall improvement of achievement due to practice. The main effect of condition failed significance ($F[3, 136] = 1.7$; $MSE = 652.76$; $p > .17$; $\eta_p^2 = .035$). More importantly, the complete model showed a significant interaction condition x block ($F[33, 1496] = 1.5$; $MSE = 39.64$; $p < .05$; $\eta_p^2 = .032$). That is, performance developed differently across the blocks for the four conditions. Figure 2 shows that this interaction may be the result of a steeper performance improvement in the *criterial* condition, whereas the other three conditions performed very similar across the practice blocks.

Figure 2. Points across practice blocks in the four conditions.



Next, we compared the *rate of learning* across the four conditions in an ANOVA. The main effect of *rate of learning* was not significant (F[3, 136] = 2.39; MSE = .78; $p < .08$; $\eta_p^2 = .050$). A priori contrasts based on our hypotheses revealed a significant higher *rate of learning* for the *criterial* compared to the *no-feedback* condition ($M_{criterial} = 1.74$; $SD_{criterial} = 1.04$; $M_{no\text{-}feedback} = 1.36$; $SD_{no\text{-}feedback} = 0.94$; F[1, 136] = 3.17; MSE = .78; $p < .05$ [one-sided]; $\eta_p^2 = .022$). Neither the *individual* ($M_{individual} = 1.22$; $SD_{individual} = 0.62$) nor the *social* condition ($M_{social} = 1.24$; $SD_{social} = 0.88$) differed significantly from the *no-feedback* condition (both $F < 1$).

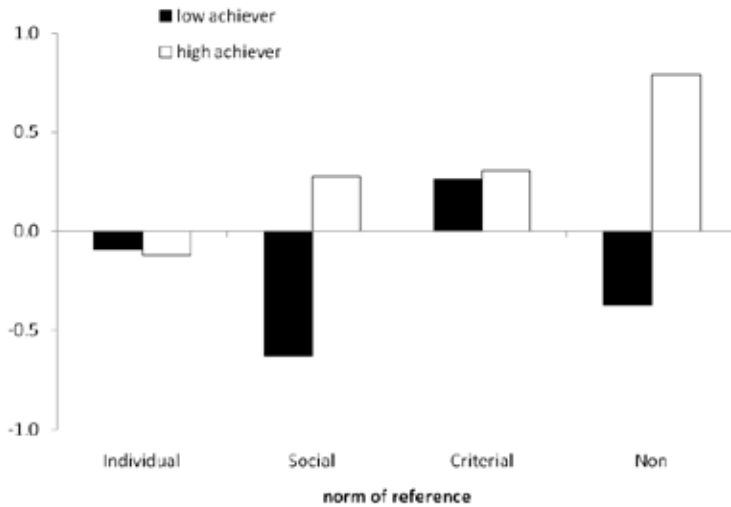
Then, we analyzed the scores on the *flow short scale*. We divided the sample into high and low achievers to differentially analyze the impact of the type of feedback based on levels of achievement. High achievers were defined as participants who scored average or above in the last three blocks while low achievers scored below average.

A 4 (condition) x 2 (achievement; high vs. low achiever) ANOVA was then conducted on the *flow short scale* scores. The main effect of condition was not significant (F[3, 132] = 2.01; MSE = .84; $p > .11$; $\eta_p^2 = .043$). The main effect of achievement was significant (F[1, 132] = 10.41; MSE = .84; $p < .01$; $\eta_p^2 = .073$). That is, high achievers had a higher flow scores than low achievers. Also, the interaction condition x achievement level was significant (F[1, 132] = 3.60; MSE = .84; $p < .05$; $\eta_p^2 = .076$). Thus, the norms of reference had a different effect on flow for high and low achieving participants. Furthermore, a- priori contrasts on the flow short scale revealed no significant difference in flow between the individual and the no-feedback condition (F[1, 132] = 2.05; MSE = .84; $p > .15$; $\eta_p^2 = .015$). The mean flow score in the social

condition was lower than in the no-feedback condition ($F[1, 136] = 3.21$; $MSE = .84$; $p < .05$ [one-sided]; $\eta_p^2 = .024$). The criterial condition did not differ significantly from the no-feedback condition ($F < 1$).

Figure 3 displays the impact of norm of reference on flow for high and low achievers. For a clearer presentation, we report z-standardized values for our sample ($M = 41.6$; $SD = 9.6$). A priori contrasts revealed that within the individual norm of reference high and low achievers did not differ ($F < 1$) and both had a flow close to average ($z = -0.09$ and $z = -0.12$). In the social norm of reference condition low achievers had significant less flow than high achievers ($F[3, 132] = 8.59$; $MSE = .84$; $p < .01$; $\eta_p^2 = .061$). That is, a social norm of reference led to a flow below average ($z = -0.63$) for the low achievers whereas for high achievers flow was above average ($z = 0.28$). Within the criterial condition both groups of achievers did not differ ($F < 1$) and showed a flow above average ($z = 0.27$ and $z = 0.31$). In the no-feedback condition, the high achievers had a significantly higher flow than the low achievers ($F[3, 132] = 15.05$; $MSE = .84$; $p < .01$; $\eta_p^2 = .102$) in which high achievers were considerably above average ($z = 0.79$) and low achievers below average ($z = -0.37$).

Figure 3. Standardized scores on the flow scale by condition separated for high and low achievers.



Discussion

The data corroborate our hypothesis that criterial feedback fosters learning processes. We found an increased performance throughout the practice blocks under criterial feedback. Analyses on the basis of the individual rate of learning supported this finding. There was no detrimental effect of individual and social feedback as we

expected. However, we did not find a beneficial effect of evaluative individual feedback as suggested by the norm of reference model (Rheinberg, 1980).

It is important to stress, that the individual and the criterial condition only differed with respect to the caption of the chart and the scale of the y-axis that was presented between the practice blocks. Participants in the individual condition could see only whether they improved and whether this improvement was high or low compared with previous performance. They had no clear reference as in the criterial feedback condition (the maximum possible points) and in the social condition (the performance of others). Compared to the social feedback condition, participants in the criterial feedback condition could see their own learning progress indicated by a rising line, whereas learning progress was covered in the social feedback condition. Taken together, this suggests that the positive effect of the criterial feedback was due to the combination of an explicit goal and the feedback of steadily growing success in reaching this goal.

Analyses of the motivation from the *flow short scale* indicated that generally higher achievement corresponded to higher motivation. It is further important to note that the design of the study did not allow us to distinguish whether higher motivation leads to improved achievement outcomes or whether improvements in achievement could lead to having higher motivation. Nevertheless, given our hypothesis that criterial feedback helps students to focus on the task, we found no positive effect of a criterial feedback for learners. As expected, social feedback decreased motivation for low-achieving participants. With respect to individual feedback, we did not find a beneficial effect on motivation. This result is in contrast to the norm of reference model as proposed by Rheinberg and colleagues (cf. Kornmann, 2005). Though an individual norm of reference revealed individual improvement, participants did not know how much they actually improved over time. They only knew that they improved. Thus, crucial information is missing which may result in uncertainty and inhibits the positive effects of the individual norm of reference.

A separation of low- and high-performing participants revealed that criterial feedback had the highest positive impact on motivation for low performing participants whereas social and no-feedback led to the lowest motivation. For high-performing participants we found a different pattern with the highest motivation when no-feedback was provided and the lowest motivation under the individual feedback condition.

The selective negative effect of social comparison on motivation for low-performing students is in line with Vancouver and Tischener (2004). Based on the model of Kluger and DeNisi (1996), they found that an attentional shift to a higher level of action goals (i.e. ego-involvement and maintenance of self-worth) takes place only when there is a discrepancy at this level. Low-performing students are especially responsive to the negative effects of feedback that involves social comparisons as they tend to have a negative self-concept of their abilities (Elbaum, 2002; Elbaum & Vaughn, 2003; Vaughn & Elbaum, 1999). As a consequence, social comparisons are potentially self-worth threatening (Covington, 2000) and may shift attention away from the task.

Overall, our results draw a differentiated pattern of the effects of feedback on motivation and learning. Most important, with respect to motivation, the op-

timal feedback may depend on the capabilities of a student. Thus, high- and low-performing students may need different kinds of feedback. However, there are several limitations of this study that should be considered. We provided feedback only in a non-problem-based learning task during ongoing learning processes; thus, we cannot conclude whether the type of feedback differs according to instructional area or learner actions, demands, or loads. Similarly, we used an artificial learning task with university students, and our conclusions regarding the instruction of low-performing students in more complex learning situations should be viewed with caution. Future research will investigate replicating this study in actual special education classroom settings with students with learning disabilities.

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