



Feedback-Memory: An approach to promoting the social acceptance of students rarely receiving positive teacher feedback

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Abstract In line with social referencing theory, recent studies have revealed that teacher feedback might be an important factor influencing how students are socially accepted by their peers. This study investigates the effects of an intervention aiming to enhance the social acceptance of students rarely receiving positive teacher feedback – the Feedback-Memory approach. Feedback-Memory was designed as a multi-component intervention with 4 elements: 1) Identifying students rarely receiving positive teacher feedback (target students), 2) giving positive teacher feedback to students (especially to the target students) at the end of every lesson, 3) asking classmates to remember positive teacher feedback at the end of the school day, and 4) rewarding students for remembering the teacher feedback content. Two main research questions are investigated within our study: 1) Does playing Feedback-Memory increase the frequency of classmates-perceived positive teacher feedback towards students rarely receiving positive teacher feedback? 2) Does playing Feedback-Memory increase the social acceptance of students rarely receiving positive teacher feedback? Twenty-five classes (fourth grade) and 531 students participated in this study in German elementary schools. Classes were randomly assigned to 10 intervention classes and 15 control classes. In every intervention and control class, the 5 students least likely to be receiving positive teacher feedback were identified. Results of multilevel analysis reveal that the Feedback-Memory intervention significantly enhanced the classmates-perceived positive teacher feedback and the

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social acceptance of the target students compared to students in the control group and their classmates.

Keywords Social participation · Social integration · Social acceptance · Social referencing · Teacher feedback · Intervention study · Elementary school

Feedback-Memory: Eine Methode zur Förderung der sozialen Akzeptanz von Schüler*innen, die selten positives Lehrkraftfeedback erhalten

Zusammenfassung Einhergehend mit der Referenzierungstheorie zeigen aktuelle Studien, dass Lehrkraftfeedback die soziale Akzeptanz von Schüler*innen beeinflussen könnte. Vor diesem Hintergrund untersucht die aktuelle Studie die Wirkungen einer Intervention zur Verbesserung der sozialen Akzeptanz von Schüler*innen, die selten positives Lehrkraftfeedback erhalten – die Feedback-Memory Methode. Feedback-Memory besteht aus 4 Elementen: 1) Identifizierung von Schüler*innen, die selten positives Lehrkraftfeedback erhalten (Zielschüler*innen), 2) Vergabe von positivem Lehrkraftfeedback (insbesondere an die Zielschüler*innen) am Ende jeder Unterrichtsstunde, 3) Erinnerung der Mitschüler*innen an den Inhalt des Lehrkraftfeedbacks am Ende des Schultags und 4) Belohnung der Schüler*innen für das korrekte Erinnern des Lehrkraftfeedbacks. Es werden zwei Forschungsfragen untersucht: 1) Erhöht Feedback-Memory die Häufigkeit des mitschüler*innenperzipierten positiven Lehrkraftfeedbacks gegenüber Schüler*innen, die selten positives Lehrkraftfeedback erhalten? 2) Erhöht Feedback-Memory die soziale Akzeptanz von Schüler*innen, die selten positives Lehrkraftfeedback erhalten? An der Studie nahmen 25 vierte Klassen und 531 Schüler*innen teil. Die Klassen wurden zufällig 10 Interventionsklassen und 15 Kontrollklassen eingeteilt. In jeder Interventions- und Kontrollklasse wurden 5 Schüler*innen identifiziert, die in der Vergangenheit am wenigsten positives Lehrkraftfeedback erhielten. Die Ergebnisse der Mehrebenenanalysen zeigen, dass Feedback-Memory das mitschüler*innenperzipierte positive Lehrkraftfeedback und die soziale Akzeptanz der Zielschüler*innen im Vergleich zu den Kindern der Kontrollgruppe und den eigenen Mitschüler*innen signifikant erhöhte.

Schlüsselwörter Soziale Partizipation · Soziale Integration · Soziale Akzeptanz · Soziales Referenzieren · Lehrkraftfeedback · Interventionsstudie · Grundschule

1 Introduction

For human beings, being socially included is a basic psychological need (Deci and Ryan 1985). However, school research has shown that not all students have positive relationships with their classmates. Many international studies have focused on student characteristics (e.g., behavioral problems, learning difficulties, special educational needs, social insecurity) to explain a lack of social integration (Weber et al.

2023; Krull et al. 2014; Lindsay 2011; Chang 2004). Furthermore, some field studies have revealed that teacher feedback (TF) might be an important aspect influencing how students are accepted by their peers (Hendrickx et al. 2017; Wullschleger et al. 2020; Spilles et al. 2023). These findings can be explained by the social referencing theory (Feinman 1992), which regards teachers as vital social references for their students (Huber 2019). Interventions that focus on the enhancement of social acceptance (SA) based on a modification of TF have not, as yet, been developed. The current study tries to close this research gap by evaluating a novel intervention that was especially developed to enhance the SA of students rarely receiving positive TF – the Feedback-Memory approach.

2 Social referencing

“Social referencing occurs when an individual’s appreciation of a social partner’s emotional communication towards a shared referent functions to disambiguate the relational significance of the individual with the referent and regulate the individual’s subsequent behavior in relation to the referent” (Walle et al. 2017, p. 245). This ability to appreciate and utilize the emotional communication of other individuals has been comprehensively documented in infants (Vaillant-Molina and Bahrck 2012). However, it seems reasonable to assume that social referencing might also explain the social perception of students by their classmates (Webster and Foschi 1992). Applying the definition of Walle et al. (2017) to the classroom setting, it becomes evident that a teacher’s (social partner) emotional communication towards a student (referent) may influence the perception of the student by his or her classmates (individuals) (see Fig. 1). In the past, this assumption has been confirmed through experimental and field studies on the relation between TF and SA (see below).

3 Social acceptance

SA is one dimension of the definition given by Koster et al. (2009) on the concept of social participation: 1) presence of positive social contact/interaction between students, 2) acceptance of students by their classmates, 3) social relationships/

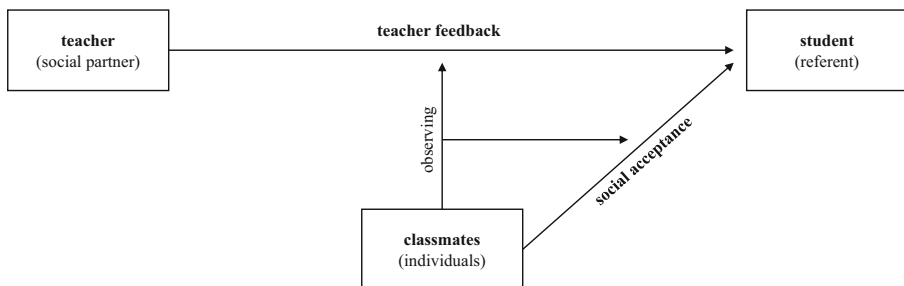


Fig. 1 How teacher feedback might influence the social acceptance of students (social referencing)

friendships between students, 4) and the students' perception that they are accepted by their classmates. In the literature review by Koster et al. (2009), a classification of how social participation, inclusion, and integration (all three terms are used interchangeably) are operationalized in empirical studies is provided. Specifically, the manner in which students are socially accepted by their peers has been operationalized through various approaches, such as social preference, social support, bullying, and social rejection. Regarding previous studies on the impact of TF, SA has been operationalized as social preference using the sociometric method proposed by Moreno (1934). In this method, students indicate their personal preference for each of their classmates. SA can be captured in questionnaires, for example, through questions such as "How much would you like to sit next to this student?" or "Which students would you like to play with during break?" The ratings of all students in a class can then be aggregated to an overall value for each individual.

4 Teacher feedback

TF is a frequently investigated variable in educational research. Hattie (2008) highlights in a widely cited meta-analysis that TF ranks among the most effective approaches for successful student learning and development. Hattie and Timperley (2007) outline feedback as a communication process aimed at providing learners with insights into the disparity between a learning objective and their current level of attainment. According to Hattie and Timperley (2007), instructive feedback can be provided at four levels: 1) The task level (how well tasks are understood and performed), 2) the process level (the main process needed to understand and perform the task), 3) the self-regulation level (self-monitoring, directing, and regulating actions), 4) the self-level (personal evaluations and affect about the learner). When considering the impact of TF on SA, it becomes evident that the instructional value of the feedback may not be a significant factor in this context. However, what is significant is that TF conveys the teacher's personal attitude towards the addressed student (level 4) publicly, thus making it a reference for the SA among peers (Nicolay and Huber 2023; Wullschleger et al. 2020; Hendrickx et al. 2017).

5 Teacher feedback and social acceptance

Experimental studies with elementary school students (White and Jones 2000; Huber et al. 2018; Nicolay and Huber 2021, 2023) have demonstrated that TF regarding a fictional student's academic performance or social behavior influences the participants' SA of this student. These experiments have consistently found that negative TF has a more pronounced negative influence on SA than positive TF, which has a positive influence. Furthermore, Nicolay and Huber (2021) demonstrated that the effects of TF and academic performance on SA are comparable. A recent study by Nicolay and Huber (2023) also suggests that person-related TF, which includes personal evaluations and affect towards the learner (e.g., "Great Kim! Much better than last time. I'm impressed with you today."), may have a more significant impact

on SA compared to task-related TF (e.g., “Great Kim! That was really good. You did read more accurately than last time.”).

In a longitudinal field study from the Netherlands, 1420 fifth graders completed sociometric questionnaires at three measurement points within one school year (Hendrickx et al. 2017). At measurement point 1, the observed teacher behavior towards specific students was coded. Three months later, negative teacher behavior towards a student at measurement point 1 was associated with peer-perceived aversion towards that student, which in turn predicted the peers’ disliking of the student at the third measurement point, six months later. A Swiss study tested the social referencing theory with a sample of 546 first to third-grade students (Wullschleger et al. 2020). TF was videotaped during non-standardized math lessons three months after the beginning of the school year in each classroom. At the end of the school year, SA was measured through peer nominations. TF related to inappropriate social behavior and academic performance, both good and poor, predicted how the students were accepted by their peers during classroom activities at the end of the school year, although not during recess. Spilles et al. (2023) analyzed cross-sectional data of 989 children from 50 German classrooms (second, third, and fourth grade). SA (assessed by a sociometric questionnaire) was related to TF (assessed by peer ratings on the frequency of positive and negative TF towards every classmate). Moreover, the correlation between SA and especially positive TF increased with the grade level (grade 2: $r=0.27$, grade 3: $r=0.39$, grade 4: $r=0.59$). One explanation for this finding is that the ability to reason about mental states (theory of mind) increases rapidly during elementary school (Janke 2008). Hence, older elementary students might be more likely to theorize about the attitude of their class teacher towards a student based on perceived TF. Additionally, the (positive) correlation between positive TF and SA was found to be slightly stronger than the (negative) correlation between negative TF and SA.

In summary, the evidence regarding the impact of TF on students’ SA appears to be robust. However, there are no intervention studies that have successfully improved students’ SA by modifying TF.

6 Feedback-Memory

Based on the social referencing theory, classmates’ perception of TF influences the SA of the feedback-receiving student (Nicolay and Huber 2023; Wullschleger et al. 2020). Thus, the essential key to influencing a student’s SA is to influence the classmates’ perception about how often a student receives positive or negative TF from his or her teacher (Spilles et al. 2023). How often a student actually receives positive or negative TF is less relevant than the respective subjective perception and memory of fellow students. That is why we named our intervention Feedback-Memory. Spilles et al. (2023) found that the classmates’ perception of positive TF is slightly more strongly correlated with SA than negative TF. For this reason, Feedback-Memory aims to increase the classmates’ perception of positive TF.

Feedback-Memory was conceptualized as a multi-component intervention and was inspired by the implications of Positive Behavior Support (Anderson and Kin-

caid 2005) which focuses on the development of individuals' positive behaviors and associated interventions like Tootling (Skinner et al. 1998) or the Good Behavior Game (Barrish et al. 1969). Every component aims to maximize the classmates' perception of the class teacher giving positive TF towards students rarely receiving positive TF in class.

The Feedback-Memory intervention contains 4 elements: 1) Identifying students rarely receiving positive TF (target students), 2) giving positive TF to students (especially to the target students) at the end of every lesson, 3) asking classmates to remember positive TF that was given to their classmates at the end of the school day, and 4) rewarding students for remembering the TF content by an interdependent group reward contingency system (for details see methods section).

7 Research questions

This study aims to provide first empirical evidence whether Feedback-Memory is an intervention that can enhance the SA of students rarely receiving positive TF. The research questions are:

Research question 1: Does playing Feedback-Memory increase the frequency of classmates-perceived positive TF towards students rarely receiving positive TF?

Research question 2: Does playing Feedback-Memory increase the SA of students rarely receiving positive TF?

Research question 3: Is Feedback-Memory accepted by the participating students and performing teachers?

Assessing social validity is an important component of intervention research (Carter and Wheeler 2019). Since Feedback-Memory is designed for use in school classes in the future, it is crucial to determine whether both teachers and students find it beneficial and practical. Additionally, as Feedback-Memory was designed as a game, assessing whether students enjoyed playing it is also of interest. Therefore, we assessed the acceptance of Feedback-Memory by both students and teachers after implementing the intervention.

8 Methods

8.1 Participants, design, and procedure

The present investigation was implemented in 2022 in 12 voluntary German schools in North Rhine-Westphalia. Twenty-five classes (fourth grade) and 531 students participated in the study. Due to the fact that the correlation of positive TF and SA was found to increase from grade 2 to 4 (Spilles et al. 2023) only fourth grade classes were chosen to participate in the project. In Germany, students in that grade are mostly 9 to 10 years old.

We implemented a quasi-experimental design with pre- and post-assessments. The independent variables encompass the categorization into Feedback-Memory group vs. control group (regular lessons) and the classification into (potential) target

children vs. their classmates in every class. The dependent variables are classmates-perceived positive TF and SA.

In a first step, school classes were randomly assigned to 10 intervention classes ($N=208$ students, 42% female) and 15 control classes ($N=323$ students, 52% female). After that, in every intervention and control class the 5 students least likely to receive positive TF (Feedback-Memory classes: target students, control classes: potential target students) were identified based on the perceptions of their classmates (see below: measurements/positive TF). This number was determined for practical reasons (sample size for the statistical calculations, practicability for teachers of the intervention classes). Two target students in the intervention classes could not participate as planned. Therefore, only 48 target students within the Feedback-Memory group were included in the evaluation.

Before the intervention was implemented, teachers of the intervention classes participated in computer-based training (see <https://osf.io/wvphs/>) in the theoretical background of the study (social referencing theory, SA, TF) and the practical implementation of Feedback-Memory (about 1 h). Afterwards, teachers implemented the Feedback-Memory intervention for 4 weeks as described below. Implementation adherence was ensured by the participation of the 10 investigators from the University of Wuppertal (special education students). Teachers had also to document the frequency of positive TF on an implementation plan.

8.2 Intervention (Feedback-Memory)

As described before, Feedback-Memory was designed as a multi-component intervention comprising 4 elements:

1. The first step includes the identification of 5 students rarely receiving positive TF (target students) based on the perceptions of their classmates. Positive TF was assessed as described below (8.3.1: classmates-perceived positive TF).
2. During the Feedback-Memory class teachers awarded positive TF to 2 students during a specific time slot at the end of every lesson from Monday to Thursday in front of the class. For example, if a classroom teacher gave four lessons in one day, eight students received public TF on that day. With an intervention plan (covering 4 weeks in our study) teachers checked whether each student was treated equitably for receiving TF. The intervention plan also ensured that the 5 target students received the same quantity of positive TF as every other student in weeks 1 and 2 and a higher frequency in weeks 3 and 4 resulting in about 100% more positive TFs for those students overall. This procedure was used to increase the classmates' perception of their received positive TF towards the end of the intervention without exposing those students too much at the beginning. The TF content was not specified. Teachers could give positive TF to students because of their social behavior or academic commitment in the particular lesson. Additionally, teachers were encouraged to demonstrate their personal sympathy towards the child during the feedback-process.
3. As described earlier, classroom teachers gave positive TF in a specially designated time slot and students knew that the teacher would give positive TF to exactly

2 students at that time. Students also knew that they had to remember the specific TF content at the end of the day. To enhance remembering TF, all students that received positive TF in the context of Feedback-Memory on one day were named at the end of the school day (i.e., eight students). Class teachers selected classmates randomly (potentially all students except the particular student involved) to remember the TF content. If a classmate could indicate the TF content to the teacher she or he earned 2 points. If not, a second classmate could function as a joker and receive 1 point by remembering the TF content correctly. Thus, on one school day with 4 lessons given by the classroom teacher 8 students received positive TF within the Feedback-Memory intervention and, on that day, students could earn a maximum of 16 points.

4. In the past, several studies have shown that using interdependent group reward contingencies (Cooper et al. 2007) can be seen as a significant predictor to enhance the outcomes of classroom interventions (e.g., Rohrbeck et al. 2003; Ginsburg-Block et al. 2006). During Feedback-Memory, the points every single classmate earned from Monday to Thursday before were summarized giving a class score. On Friday, the whole class was rewarded by the class teacher. Depending on the quantity of points, the whole class earned in one week, for example, free time on Friday (time for playing, reading etc.). For example, if a classroom teacher gave four lessons every day (from Monday to Thursday) students could be rewarded with a maximum of 16 points every day and a weekly score of 64 points. According to a reward-table, students could be awarded 5 min of free time for collecting 0–10 points, 10 min of free time for collecting 11–20 points etc. Due to the individual conditions, class teachers created their reward-tables individually.

Using the procedure described above, the plan was as follows: 1) Positive TF was increased systematically and playfully in the school day. 2) Classmates were encouraged to remember the TF content by being randomly chosen to designate the TF content to the teacher and the interdependent group reward contingency system. 3) Students who tended to receive less positive TF in everyday school life (target students) get positive TF more frequently. By doing so it was expected that target students would be perceived differently by their peers after the intervention. Perceived differently means that their classmates think that these students receive positive TF more frequently during the school day than they did before the intervention.

8.3 Measurements

8.3.1 *Classmates-perceived positive teacher feedback*

Positive TF was rated for each student by his or her classmates on a single Likert-scaled item before and after the intervention (“How often does your class teacher praise your classmate?” 0 = very rare, 1 = rather rare, 2 = average, 3 = rather often, 4 = very often). After that, all peer ratings in a class were aggregated to an individual mean for each student. The procedure was based on the study by Spilles et al. (2023).

8.3.2 *Social acceptance*

SA was also rated for each student by his or her classmates on a single Likert-scaled item before and after the intervention (“How much do you want to sit beside that child in class?” 0=not at all, 1=rather not much, 2=average, 3=rather much, 4=very much). After that, all peer ratings in a class were aggregated to an individual mean for each student, too. The procedure was based on the sociometric method (Moreno 1934).

8.3.3 *Control variables*

Since sociometric choices are gender-dependent (McPherson et al. 2001) and SA was found to correlate negatively with behavioral problems as well as with learning difficulties (Krull et al. 2018; Spilles et al. 2023), these variables were assessed for statistical control before the intervention. Classroom teachers rated behavioral and learning problems for each student in their class using two Likert-scaled items (0=very low, 1=rather low, 2=average, 3=rather high, 4=very high). Gender was coded with 0=female and 1=male.

8.3.4 *Implementation adherence*

Implementation adherence was documented during the intervention by the teachers and investigators. They filled out an implementation check-list in which they noted which students received positive TF during Feedback-Memory on every day. The TF frequency regarding every student during the whole intervention was summarized at the end of the study.

8.3.5 *Social validity*

Social validity was rated by students and teachers of the intervention classes on respectively five Items after playing Feedback-Memory (e.g., students: “I enjoyed playing Feedback-Memory” teachers: “I think Feedback-Memory is a useful approach”). Items were created by the authors and rated on a Likert-scale (0=not true at all, 1=rather not true, 2=true a little, 3=rather true, 4=absolutely true).

8.4 **Statistical analysis**

Since the data of the present study is hierarchically structured (students nested in classes as well as measurement points nested in students), multilevel models (random intercept) were calculated. We calculated a regression model respectively for research question 1 (positive TF) and research question 2 (SA). In both models, all control variables (gender, behavior problems, learning difficulties) were included as well as the main effects of repeated measurements (1=t1: before the intervention, 2=t2: after the intervention), group membership (0=control classes, 1=intervention classes) and target students (0=classmates, 1=target students) as well as the statistical interactions of the last 3 variables. In order to answer both research questions,

the statistical interaction of group, time and target students was taken into account. To correct for classroom-level tendencies, all control variables were group-mean centered (Enders and Tofghi 2007). Analyses were conducted using the R packages lme4 (Bates et al. 2015) and lmerTest (Kuznetsova et al. 2017).

With regard to research question 3 (social validity), the descriptive results of the single items of the teacher and student questionnaire were used.

9 Results

Before examining the results related to the research questions, we will provide a brief description of the baseline characteristics (Table 1). As previously mentioned, in each intervention and control class, 5 target students were identified based on the aggregated TF perceptions of all classmates. Comparing this group of 123 students (Feedback-Memory classes: 48 target students, control classes: 75 potential target students) with their 408 classmates at the initial measurement point before the intervention began using multilevel models (random intercept), it's evident that the target students received less positive TF from their peers than intended based on their selection ($B = -0.94$). Additionally, these students had a lower level of SA ($B = -0.63$). There were no differences between the Feedback-Memory group and the control group.

Within the Feedback-Memory classes target students received about $M = 8.77$ ($SD = 2.60$) times positive TF during the intervention (derived from the intervention plans of each class). Their classmates received about $M = 3.68$ ($SD = 1.57$) times positive TF. Thus, the frequency of giving positive TF to the target students during Feedback-Memory was twice as high compared to their classmates, which was as intended in the implementation plan.

Table 1 Baseline description

	Classmates-perceived positive TF			SA		
	<i>B</i>	<i>SE</i>	<i>p</i>	<i>B</i>	<i>SE</i>	<i>p</i>
Intercept	2.58	0.08	<0.001	1.79	0.07	<0.001
Group	-0.16	0.13	0.215	-0.09	0.11	0.388
Target students	-0.94	0.06	<0.001	-0.63	0.06	<0.001
Group * target students	0.01	0.10	0.890	-0.02	0.09	0.821
σ^2 (individuals)	0.21			0.18		
σ^2 (nesting within classes)	0.09			0.06		
<i>ICC</i>	0.30			0.23		
R^2m/R^2c	0.353/0.547			0.240/0.417		
AIC/BIC/deviance	733.69/759.34/721.69			666.11/691.76/654.11		

Whole sample: $N = 531$ (Feedback-Memory group = 208, control group = 323)

Target students: $N = 123$ (Feedback-Memory group = 48, control group = 75)

Classmates: $N = 408$ (Feedback-Memory group = 160, control group = 248)

Table 2 Descriptive statistics

Dependent variable	Group	<i>M</i> (<i>SD</i>) t1	<i>M</i> (<i>SD</i>) t2
–	<i>Whole sample</i>		
Classmates-perceived positive TF	Feedback-Memory group	2.17 (0.69)	2.12 (0.61)
	Control group	2.33 (0.62)	2.16 (0.59)
SA	Feedback-Memory group	1.53 (0.57)	1.58 (0.57)
	Control group	1.62 (0.54)	1.53 (0.58)
–	<i>Target students</i>		
Classmates-perceived positive TF	Feedback-Memory group	1.49 (0.50)	1.99 (0.55)
	Control group	1.65 (0.49)	1.62 (0.54)
SA	Feedback-Memory group	1.04 (0.45)	1.25 (0.55)
	Control group	1.15 (0.49)	1.07 (0.49)
–	<i>Classmates</i>		
Classmates-perceived positive TF	Feedback-Memory group	2.37 (0.60)	2.16 (0.62)
	Control group	2.53 (0.54)	2.32 (0.50)
SA	Feedback-Memory group	1.67 (0.52)	1.68 (0.54)
	Control group	1.76 (0.47)	1.67 (0.53)

Whole sample: $N=531$ (Feedback-Memory group=208, control group=323)

Target students: $N=123$ (Feedback-Memory group=48, control group=75)

Classmates: $N=408$ (Feedback-Memory group=160, control group=248)

9.1 Research question 1: Classmates-perceived positive teacher feedback

Table 2 presents the descriptive statistics for research questions 1 and 2. It is evident that target students in the Feedback-Memory group received a higher frequency of classmates-perceived positive TF during the intervention than before (t1: $M=1.49$, $SD=0.50$, t2: $M=1.99$, $SD=0.55$). Meanwhile, the means of the potential target students in the control group before and after the 4 weeks remained consistent (t1: $M=1.65$, $SD=0.49$, t2: $M=1.62$, $SD=0.54$).

In Table 3 (research question 1), the coefficients reveal that boys ($B=-0.09$), students with behavioral problems ($B=-0.17$), learning difficulties ($B=-0.12$), and the target students ($B=-0.59$) received positive TF less frequently according to their classmates' perception. There was also an overall decrease over time ($B=-0.21$).

Regarding research question 1, the statistical interaction of group, time, and target students ($B=0.54$) is significant. A visual representation of this interaction effect can be found in Fig. 2, confirming a significant improvement in classmates-perceived positive TF towards the target students in the Feedback-Memory group compared to the potential target students in the control group and their classmates in both groups.

The interaction of time and target students ($B=0.18$) indicates an overall increase for these students in both groups, largely driven by the substantial increase observed among the target students in the Feedback-Memory group.

9.2 Research question 2: Social acceptance

In Table 2, we observe an increase in SA for target students in the Feedback-Memory group (t1: $M=1.04$, $SD=0.45$, t2: $M=1.25$, $SD=0.55$). In contrast, the means of the

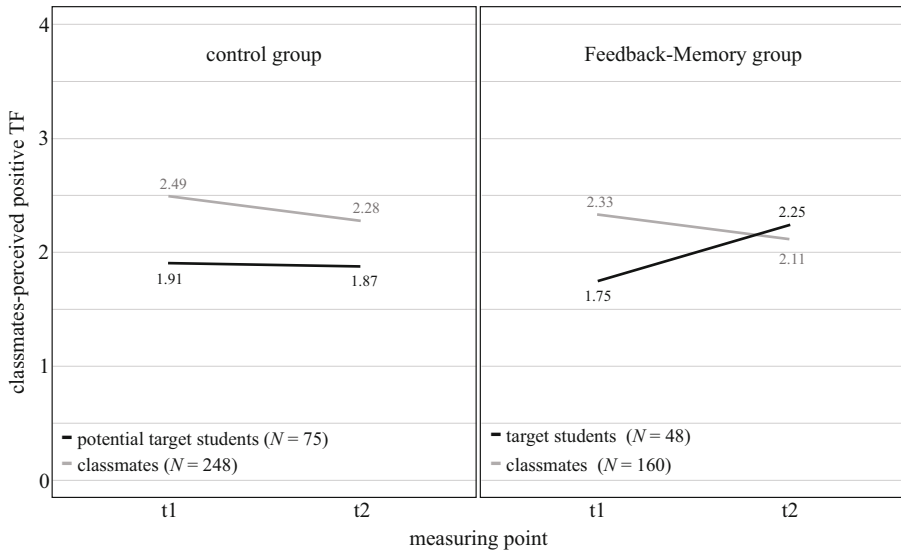


Fig. 2 Classmates-perceived positive teacher feedback. (Means derive from the regression model (classmates-perceived positive TF) in Table 3)

potential target students in the control group are slightly decreasing (t1: $M=1.15$, $SD=0.49$, t2: $M=1.07$, $SD=0.49$).

Table 3 (research question 2) presents the results of the multilevel analysis, indicating that children with behavioral problems ($B=-0.13$) and learning difficulties

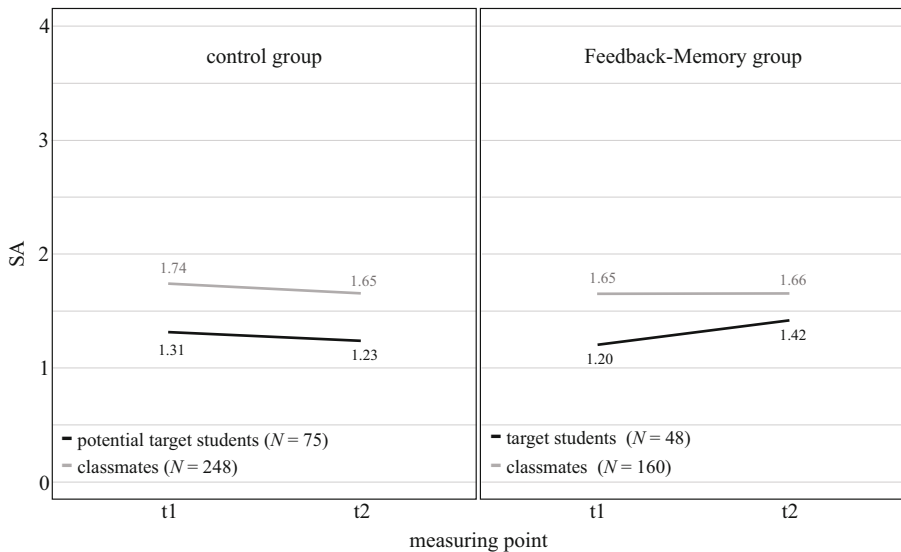


Fig. 3 Social acceptance. (Means derive from the regression model (SA) in Table 3)

Table 3 Multilevel analysis

	Research question 1: classmates-perceived positive TF			Research question 2: SA		
	<i>B</i>	<i>SE</i>	<i>p</i>	<i>B</i>	<i>SE</i>	<i>p</i>
Intercept	2.49	0.07	<0.001	1.74	0.06	<0.001
Sex	-0.09	0.03	0.008	-0.05	0.04	0.147
Behavioral problems	-0.17	0.02	<0.001	-0.13	0.02	<0.001
Learning difficulties	-0.12	0.01	<0.001	-0.05	0.02	0.002
Group	-0.16	0.11	0.147	-0.09	0.10	0.397
Time	-0.21	0.03	<0.001	-0.09	0.02	<0.001
Group * time	-0.00	0.04	0.937	0.09	0.04	0.017
Target students	-0.59	0.06	<0.001	-0.42	0.06	<0.001
Group * target students	0.00	0.09	0.990	-0.02	0.09	0.807
Time * target students	0.18	0.06	0.002	0.00	0.05	0.924
Group * time * target students	0.54	0.09	<0.001	0.21	0.08	0.010
σ^2 (individuals)	0.10			0.07		
σ^2 (nesting within individuals)	0.08			0.12		
σ^2 (nesting within classes)	0.06			0.05		
<i>ICC</i>	0.59			0.69		
R^2m/R^2c	0.424/0.762			0.276/0.778		
AIC/BIC/deviance	1117.2/1186.8/1089.2			1061.5/1131.1/1033.5		

Whole sample: $N = 531$ (Feedback-Memory group = 208, control group = 323)

Target students: $N = 123$ (Feedback-Memory group = 48, control group = 75)

Classmates: $N = 408$ (Feedback-Memory group = 160, control group = 248)

($B = -0.05$), as well as the target students ($B = -0.42$), were less socially accepted than their classmates. There was also an overall decrease over time ($B = -0.09$).

Regarding research question 2, the statistical interaction of group, time, and target students ($B = 0.21$) is significant. Figure 3 shows an enhancement in the SA of the target students in the Feedback-Memory group compared to the potential target students in the control group and their classmates in both groups. The interaction of group and time ($B = 0.09$) also indicates an overall intervention effect in favor of the Feedback-Memory group.

9.3 Research question 3: Social validity

The descriptive results of the social validity questionnaires for students and their teachers (Feedback-Memory group only) are presented in Table 4. The means reveal that students enjoyed the Feedback-Memory intervention (“rather true” to “absolutely true”). Teachers also stated that Feedback-Memory was fun for their students (“rather true” to “absolutely true”). However, the practical implementation was rated more critically (“true a little”).

Table 4 Social validity

	<i>M (SD)</i>
<i>Students</i>	
I enjoyed playing Feedback-Memory.	3.46 (0.80)
I would like to continue playing Feedback-Memory.	3.43 (0.86)
It was nice to be praised during Feedback-Memory.	3.52 (0.85)
Guessing during Feedback-Memory was fun.	3.30 (1.02)
It was great to get a reward during Feedback-Memory.	3.55 (0.90)
<i>Teachers</i>	
I think Feedback-Memory is a useful intervention.	2.80 (0.98)
Feedback-Memory has added value to everyday teaching.	2.50 (1.20)
Feedback-Memory was fun for the students.	3.70 (0.46)
Feedback-Memory was practical to implement.	2.10 (0.94)
I would continue to play Feedback-Memory.	2.00 (1.27)

N = 208 students from 10 classes (all students from the Feedback-Memory group). No significant differences between target and non-target students (*t*-tests for independent samples). Items rated on a 5-point-Likert-scale (0 = not true at all, 1 = rather not true, 2 = true a little, 3 = rather true, 4 = absolutely true)

10 Discussion

In accordance with the social referencing theory (Feinman 1992), experiments (Nicolay and Huber 2021, 2023) and field studies (Hendrickx et al. 2017; Wullschleger et al. 2020; Spilles et al. 2023) have revealed that TF might be an important factor influencing how students are socially accepted by their peers. Classroom interventions focusing on improving SA through TF modification have not been explored until now. Therefore, the present study investigated the effects of an intervention aimed at enhancing the SA of students who rarely receive positive TF – the Feedback-Memory approach.

10.1 Main findings

The results of the multilevel analysis revealed that Feedback-Memory significantly enhanced the classmates' perceived positive TF (research question 1) and the SA (research question 2) of the target students compared to the control group and their classmates. These findings suggest that Feedback-Memory could be a promising approach to support SA by enhancing the classmates' perception of positive TF. This is in line with the results of Spilles et al. (2023), who found a positive correlation between both variables in their cross-sectional study. Furthermore, our results replicate the findings of experiments conducted by Nicolay and Huber (2021, 2023), as well as longitudinal field studies conducted by Hendrickx et al. (2017) and Wullschleger et al. (2020), which indicate a causal relationship between TF and SA. In addition, the current study demonstrates that SA can also be increased through the manipulation of TF by classroom teachers. This result is particularly significant as it is the first time that such an effect has been shown in an educational setting.

Upon examining the results of social validity, it appears that students thoroughly enjoyed playing Feedback-Memory. Every item on the Likert scale, such as "I en-

joyed playing Feedback-Memory”, received an average rating ranging from “rather true” to “absolutely true”. Additionally, teachers believe that “Feedback-Memory fun for the students”, with an average rating of “rather true” to “absolutely true”. However, teacher ratings regarding the implementation of the intervention, as indicated by responses to items such as “Feedback-Memory was practical to implement” and “I would continue to play Feedback-Memory”, were somewhat critical, with ratings leaning towards “true a little”. Teachers reported that the procedures for providing positive TF to the target students, as outlined in the implementation plan, as well as the data collection, were perceived as very complex tasks, which may explain these results. In essence, the results suggest that Feedback-Memory not only represents an effective method for improving SA but also holds the potential for implementation in school classes. However, it would be essential to explore ways to streamline the implementation process and reduce the associated effort.

10.2 Limitations and perspectives

Of course, there are several limitations to this study that should be addressed.

First and foremost, Feedback-Memory was conceptualized as a multi-component intervention. Therefore, it is unclear which elements of the intervention contributed to the observed effects. For instance, it is plausible that the enhancement SA was not solely due to the increased perception of positive TF. The group reward system may have also played a role in promoting group cohesion and, subsequently, the development of SA (Huber 2019). The significant interaction of time and group in favor of the entire Feedback-Memory group (not just the target students) could be attributed to such an effect. Studies on other interdependent group reward contingency systems, such as the Good Behavior Game (Barrish et al. 1969), have demonstrated their potential to improve positive peer relations (Witvliet et al. 2009). Future research should delve into other elements of the Feedback-Memory approach to assess their specific effects, including those related to the implementation of the group reward system.

Additionally, it is worth noting that while the frequency of TF during Feedback-Memory was documented, the specific content of TF was not recorded. Consequently, it remains unclear which particular aspects of TF content had a significant impact on SA. Given that different TF content can have varying effects on SA (Wullschleger et al. 2020), future implementations of Feedback-Memory should consider capturing the TF content to provide a more comprehensive perspective.

Furthermore, it is not evident whether it is the increased quantity of TF or an improved perception of TF quality that causally contributes to the enhancement of SA. As part of teacher training, educators were explicitly instructed on how to deliver positive TF effectively for a positive impact on SA. This aspect might be investigated in future studies, potentially through video-based research methods.

Exploring whether Feedback-Memory is relevant for other target groups is an important avenue for future research. It is possible that increased positive TF could have a different impact on SA for certain students, potentially even negative effects. Previous studies have shown that older students may interpret teacher praise for easy tasks as a sign of low academic competence (Rheinberg 1988). Given the neg-

ative correlation between SA and perceived academic competence, it is conceivable that playing Feedback-Memory with older students could result in adverse effects. Moreover, it's worth considering the developmental differences in the influence of adults and peers on children and adolescents. Research suggests that children tend to be more influenced by adults, while the reverse is true for adolescents (Ruggeri et al. 2017).

Within the group of target children, male students were significantly overrepresented, making up approximately two-thirds of the participants. Therefore, it is essential to proactively investigate whether female students benefit from the intervention to the same extent. One approach could involve selecting two female and two male students who receive the least positive TF perception from their classmates. This approach would help achieve an equivalent gender ratio within the group of target students.

Regrettably, our study did not assess whether and to what extent the children were capable of recalling the TF. In future research, it is important to investigate whether the children's memory and recall abilities could potentially impact the effectiveness of the intervention.

It's intriguing to observe that within a relatively short interval of only 4 weeks, there was a noticeable increase in both variables. However, the longer-term effects of participating in Feedback-Memory should also be assessed in future studies. Firstly, it remains unclear how long the effects of the intervention will endure. Secondly, it is important to determine whether it can be integrated into the school day on a long-term basis.

10.3 Conclusion

Feedback-Memory is a first approach to increase SA of students rarely receiving positive TF based on an enhancement of the classmates' perception of those students receiving positive TF within the school day. The current study thus makes an important contribution in the field of social referencing and SA. We hope that our findings can be replicated in future studies which could lead to a new perspective on strengthening positive peer relations in classrooms.

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Conflict of interest M. Spilles, C. Huber and P. Nicolay declare that they have no competing interests.

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