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## Active music making and leisure activities for people with intellectual disabilities: A cluster randomized pilot study

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### ABSTRACT

**Aim:** A pilot cluster randomized controlled trial was performed to evaluate the effects of a music group intervention and a leisure activities group intervention on well-being, self-esteem, social acceptance, challenging behaviour and three components of executive functions (inhibitory control, cognitive flexibility and visual working memory) of adults with intellectual disabilities (ID).

**Method:** Twenty-nine participants living in four residential facilities for people with ID were randomized into a music or a leisure activities group intervention. Sixteen weekly sessions of one hour were performed with six to eight participants per group. Measurements were carried out at baseline, post-intervention and 11 weeks follow-up. Results were analysed with linear mixed models.

**Results:** The leisure activities group intervention improved more than the music group intervention on internalizing behaviour overall and on inhibitory control at post-intervention. However, further analyses showed that this improvement was only significant in one of the two leisure activities facilities.

**Conclusion:** A leisure activities group intervention seems a promising intervention to improve internalizing behaviour and inhibitory control of younger adults with mild ID. Implications for the delivery of leisure activities group interventions and especially music group interventions are discussed.

**What this paper adds:** Involvement in leisure activities of people with ID is associated with better well-being, an improvement in social skills and a reduction in emotional and behavioural problems. Active music making, as a specific form of leisure activities, seems to improve well-being, social acceptance and challenging behaviour (CB) as well. Moreover, in different (non-clinical) groups a significant effect of active music making has been found on self-esteem and executive functioning (EF). So far, little attention has been paid to the possible positive effects of active music making on adults with ID. In the current paper, a randomized controlled trial (RCT) was conducted to compare the post-intervention and follow-up measurements with baseline

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measurements between a music group intervention and a leisure activities group intervention on well-being, self-esteem, social acceptance, CB and EF in adults with ID. Multilevel models were used to detect possible intervention effects of 16 weekly sessions. Overall, inhibitory control and internalizing behaviour improved more amongst the participants of the leisure activities group

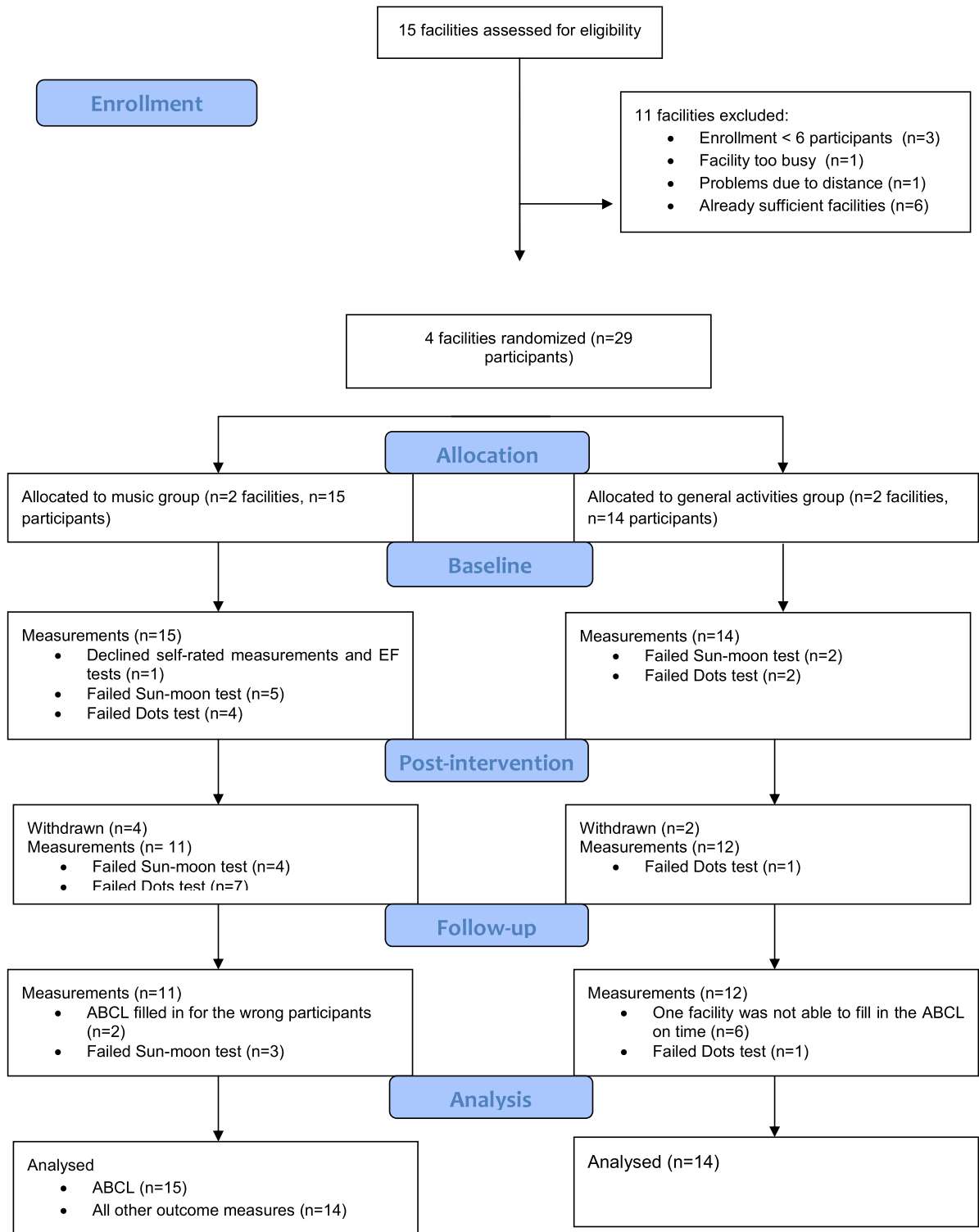


Fig. 1. Flow diagram following participants through the study.

than amongst the participants of the music group. This was mainly the case for younger participants who had mild ID. These effects are discussed and recommendations regarding the improvement of a music intervention for people with ID are presented.

## 1. Introduction

People with intellectual disabilities (ID) are more likely to show challenging behaviour (CB), such as aggression, self-injury, and destructive behaviour (Emerson et al., 2001). They also experience lower self-esteem than people without ID (Garaigordobil & Pérez, 2007; Valås, 1999) and lack contact with peers (Nouwens et al., 2017). Their executive functioning (EF) is also impacted (Spaniol & Danielsson, 2021; Zagaria et al., 2021), which is not surprising, since EF is linked to intellectual functioning (Miyake et al., 2001). EF is a collective term for an assembly of interrelated higher cognitive processes and is often divided into three components: cognitive flexibility, inhibitory control (inhibition) and working memory (Diamond, 2013). EF processes play an important role in human functioning, as they are crucial for the planning and execution of activities for daily living (Diamond, 2013). Given the importance of CB, self-esteem, social support and EF, as well as their association with the well-being of people with ID (Kim et al., 2016; Koch et al., 2015; Luerssen & Ayduk, 2017; Lunsky & Benson, 2001), it is important to look for interventions that can improve these factors.

Involvement in leisure activities is associated with a better well-being (Duvdevany & Arar, 2004) and may improve social skills and reduce emotional and behavioural problems among people with ID (Eratay, 2013). Unfortunately, people with ID participate less in leisure activities than people without ID (Merrells et al., 2018). Moreover, people with ID tend to perform leisure activities that occur in specialist settings like day centres (Reynolds, 2002) and are mostly solitary and passive in nature (Buttimer & Tierney, 2005). People with ID may experience various barriers to leisure participation, such as expenses (for the activity itself and the involved caregivers) and the facility being too short-staffed to adequately meet the activity interests of individuals (Reynolds, 2002). Interventions aimed at facilitating participation in leisure activities may contribute to the well-being of people with ID (Badia et al., 2013). An active leisure life can consist of a variety of enjoyable activities, such as watching a movie, playing bingo and craft activities (Buttimer & Tierney, 2005; Reynolds, 2002; Umb-Carlsson & Sonnander, 2006). It can also include musical activities (Buttimer & Tierney, 2005; Reynolds, 2002).

Several reviews present a positive association between well-being and musical activities in the general population (Dingle et al., 2021; Macdonald, 2013; Sheppard & Broughton, 2020). Furthermore, it has been suggested that active music making (i.e. making music or sounds together) can be more promising than passive music methods (i.e. listening) for targeting well-being and EF (Haering, 2018; Van Der Steen et al., 2017; Weinberg & Joseph, 2017). In addition, music group interventions seem to improve some components of EF more than other leisure activities group interventions (e.g. visual arts or Lego brick training) among children (Bugos & DeMarie, 2017; Frischen et al., 2021). Active music making can be used as an effective intervention for increasing self-esteem in community settings (Hallam et al., 2012) and in people with mental health problems (Kwan & Clift, 2018). Furthermore, studies including children, adolescents and elderly people found that active music making improved CB (Geipel et al., 2018; Raglio et al., 2008; Sung et al., 2006). Remarkably, little attention has been paid to the possible positive effects of active music making on adults with ID. One study showed that performing music activities improved communication and facilitated skill development (MacDonald et al., 1999). Furthermore, a non-systematic literature review concluded that music making interventions can decrease levels of aggression and self-injurious behaviour and can improve well-being (Savarimuthu & Bunnell, 2002). To summarize, while various studies have found an association between making music and an improved well-being, self-esteem, social acceptance, CB and EF in non-disabled and other patient groups, there is limited evidence with respect to people with ID.

The aim of the present pilot study was therefore to investigate the possible superiority of active music making activities over non-musical leisure group activities regarding their effects on well-being, self-esteem, social acceptance, CB and EF in adults with ID. Feasibility of this music intervention will be described in detail elsewhere.

## 2. Method

### 2.1. Design

We conducted a pilot cluster randomized controlled trial (RCT) with 29 adults with ID. The efficacy of a weekly active music group intervention was compared to the efficacy of a leisure activities group intervention using pre, post and follow-up measurements.

### 2.2. Participants

Participants ( $n = 29$ ) were recruited from four residential facilities of the Dutch service organization Philadelphia Care Foundation (see Fig. 1). Fifteen facilities expressed an initial interest in participating in this study and were assessed for eligibility (i.e. majority of their residents (>80%) function at mild (IQ 50–69) or borderline (IQ 70–84) ID). Individual residents could participate if they had a mild or borderline ID, were 18 years or older, were able to participate in a group and were mentally competent to give consent to participate. When people with a moderate ID from the included facilities expressed interest in the study they could also participate since it seemed unethical to exclude them from being involved in free enjoyable activities with their peers. This happened more often in the music group intervention than in the leisure activities group intervention. Unfortunately, some participants with moderate ID were

not able to complete two of the selected assessment measures (see Fig. 1), and one participant refused all self-rated measurements and tests (see Fig. 1).

### 2.3. Material and procedure

In this pilot cluster RCT, a comparison was made between two different types of groups: groups in which participants took part in an active music group intervention and groups in which participants were engaged in a leisure activities group intervention. The maximum group size was eight. After we recruited four facilities and all informed consents were collected, we found two music practitioners who would carry out the music intervention. Randomization of the facilities was pragmatic in nature: the facilities that were the nearest to the two music practitioners were allocated to the music group intervention. After the allocation, the special psychologists of the facilities were asked to fill in the characteristics of each participant: age, gender, level of ID and co-morbid psychiatric diagnoses. Data were collected at three time points: prior to the start of the intervention (baseline), the week after completing the intervention (post-intervention), and eleven weeks after the intervention ended (follow-up). Ethical approval for this study was granted by the Medical Ethical Committee of the VU University Medical Center. All participants and their legal representatives (when applicable,  $n = 9$ ) provided written informed consent.

### 2.4. Intervention

In both intervention conditions, sixteen one-hour sessions were performed once a week. At each facility, two caregivers were assigned as coordinators for the intervention and during each session at least one of them was present. During the course of the RCT, the facilities could not start new musical or leisure activities (other than the intervention), however, musical or leisure activities that started pre-intervention were still allowed in both intervention conditions.

The music intervention was carried out by two trained music practitioners: one for each facility. A guideline was developed to ensure the intervention's validity and replicability. Prior to each session, the music practitioner and one of two caregivers who functioned as coordinators had a 10-minute meeting to prepare. Each session followed a routine beginning with a welcoming song, a listening exercise and a vocal warming-up. After this, the main part consisted of active music making, with participants choosing an instruments to play (a variety of instruments was present) and ended with a cooling-down and always the same closing song. During each session, the trained music practitioner was not only assisted by a caregiver who functioned as coordinator, but also by a second caregiver. This way, most caregivers from each facility experienced the techniques used by the music practitioner and participated actively. The idea behind such a caregiver-assisted music intervention was that this would stimulate the integration of music into daily caring situations (Götell et al., 2000). Furthermore, participants and their caregivers were encouraged to perform musical activities in-between the music sessions.

The leisure activities intervention was carried out by a research assistant. Per session, the participants could choose which non-musical activities they wanted to engage in (e.g., gaming, playing darts, playing cards, baking, puzzling). They could choose the same activity multiple times. These activities were chosen as several caregivers indicated in a survey that these activities were suitable and enjoyable. In addition, the activities all had an interactive nature in order to mirror the music intervention and to ensure a comparable level of attention and group contact. A manual and list with possible activities was provided to the research assistant.

### 2.5. Behavioural and cognitive tests

#### 2.5.1. Challenging behaviour

The Adult Behaviour Checklist (ABCL) (Achenbach & Rescorla, 2003) was used to assess the level of emotional and behavioural problems of each participant as perceived by two caregivers who work at the facility and know the participant well. The caregivers from each facility could choose whether to distribute the task of filling in the ABCL for all participants from their facility among different caregivers, or to assign two caregivers who fill in the ABCL for all the participants from their facility. The researchers stressed the importance of inter-observer reliability (and lobbied for assigning two caregivers to the task), but only at one facility the ABCL was filled in by the same two caregivers at all three time points. The ABCL has been found to be a reliable (mean Cronbach's  $\alpha = 0.84$ ) and valid measure of emotional and behavioural problems in an ID inpatient sample (Tenneij & Koot, 2008). The ABCL consists of 118 items scored on a 3-point Likert scale. The items form eight subscales and a total score (maximum 236) can be calculated. A higher score on the (sub)scales indicates more CB. Three subscales concern internalized problems (anxious/depressed, withdrawal, and somatic complaints), three concern externalized problems (aggressive behaviour, rule-breaking behaviour, and intrusiveness), and two concern cognitive problems (thought and attention). In this study, the total score as well as the internalizing subscale (maximum score 64) and the externalizing subscale (maximum score 70) were used.

#### 2.5.2. Well-being

As an indicator of well-being, we chose to determine the level of satisfaction and frustration regarding the need for competence, autonomy and relatedness through administrating the Basic Psychological Need Satisfaction and Frustration Scale – Intellectual Disability (BPNSFS-ID, Frielink et al., 2019). This is a self-report questionnaire consisting of 24 items that are scored on a five-point Likert scale (Frielink et al., 2019). The BPNSFS-ID has been shown to be a valid and reliable measure for people with ID, with a Cronbach's  $\alpha$  of .92 (Frielink et al., 2019). Two higher-order constructs need satisfaction and need frustration were assessed, with a maximum score per construct of 60. A low score on need satisfaction is associated with a dissatisfied person, whereas a high score on

need frustration is associated with a frustrated person.

### 2.5.3. Self-esteem and social acceptance

Self-esteem and social acceptance were measured using the adapted Dutch version (Treffers et al., 2002) of Harter's (1988) Self-Perception Profile for Adolescents (SPPA). In this self-report questionnaire, the item format of the SPPA was modified with only one statement per question (Soenens et al., 2006; Vermeir & Van de Sompel, 2014). The two used subscales of the SPPA both consists of five items scored on a four-point Likert scale (maximum score 20), with higher scores representing more self-esteem or social acceptance. The validity and reliability of the Dutch version of the SPPA is acceptable to good with Cronbach's alpha > 0.70 (Treffers et al., 2002).

### 2.5.4. Executive functioning: inhibitory control

Inhibitory control was measured by the Sun-Moon Test (Dutch: Zon-Maan Test) from the Cross-Cultural Dementia (CCD) Screening (Goudsmit et al., 2017). Part A consists of sets of pictures of suns and moons which participants with ID have to name as fast as possible. In part B, participants with ID have to name 'sun' as moon and 'moon' as sun, using the standard Stroop paradigm. The time to completion and the number of errors is recorded. Each error results in penalty seconds (3.4 per error) which are added to the completion time. In this study, only the time score on part B was analyzed, since this part measures inhibition (Goudsmit et al., 2017).

### 2.5.5. Executive functioning: cognitive flexibility

Cognitive flexibility was assessed by applying the Dots Test (Dutch: Stippentest) from the CCD Screening (Goudsmit et al., 2017). This test is based on the Trail Making Test (Reitan & Wolfson, 1985), but uses stimuli that resemble domino pieces instead of letters and numbers. In part A, dominoes ranging from 1 to 9 have to be connected by the participant with ID in the right order, as fast as possible. In part B, black and white dominoes have to be connected alternately while also taking into account the ascending numbers, again as fast as possible. To obtain a measure of cognitive flexibility, the time to completion in part A is subtracted from the time to completion in part B (Bugos et al., 2007; Thaut et al., 2009).

### 2.5.6. Executive functioning: visual working memory

Visual working memory was assessed using the Circle Span Backward Test from the Neuropsychological Test Series for Elderly People with Mild Intellectual Disability (NETOL) (Verberne, 1998). The Circle Span Test resembles the Corsi Block task (Lezak, 1983). Participants with ID have to mimic the research assistant backwards as they 'tap' a sequence of circles. The participant receives 1 point for each correct sequence of 'taps' and there are 8 sequences in total.

## 2.6. Data analysis

Raw scores were used in all analyses. Person mean imputation per subscale was applied for the ABCL and BPNSFS-ID in order to handle missing values. An exception was made for items 56a-56g of the ABCL: if these were left blank, they were scored 0, in accordance with the manual (Achenbach & Rescorla, 2003). Mann-Whitney, chi-square and Fisher's Exact tests were used to explore whether baseline characteristics differed between the two intervention groups (see Table 1).

To examine the effect of each intervention separately, an exploratory linear mixed model was performed to assess the within-group change from baseline to post-intervention and from baseline to follow-up. Since there were significant age differences between the intervention groups, age was added as a covariate in the following analyses. Three linear mixed models analysis were performed for the interaction between the treatment variable and time (overall), post intervention (T2) and follow-up (T3) (Twisk et al., 2018). This made it possible to adjust for the dependency of the repeated observations within the subjects. If an interaction effect was significant, an extra analysis using Friedman's ANOVA or Wilcoxon signed-rank test was performed between the facilities of the intervention group in which the initial effect was found (to check whether the effect was significant in both facilities or caused by only one facility).

A p-value less than 0.05 was considered statistically significant. Given the exploratory nature of this study, no corrections for

**Table 1**

Participant characteristics per intervention group.

	Music group	Leisure activities group	Statistic (degrees of freedom)	P-value
<b>N</b>	15	14		
<b>Median age in years (range)</b>	56 (42–78)	41 (19–73)	54.50	.03
<b>Gender (men)</b>	6	7	.29	.59
<b>Level of ID</b>			4.22	.16
	IQ ≥ 70	1		
	IQ 50–69	11		
	IQ 35–49	2		
<b>Psychiatric diagnosis</b>			2.98	.64
	ASD	2		
	MD	1		
	PD	0		

Notes: ASD = Autism Spectrum Disorder; MD = Mood Disorder; PD = Personality Disorder

multiple tests were made (Streiner & Norman, 2011). All statistical analyses were performed in SPSS version 26.

### 3. Results

Three of four facilities completed the full 16 intervention sessions. Due to miscommunication between the caregivers and the research assistant that carried out the leisure activities group intervention, one leisure activities facility completed fourteen sessions. Visual inspection of the standardized residuals for each analysis demonstrated a normal pattern of distribution. Baseline characteristics are shown in Table 1.

Table 2 presents an overview of the median scores and range of each test per intervention group per measurement, and of the significant within-group differences at post-intervention and follow-up compared to baseline. Participants in the music groups felt significantly less frustrated of their needs and expressed more self-worth post-intervention compared to baseline. Participants in the leisure activities groups exhibited less CB and internalizing behaviour and felt more social acceptance post-intervention compared to baseline. In addition, participants in the leisure activities group reported more satisfaction of their needs at follow-up and better inhibitory control at both post-intervention and follow-up compared to baseline.

Table 3 presents the results of the linear mixed model analyses for each outcome variable with the overall interaction effect (Group x Time effect on average over time), and the interaction effect (group x time) at post-intervention (T2) and at follow-up (T3) between intervention groups. The overall interaction effect was only significant on the subscale internalizing behaviour of the ABCL, showing that participants of the leisure activities group intervention exhibited a larger reduction in internalizing behaviour than participants of the music group intervention ( $F(1, 44.81) = 5.27, p = .03$ ). Further analysis showed that the scores on the internalizing behaviour subscale were only significantly lower at post-intervention compared to baseline for one of the two facilities participating in the leisure activities group intervention ( $\chi^2(1) = 5.00, p = .03$ ). The age of the participants in this facility ( $n = 6, \text{Mdn} = 27$ ) was significantly lower compared to the other leisure activities facility ( $n = 8, \text{Mdn} = 58$ ) (Mann-Whitney  $U = 46.50, z = 2.91, p = .00$ ).

At post-intervention, a significant interaction effect was found on inhibitory control in favour of the leisure activities group intervention ( $F(1, 39.64) = 5.67, p = .02$ ). Further analysis showed that there was only a significant effect at the same leisure activities facility as mentioned regarding the subscale internalizing behaviour ( $T = .00, p = .04$ ). At follow-up, no significant interaction effect was found.

### 4. Discussion

This pilot cluster RCT found significant within-group changes in several outcome measures after executing both types of interventions for adults with ID. However, no evidence was found that active music making in a group improves well-being, self-esteem, social acceptance, CB and EF more than other leisure activities within 16 weekly sessions. In contrast, people in the leisure activities

**Table 2**

Median and range per outcome measure per intervention group at baseline (T1), post-intervention (T2) and follow-up (T3).

Outcomes	Music group			Leisure activities group		
	T1	T2	T3	T1	T2	T3
<b>Challenging behaviour (ABCL)</b>						
Total (0–236)	48.00 (10–100.58)	39.34 (14.00–109.00)	40.00 (7.00–129.38)	35.46 (12.00–83.26)	29.61 * (12.00–58.25)	39.50 (23.00–54.00)
Internalizing Behaviour (0–64)	13.00 (1.00–36.00)	12.00 (3.00–38.00)	12.00 (2.00–33.00)	11.50 (5.00–28.00)	7.00 * (1.00–17.00)	10.00 (5.00–13.00)
Externalizing Behaviour (0–70)	12.00 (3.00–32.58)	12.00 (2.00–46.00)	10.00 (2.00–40.00)	11.14 (0.00–24.00)	8.50 (2.00–31.00)	11.00 (2.00–25.00)
<b>Well-being (BPNSFS-ID)</b>						
Need Satisfaction(12–60)	58.00 (42.00–60.00)	56.00 (35.00–60.00)	57.00 (31.00–60.00)	52.50 (36.00–59.00)	49.50 (40.00–59.00)	55.00 * (48.00–58.00)
Need Frustration (12–60)	28.00 (15.00–60.00)	25.00 (18.00–44.00)	18.00 * (15.00–43.00)	22.84 (12.00–52.00)	20.00 (12.00–46.00)	22.00 (15.00–40.00)
<b>Self-esteem (SPPA)</b>						
Global Self-Worth (5–20)	17.00 (8.00–20.00)	19.00 * (7.00–20.00)	19.00 (5.00–20.00)	17.50 (12.00–20.00)	17.50 (9.00–20.00)	17.50 (11.00–20.00)
<b>Social acceptance (SPPA)</b>						
Social Acceptance (5–20)	15.50 (12.00–20.00)	17.00 (7.00–20.00)	15.00 (8.00–20.00)	13.50 (9.00–19.00)	16.00 * (12.00–19.00)	15.00 (10.00–18.00)
<b>Executive functioning</b>						
Sun-Moon Test (seconds)	58.0 (41.0–117.6)	64.8 (40.0–143.8)	61.0 (42.0–129.8)	39.5 (19.0–137.6)	33.5 * (19.0–69.6)	35.5 * (19.0–80.2)
Dots Test (seconds)	87.0 (–79.0 to 134.0)	74.5 (52.0–163.0)	74.0 (38.0–124.0)	44.0 (3.0–258.0)	45.0 (9.0–199.0)	37.0 (11.0–235.0)
Circle Span Backward Test (0–8)	1.5 (0.0–3.0)	0.0 (0.0–4.0)	0.0 (0.0–4.0)	3.0 (1.0–8.0)	3.0 (0.0–8.0)	2.0 (1.0–8.0)

Notes: \* $p < .05$ , with exploratory linear mixed models analyses within-group compared to baseline; ABCL = Adult Behaviour Checklist; BPNSFS-ID = Basic Psychological Need Satisfaction and Frustration Scale – Intellectual Disability; SPPA = Self-Perception Profile for Adults



**Table 3**

Results of the linear mixed models analyses regarding the overall interaction effect and the interaction effect at post-intervention (T2) and follow-up (T3) between intervention groups.

	B (95% confidence interval)	F	p-value
<b>ABCL Total</b>			
Overall	-9.48 (-21.24 to 2.27)	2.64	.11
T2	-12.09 (-25.09 to .91)	3.53	.07
T3	-2.39 (-18.25 to 13.47)	.09	.76
<b>ABCL Internalizing Behaviour</b>			
Overall	-4.43 (-8.31 to -.54)	5.27	.03
T2	-6.11 (-10.34 to -1.88)	8.51	.01
T3	-.96 (-6.13 to 4.20)	.14	.71
<b>ABCL Externalizing Behaviour</b>			
Overall	-2.49 (-7.69 to 2.72)	.92	.34
T2	-2.81 (-8.73 to 3.10)	.92	.34
T3	-1.10 (-8.36 to 6.17)	.09	.76
<b>BPNSFS-ID Need Satisfaction</b>			
Overall	1.04 (-2.87 to 4.96)	.29	.60
T2	-1.15 (-5.57 to 3.27)	.27	.60
T3	3.60 (-.82 to 8.02)	2.67	.11
<b>BPNSFS-ID Need Frustration</b>			
Overall	2.33 (-2.46 to 7.12)	.95	.33
T2	.54 (-4.94 to 6.03)	.04	.84
T3	4.16 (-1.32 to 9.65)	2.33	.13
<b>SPPA Global Self-Worth</b>			
Overall	.67 (-1.17 to 2.51)	.53	.47
T2	.98 (-1.27 to 3.24)	.76	.39
T3	.32 (-1.93 to 2.58)	.08	.78
<b>SPPA Social Acceptance</b>			
Overall	-.83 (-2.62 to .96)	.85	.36
T2	-1.13 (-3.23 to 1.04)	1.01	.30
T3	-.51 (-2.67 to 1.65)	.23	.64
<b>Sun-Moon Test</b>			
Overall	-13.98 (-30.48 to 2.52)	2.91	.10
T2	-22.35 (-41.32 to -3.37)	5.67	.02
T3	-6.43 (-24.76 to 11.92)	.50	.48
<b>Dots Test</b>			
Overall	2.23 (-37.78 to 42.26)	.01	.91
T2	-10.88 (-67.14 to 45.37)	.15	.70
T3	6.96 (-41.10 to 55.03)	.09	.77
<b>Circle Span Backward Test</b>			
Overall	.50 (-.66 to 1.66)	.75	.39
T2	.61 (-.80 to 2.01)	.76	.39
T3	.44 (-.97 to 1.84)	.39	.54

Notes: ABCL = Adult Behaviour Checklist; BPNSFS-ID = Basic Psychological Need Satisfaction and Frustration Scale – Intellectual Disability; SPPA = Self-Perception Profile for Adults

group intervention showed significantly higher inhibitory control and significantly less internalizing behaviour at post-intervention compared to people attending a music group intervention. The improvement on inhibitory control within the leisure activities group intervention is in line with the finding that a leisure time activity programme for people with ID improved self-control (Eratay, 2013) and that a creative movement group for children resulted in more improvement in EF compared to a musical arts program (Park et al., 2015). Concerning the effect on internalizing behaviour, other studies also found less CB in people with ID after general leisure activities (Heyvaert et al., 2012). This promising effect of a leisure activities group intervention on inhibitory control and internalizing behaviour highlights the importance of structurally available caregivers to organize leisure activities and support people with ID participating in them.

The between-group differences on inhibitory control and internalizing behaviour were mainly caused by participants in one leisure activity facility. It therefore seems likely that differences in characteristics between (the participants of) these facilities played an important role. To begin with, the participants of the facility that caused the effect were significantly younger than the participants of the other facility. This seems relevant and is in line with Ferguson et al. (2021) who reported a decline in inhibitory control across the lifespan. Also, these participants were all diagnosed with mild ID, while the participants in the other facility were not (also moderate and borderline ID). Furthermore, it was reported by their caregivers that these participants spent a lot of time on their own before the start of our intervention. These findings suggest that a leisure activities group intervention is more effective on behaviour for younger participants with mild ID, possibly because people with mild ID in institutional settings tend to experience barriers to their social inclusion (Abbott & McConkey, 2006). Further studies which take the variables of age, level of ID and social inclusion into account, are needed to develop a better picture of the effectiveness of leisure activities group interventions.

There are several possible reasons for not finding more improvement after attending a 16 week active music making group on any of the outcomes. A first reason is that it is plausible that a relatively short-term active music group intervention (<20 weeks) does not



improve well-being, self-esteem, social acceptance, CB and EF more than a leisure activities group intervention. The findings of other studies seem to conform this. For example, one month of musical interventions did not improve well-being and CB among people with dementia more than being engaged in other pleasant activities (Samson et al., 2015). Likewise, D'Souza and Wiseheart (2018) found no improvement in EF after three weeks of music training, compared to a dance training. The only short-term music intervention (8 weeks) in which an improvement in EF (i.e. inhibition) was found, made a comparison with care-as-usual and this positive effect disappeared when compared to art classes (Bowmer et al., 2018). Benefits in CB among children with ID have been seen after 24 weeks of music training, however, in this study participants in the other group received no comparable activities at all (Kalgotra & Warwal, 2017). When looking at musical interventions that were carried out for a longer period, it was found that after 32 weeks of active music making the self-esteem and well-being of people with a severe mental illness improved (Chang et al., 2018). In addition, EF among primary school children increased more after respectively 8 months (Frischen et al., 2021), 1,5 year (Roden et al., 2014) and 2,5 years (Jaschke et al., 2018) of musical involvement when compared to children involved in an arts group or natural science training. In sum, it seems possible that some of the benefits of musical involvement are only achieved after a longer period of time, with a minimum of 32 weeks.

A second reason is that the frequency of the music intervention (once a week) was too low, and that significant changes require a more intensive intervention. Previous studies have shown that 5 days a week of active music making results in benefits in EF among children without ID (Shen et al., 2019) and in CB among children with ID (Kalgotra & Warwal, 2017). However, the latter study made a comparison with care-as-usual only. When a comparison was made with a group that also received an intervention for 5 days a week, both groups showed an equal improvement in EF (Kosokabe et al., 2021). In our study, caregivers were expected to stimulate participants of the music group intervention to also play music in-between the sessions. Unfortunately, this active stimulation was not performed according to protocol and this may have resulted in a frequency of active music making that was too low to realise a detectable impact on the outcome measures.

A third reason is that the music group played music together as a 'one-intervention-suits-all' approach. This seems challenging with regards to the diversity among participants concerning musical preference, cognitive functions, communicative and social skills (Mulhall et al., 2020; Ptomey et al., 2017). It is for example possible that for some participants the musical activity was not challenging enough, which is a necessary condition to increase EF (Diamond & Ling, 2016). Several authors express that an individual-based music intervention can be more effective (Ogg-groenendaal et al., 2014; Vereenooghe & Langdon, 2013). This is supported by a study among children with autism, whose self-esteem and peer attitudes increased while anxiety decreased following a music intervention with a staff to participant ratio close to 1:1, which ensured enough individual attention (Hillier et al., 2012). An individual-based intervention also prevents the ethical dilemma of withholding an enjoyable group activity to people living at the same facility who do not meet the inclusion criteria, since an individual intervention can be held at the comfort of their own apartment and ensures a more homogeneous inclusion of participants. Within the leisure activities group intervention, it was possible to split different activities in smaller groups, which might explain why this intervention was more effective on outcome variables. In fact, this was indeed done by the two facilities of the leisure activities group intervention: sometimes the group split up (and played for example board games and table tennis in smaller groups) and sometimes they did an activity with the whole group (e.g. making a large drawing together). This finding provides support for the importance of tailoring interventions to the needs and preferences of participants.

Besides the discussed between-group outcomes on EF and CB, significant within-group changes in several outcome measures were found after both types of interventions. First, self-esteem of participants in the music group intervention improved. This is in line with Park et al. (2015), who found that self-esteem improved after 30 h of arts education composed of musical arts, while it did not improve after a similar amount of creative movement. This effect seems promising and needs further investigation. Second, the need frustration of participants in the music group and the need satisfaction of participants in the leisure activities group improved. These results need to be treated cautiously since the used questionnaire (BPNSFS-ID, Frielink et al., 2019) proved to be quite complex for many participants, especially for people with moderate ID. There are concerns about the usage of self-report questionnaires in general (of which the BPNSFS-ID is just one example) among people with moderate ID (Kooijmans et al., 2022). In addition, it should also be mentioned that the need satisfaction of the participants in the music intervention group was quite high at baseline, demonstrating a well-being homeostasis (Mcgillivray et al., 2009). Third, the social acceptance of the participants in the leisure activities group intervention improved. This resonates with indications that engagement with others as part of community and structured activities promotes social well-being (Eisenman et al., 2017).

The current study has several limitations. First, the uneven distribution of ID level between the two intervention groups was a consequence of the cluster randomization and the small number of clusters involved. Second, the small sample size limits the generalizability of the results, which is quite common in RCTs that include people with ID (Mulhall et al., 2018). The sample size was further reduced by the fact that the used EF measures proved to be too difficult for some participants, especially for those with moderate ID. This especially reduced the sample size in the music group, and resulted in limited power to detect changes on EF outcome measures. Problems with limited power occur often in ID-research studying EF (Spaniol & Danielsson, 2021), especially when the limits of the participants' EF skills are pushed on demanding EF tasks (Diamond & Ling, 2016), which might have occurred with our participants with moderate ID. This 'floor effect' is therefore common when studying EF in people with ID (Willner et al., 2010). Third, the data completion rate was rather low at follow-up for the ABCL, because some caregivers did not deliver this questionnaire on time. Fourth, since the inclusion criteria were broadened for ethical reasons, the group of participants was more heterogeneous with respect to level of ID than anticipated. This made it challenging for the researchers to identify instruments that assess the relevant outcomes and are appropriate for all participants. Heterogeneity and its practical implications and barriers is a common issue in RCTs in the field of ID care (Mulhall et al., 2020). This underlines the importance of both homogeneous inclusion and using questionnaires and tests that are appropriate for all included participants.

Overall, there is a lack of consensus regarding the appropriate length and intensity of the intervention that is needed to reliably improve well-being, self-esteem, social acceptance, CB and EF in adults with ID. Further research is therefore necessary. Future studies should also explore whether an individualized music intervention suits the needs and interests of such a heterogenic group of people with ID better. Furthermore, to enable the measurement of the planned outcomes in people with mild and especially moderate ID, it is recommended to make more use of custom-developed tests that are adapted to their skills (Willner et al., 2010). For now, this paper shows the promising pilot results of a leisure activities group intervention for younger people with mild ID and contributes to a better understanding of the issues that should be addressed when carrying out an effective music intervention for people with ID.

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### CRedit authorship contribution statement

**Gerianne J.J. Smeets:** Conceptualization, Formal analysis, Investigation, Writing – original draft, **Karin M. Volkerts:** Conceptualization, Resources, Writing – review & editing, Supervision, **Erik J.A. Scherder:** Conceptualization, Writing – review & editing, Supervision, **Xavier M.H. Moonen:** Conceptualization, Writing – review & editing, Supervision.

### Conflict of interest

All authors declare no conflict of interest.

### Data Availability

Data will be made available on request. The data that support the findings of this study are available from the corresponding author upon reasonable request.

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