

Title: The effect of feedback validity on learning and its relation to self-efficacy in children: an ERP study.

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The study evaluated the effect of consistent and inconsistent performance feedback on learning in children. Children ($n = 110$) between the ages of 8 and 10 years performed a probabilistic task while their electrophysiological data were recorded. Participants were tasked with sorting items into two bins based on the category to which they belonged (total of 8 categories). Participants were presented with performance feedback after each of their responses. Under the *consistent feedback* condition, performance feedback was consistent with the participants' responses. Under the *inconsistent feedback* condition, feedback was consistent on 80% of the trials, while on 20% of the trials, participants received the wrong feedback. Two event related potentials associated with feedback processing were evaluated, the feedback related negativity (FRN) and a fronto-central positivity (FCP). Each participant completed the Students' Perception of Control Questionnaire (SPOCQ), a measure of self-efficacy. Analysis of the behavioral data indicated that participants performed better under the *consistent feedback* condition. Self-efficacy scores related to control beliefs were found higher among the older children in the study (10-year-olds) when compared with the younger children. Linear regression analysis indicated that greater difference in FRN to positive feedback between the consistent and inconsistent conditions was associated with greater difference in accuracy between the two conditions. Higher self-efficacy scores were found associated with greater differences in FRN to negative feedback between consistent and inconsistent condition in 9-year-olds. Higher self-efficacy was associated with smaller differences in FCP amplitude to negative feedback between consistent and inconsistent condition in 10-year-olds.

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Objective

The purpose of the study was to evaluate the role of feedback related negativity (FRN) and fronto-central positivity (FCP) in children (age 7 to 11) under feedbacks varied in consistency.

Method

We recruited 113 participants from the age of 7 to 11 and collected their FRN and FCP data while they were completing classification tasks varies in consistency: 1) 100% valid feedback and 2) 80% valid feedback and 20% invalid feedback.

Main Results

Behavioral data analysis showed that participants did significantly better in valid feedback condition than in invalid feedback condition. Further analysis showed that the difference in FRN to positive feedback in valid feedback condition and invalid feedback condition formed a positive relationship with the difference in accuracy between valid and invalid feedback condition. In general, we see a Valance effect in FCP amplitude in all participants, indicating that negative feedback induced a more positive FCP than positive feedback in our participants. Since the sample size of Age 11 group was too small, these three participants were taken out. The repeated measures ANOVA analysis without Age 11 participants showed a Valance effect in both FRN and FCP, indicating that the negative feedback induced a more negative FRN and a more positive FRN than the positive feedback in our participants. One-way ANOVA analysis showed that there were differences in Control Belief (a measure of self-efficacy) in participants in different ages, indicating a larger self-efficacy in children in age 10 than children in age 8 and children in age 9 (Age 10 vs Age 8: $t = -2.381$, $p = 0.020$; Age 10 vs Age 9: $t = -2.596$, $p = 0.012$)

- Greater self-efficacy (control belief), greater differences in FRN to negative feedback between consistent and inconsistent condition