

# Unlocking the benefits of montessori-based reading activities in nursing home: A multiple baseline study on groups of individuals with severe dementia

Dementia

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**Abstract**

**Objective:** Group activities are commonly offered to residents of nursing homes, and increasingly with a person-centred care approach. The aim of this study is to compare the impacts of a Montessori-based reading activity with a more traditional reading activity.

**Method:** A multiple baseline design was used, with 3 groups of 5 older adults with moderate to severe dementia. All sessions were videorecorded and analysed by independent judges, blinded to our hypotheses and conditions. Impacts of the type of activity (storytelling or Montessori-based reading) on verbal interactions, engagement level, affect and behavioural aspects were estimated with both visual analyses and statistical analyses using the between-case standardised mean differences method.

**Results:** Significant differences were found in favour of the Montessori-based activities with regard to the number of verbal interactions, constructive and passive engagement and positive affect expressed, with moderate to large effect size (from 0.46 to 1.66).

**Conclusion:** The Montessori-based reading group activity really seems to be preferable to a more traditional storytelling activity, with multiple benefits for residents. Depending on the preserved abilities and interests of the participants, it can also be aimed at people with severe dementia.

**Keywords**

dementia, person-centred care, montessori, group activity, single-case experimental design

**Introduction**

Several alarming studies have revealed that up to 75% of nursing home residents are inactive, often found asleep or watching television during daily observation periods (den Ouden et al., 2015; Silveira et al., 2022; Smit et al., 2016). The majority of time spent by residents in nursing homes would therefore not allow essential human needs to be met (Cohen-Mansfield et al., 2010). The Unmet Needs Model posits a relationship between the presence of unmet needs in an individual and the occurrence of responsive behaviours. This association highlights the challenge faced by those with cognitive impairment in autonomously addressing or expressing these unmet needs (Cohen-Mansfield, 2015). The presence of unmet needs has been associated with an increase in depressive symptoms and a multiplicity of responsive behaviours such as agitation (Cohen-Mansfield et al., 2015; Cohen-Mansfield & Werner, 1995; Hancock et al., 2006). Among these needs, the need for occupation is essential for maintaining well-being, through meaningful activities and regular positive social interactions (Smit et al., 2014; Smrokowska-Reichmann et al., 2024). Yet, engaging daily in social interactions and meaningful activities were found to be almost always unseen among elderly residents (Morley et al., 2014; Uchino et al., 1996). Lack of social activity has major repercussions on health, both physical and mental, and has also been shown to be a risk factor for

mortality (Bone et al., 2022; Cohen, 2004; Holt-Lunstad et al., 2010). It is now widely accepted that engagement in positive social activities is associated with a reduction in depressive symptoms, a reduction in responsive behaviours associated with dementia such as agitation and an improvement in quality of life (Cohen-Mansfield & Marx, 1992; Erkes & Bayard, 2023; Kolanowski et al., 2005; Lou et al., 2013; Smit et al., 2016; van der Ploeg et al., 2013). Drawing on all these scientific findings, recommendations for good practice in nursing homes include reducing social isolation, increasing opportunities to engage in positive social interactions and facilitating access to occupation (Haute Autorité de Santé, 2022; James et al., 2020; WHO, 2016).

Person-centred care is also central to the World Health Organization's recommendations, especially in light of the current 'Decade of Healthy Ageing' (WHO, 2016). Initially conceptualised by Kitwood, it promotes the individualisation of care in line with the preferences and needs of the individual, based on their intrinsic and environmental resources (Kitwood, 1997; Kitwood & Bredin, 1992). Person-centred care is now considered the gold standard by the American Society of Aging and is recommended for supporting people with cognitive disorders (Berkovic et al., 2023; Bourgeois et al., 2015; Camp et al., 2018; James et al., 2020; Love & Pinkowitz, 2013). The Montessori method is among the most documented, demonstrating multiple positive effects on residents and caregivers (Camp et al., 2018; Malone & Camp, 2007; van Voorden et al., 2023). In nursing homes, group activities represent an appropriate response to current health policies, while also aligning with the day-to-day imperatives of carers. Montessori-based activities are adapted to the abilities of each participant and based on their interests, fostering constructive engagement rather than passive engagement or non-engagement (Chan et al., 2021; Jarrott et al., 2008; Judge et al., 2000; Lee et al., 2007; Orsulic-Jeras et al., 2000). In groups, they are also intended to encourage positive social interaction between participants. The affect expressed during an activity in line with Montessori principles tends to be more positive compared to a non-Montessori-based activity (Camp & Skrajner, 2004; Chan et al., 2021; Jarrott et al., 2008; Judge et al., 2000; Lin et al., 2009; Orsulic-Jeras et al., 2000). Moreover, there is a link between participation in activity groups focused on individuals' interests and abilities, and a reduction in responsive behaviour observed after the activity (Camp & Skrajner, 2004; Kolanowski et al., 2005; Roberts et al., 2015).

Surprisingly, to the best of our knowledge, responsive behaviours during Montessori-based group activities have never been studied specifically. While the existing literature on Montessori-based activities for individuals with dementia is comprehensive, it reveals several fundamental methodological shortcomings that require attention. These studies often lack operationalisation of Montessori-based activities, leading to vague session content. Furthermore, control conditions typically involve following the standard institution-based programmes, lacking specificity and detailed descriptions. None of the studies confirmed the temporal stability of measurements prior to the intervention, a critical factor given the expected variability in measured indices over time. Lastly, none of the studies examining group activities in nursing homes provide any information regarding compliance with Montessori principles.

We therefore propose a single-case experimental design using multiple baseline protocol to examine the effects of a Montessori-based reading group activity on three groups of residents with moderate to severe cognitive impairment (Malone & Camp, 2007). This study will involve the operationalisation of baseline and intervention activities. We hypothesise that, in comparison to a storytelling activity, the Montessori-based activity will foster increased verbal interactions, more constructive engagement, more positive affect and a decrease in responsive behaviours during the activity.

## Methods

### Participants

Fifteen residents from a nursing home in southwest France, affiliated with *Fondation Partage & Vie* and accommodating 60 older adults with moderate to severe cognitive impairment, were recruited to participate in the study.

Only residents aged 65 or above and who passed a reading ability test were included in the study (Camp et al., 2018). An interest in reading was also a criterion for inclusion. Participants were divided into three groups using a pseudo-random allocation method that considered the participants' schedules to maximize attendance and their personalities to encourage better cohesion and understanding among group members. Participant 15 was the only man of the sample. Demographic and clinical characteristics are documented in Table 1.

Three female caregivers employed at the nursing home were selected as facilitators for the study's activities, each entrusted with guiding a specific group. These facilitators encompassed a healthcare support worker, a nursing assistant, and an occupational therapist. Notably, the occupational therapist provided support to the researcher responsible for overseeing sessions within group C.

### Design

A multiple baseline AB design was used in this study (Ledford & Gast, 2018). Training facilitators before the Montessori phase posed a challenge because returning to the initial phase would have required them to unlearn their training. Phase A focused on storytelling activity, while Phase B introduced the Montessori-based activity.

The start and end of the protocol were partially predetermined due to constraints related to the availability of the caregivers recruited for the study. Over a period of nearly two months, the storytelling and Montessori-based activities continued until relative data stability was observed within each of the three groups, during each phase.

A three-day training course in the Montessori method was provided by an organisation, *AG&D Montessori Lifestyle*, specialising in person-centred care training for healthcare staff. In addition, the three carers and the researcher involved in the study received half-day training specific to the Montessori-based reading group activity.

### Description of the sessions

**Setting.** All study activities took place consistently on the same days of the week, during specific afternoon time slots allocated for each group. In the activity room, a glass door opened onto the nursing home's garden, which inadvertently led to at least one visual distraction during each session. Additionally, several unintentional noise disturbances occurred throughout the study due to the nursing home life.

**Description of the storytelling and Montessori-based activities.** Each session followed the same pattern: introduction of the participants, introduction of the day's session, reading, questions and discussions, followed by closure.

During the phase A, a predetermined storytelling was read to the group by the facilitator. Seven stories were gathered from books found within the nursing home and from the internet (Hawthorne, 1876; La Clef Du Bonheur [The Key to Happiness], n.d; Lacerte, 1942; Lafonta, 2009; Leprince de Beaumont, 1757;

**Table 1.** Participants characteristics.

Variables	Group A - participants					Group B - participants					Group C - participants				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
<b>Demographic data</b>															
Age (years)	68	76	91	74	85	84	86	84	90	84	86	89	83	81	72
Marital status	Single	Married	Married	Married	Widowed	Widowed	Widowed	Widowed	Married	Widowed	Married	Widowed	Widowed	Married	Married
Last occupation	Cashier	Employee	Merchant	Nurse	Nurse	—	Piano teacher	—	Housewife	Secretary	French teacher	Tax officer	Pharmacist	Secretary	Breeder
<b>Clinical characteristics</b>															
Length of stay (months)	3	20	31	23	4	21	19	1	18	18	3	14	74	26	18
Diagnostic	MD	AD	—	—	—	AD	—	—	AD	AD	MD	AD	AD	AD	MD
Dependency level*	High	High	Moderate	High	High	High	High	—	High	High	High	High	High	High	High
Cognitive assessment at baseline	7	Refused	14	Refused	8	12	6	7	NA	9	NA	NA	NA	Refused	4
MMSE total score (/30)	SIB total score (/50)	32	Refused	Refused	41	40	39	38	15	34	15	29	NA	Refused	Refused
Cognitive assessment at the end of the experiment	MMSE total score (/30)	7	NA	16	Refused	6	4	Refused	NA	11	NA	NA	NA	Refused	Refused
SIB total score (/50)	30/33	Refused	Refused	Refused	42	37	19	Refused	NA	35	16	35	NA	Refused	Refused
Attendance rate	100	100	100	100	67, 100	100, 83	100, 83	17, 17	100, 83	100, 67	100, 100	83, 83	100, 100	100, 33	100, 100
Storytelling montessori (%)															

Note. \* Dependency level was categorised based on the AGGIR grid score provided by the institution, with high accounting for a score of 1–2 and moderate for a score of 3–4. Abbreviations: MD, Mxlt Dementia; AD, Alzheimer’s Disease; MMSE, Mini-Mental State Examination; SIB, Severe Impairment Battery; NA, non-assessable.

Perrault, 1694). They were rewritten when their length and wording were not adapted to the context and the audience.

In the phase B, Montessori principles were incorporated. Choice was provided at every opportunity and an adapted book was furnished to each participant, with adjusted font and visual cues to encourage alternance between readers, for instance. The focus remained on the overall theme of the book, eliminating the need for participants to memorise the current page. A total of seven Montessori books were read by the residents themselves throughout the sessions, each resident reading a page aloud while other residents followed along, with the next page then being read by another resident (Bonnemort & Stroinska, n.d; Donsimoni, n.d; Grosrenaud, n.d; Nano & Stroinska, n.d; Salah & Stroinska, n.d; Stroinska, n.d; Stroinska & Marushina, n.d).

With regard to compliance with the twelve Montessori principles, three to four of the principles were systematically complied with during phase A, mainly due to the constraints of the research protocol. All the principles were respected during phase B (see Table 1 in supplemental material).

*Procedural fidelity.* Following the activity, a comprehensive discussion was held with the facilitator and a researcher, allowing to retrospectively assess both positive and negative events during the session and to comment on adherence to the protocol.

Group B's facilitator initially asked residents about their interest in future activity participation during the phase A, but adherence to this Montessori principle was sporadic compared to typical nursing home practices. After two sessions, she refrained from this until phase A ended, but was later encouraged to reintroduce the inquiry.

Participant 6 had advanced age-related macular degeneration, which resulted in failing the reading test after the first line. As a result, the Montessori books were reprinted to match her reading ability. Despite iterative adjustments made collaboratively between sessions, she made little use of the new material and preferred to listen.

### *Assessment and procedure for data collection*

All the sessions were entirely recorded to enable remote assessment for each participant during each session. Video recordings were made using 2 cameras equipped with a microphone (Panasonic HDC SD700 and Sony HDR CX625). Cameras were always positioned at the same spot and placed in the room before the beginning of every session.

### *Measures*

*Measure of verbal interactions.* Four types of verbal interaction were enlisted: responses to questions from the carer/facilitator, responses to questions from other participants, spontaneous sharing related to the activity, and spontaneous sharing unrelated to the activity. The total number of interactions related to the activity were then combined. An inter-rater agreement of 72% was achieved.

*Measure of engagement.* The Menorah Park Engagement Scale distinguishes four levels of engagement that can be displayed by an individual during an activity (Judge et al., 2000). This instrument has undergone validation in individuals with moderate to severe dementia. The levels of engagement range from constructive engagement, involving explicit interaction related to the task, to passive engagement, where one observes or listens. Self-engagement refers to attention directed elsewhere, while non-engagement manifests as sleeping or staring into space. Each level of engagement was assessed on a Likert scale ranging from 0 (never observed) to 2 (observed more than

half the time) during a 6-min observation period for each segment in the current study. In previous studies, inter-rater agreement was 95 % (Jarrott et al., 2008; Judge et al., 2000). In the current study, it achieved 91 %, with 82.5% of agreement for constructive engagement, 87% of agreement for passive engagement, 98% of agreement for self-engagement and 97% of agreement for non-engagement.

*Measure of affect.* The Apparent Affect Rating Scale evaluates occurrence of five distinct affects, specifically pleasure, anger, anxiety/fear, sadness, and overall interest, using a five-point Likert scale, ranging from 1 (never) to 5 (more than 6 minutes) (Lawton et al., 1996). This scale has demonstrated both good validity and reliability when applied as a measure of affect in persons with dementia living in nursing homes (Jarrott et al., 2008; Lawton et al., 1996). Negative affect dimensions, including anger, anxiety/fear, and sadness, were combined for the purposes of analyses. Inter-rater agreement was found to be 79% for pleasure and 94% of agreement for the negative affect.

*Measure of responsive behaviours.* A list of behaviours descriptions, also known as ethogram, was used to score for all the verbal and motor behaviours witnessed (Bateson & Martin, 2021). The ethogram provides an objective description of the different behaviours that occur in a specific context, and has previously been used in other studies about engagement in elderly persons (Olsen et al., 2019; van der Ploeg et al., 2013). An inter-rater agreement of 97% was obtained.

## Ethics

The research project adhered to the principles outlined in the Helsinki Declaration and received approval from the Ethics Committee at Université Paul Valéry Montpellier 3 (IRB 00013307-2022-02-CER UPVM - Université Paul Valéry - Montpellier III (France) IRB #1). Before the study and prior to every session, participants were fully briefed about the study, their freedom to leave the activity at any time, the video recording and provided verbal consent. Legal guardians of all participants provided written consent, containing detailed information about the project, intervention, assessments (including video recording), and the option for participants to withdraw from the study at any point.

## Analyses

*Coding of the videos.* Only the first 12 minutes of each session were considered in the coding procedure (see Preliminary analyses section, below, for an explanation of this decision). All the recordings were cut into two sections of 6 minutes each, and the 144 extracts were then randomised. The scoring work was divided between three psychologists, blind to the objectives and hypotheses of the study, who respectively scored 50%, 25% and 25% of all the extracts. A fourth judge again scored 30% of all the extracts to calculate inter-rater agreement. All judges received about 2 hours of training in scoring, equipped with a comprehensive scoring guide, including written and video examples. The assessments were conducted digitally using tablets, with simultaneous viewing of the videos.

Inter-rater reliability was calculated using partial agreement percentage and trial-by-trial technique. The average percentage of agreement for the variables of interest was 88%.

*Statistical analyses.* Analyses were computed using the statistical software IBM SPSS Statistics for Windows, Version 26.0. Armonk, NY: IBM Corp and a web-based calculator for between-case

standardised mean differences (Pustejovsky et al., 2023). An analysis of variance (ANOVA) was used to test the differences in session durations between groups and activity.

Visual analyses were conducted on the data distributions of the variables of interest, treating each group as a single subject. To account for the varying number of participants, which ranged from 3 to 5 depending on the session, score adjustments were applied.

Finally, between-case standard mean difference analyses were done on the raw data using the Restricted Maximum Likelihood estimation method for a clustered multiple baseline across participants design (Chen et al., 2023). This type of analysis allows to calculate an effect size, which should be interpreted similarly to Cohen's  $d$  (Chen et al., 2023). Due to adjustments for multiple comparisons, our  $p$ -value was reduced to 0.0056, indicating a more stringent significance level to account for the number of comparisons made.

## Results

### Preliminary analyses

A 3 (group)  $\times$  2 (activity) ANOVA with session duration as dependent variable was performed. A significant group effect ( $F = 9.30, p = .001, \eta^2 = 0.38$ ) was noted. Contrast analyses revealed that the session duration expressed in minutes was significantly longer in group C ( $32.33 \pm 10.74 [15 - 48]$ ) compared to group A ( $24.43 \pm 5.18 [16 - 36]$ ) and group B ( $22.83 \pm 5.66 [12 - 35]$ ); respectively,  $p < .001$  and  $p = .002$ , with no difference between groups A and B ( $p = .50$ ).

An activity effect was also noted ( $F = 14.97, p = .001, \eta^2 = 0.33$ ) with longer session durations for the Montessori sessions compared to storytelling (respectively,  $30.26 \pm 9.77 [12 - 48]$  versus  $22.81 \pm 4.94 [15 - 36]$ ).

A significant group  $\times$  activity interaction ( $F = 6.22, p = .006, \eta^2 = 0.29$ ) was observed. In group C, Montessori sessions were significantly longer than the storytelling sessions (respectively,  $40.67 \pm 5.13 [34 - 48]$  and  $24.00 \pm 7.80 [15 - 36]$ ;  $p < .001$ ), while this duration discrepancy between the Montessori and storytelling sessions was not observed in groups A ( $27.03 \pm 5.74 [20 - 36]$  and  $21.83 \pm 3.16 [16 - 25]$ ) and B ( $23.08 \pm 7.81 [12 - 35]$  and  $22.58 \pm 3.07 [17 - 26]$ ).

Considering the pattern of these results and to control for the effect of session duration, we decided in subsequent analyses to include only the first 12 minutes of each session, as it represented the shortest observed duration across all sessions.

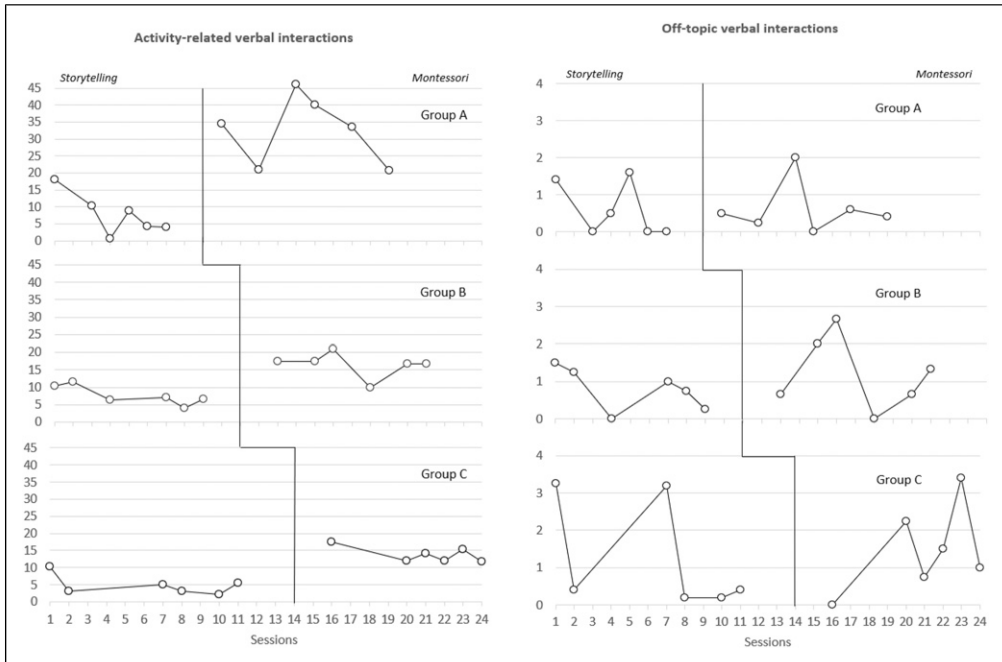
No significant group effect was noted for both storytelling and Montessori-based activities in terms of number of exchanges, levels of engagement, affect expressed and responsive behaviour (see Table 2 in supplemental material).

### Visual analyses

**Verbal interactions.** The visual analysis of the activity-related verbal interactions graph reveals a consistent pattern of level change across all three groups during the Montessori-based activity, as well as a relative stability of levels within each group (Figure 1). With regard to the off-topic interactions, the visual analysis fails to identify three instances of level changes, as well as any trend in the patterns.

**Engagement.** Considering constructive engagement, a consistent pattern of level changes after the implementation of the Montessori-based activity can be identified in the three groups, along with the relative stability of levels within each group (Figure 2).





**Figure 1.** Verbal interactions across each group.

In the context of passive engagement, it is observed that following the implementation of the Montessori-based activity, levels consistently rise within all three groups, while the overall trend remained stable.

Upon the introduction of the Montessori-based activity, group A and B immediately experienced a clear decrease in self-engagement scores. Given the noticeable decline in scores during the storytelling phase within Group C, coupled with a less stable trend under Montessori-based activities, visual analysis interpretation must be cautious. However, it is worth noting that levels exhibit a decline across all groups subsequent to the implementation of the Montessori-based activity.

Upon the introduction of the Montessori-based activity, both group A and B immediately experienced a decrease in non-engagement scores. Group C showed a somewhat delayed change, the overall pattern was lower than the baseline levels. The trends for non-engagement remained generally stable, with a slight increase observed during the final sessions in groups B and C.

**Affect.** Constant changes in pleasure levels, particularly in groups A and B, were observed exclusively following the introduction of the Montessori-based activity (Figure 3). In group C, an increase in the trend during the last two storytelling sessions complicates the interpretation of the changes in levels and trends observed in the Montessori-based activity data pattern.

Following the introduction of the Montessori-based activity, an immediate decrease in negative affect was observed in groups B and C. However, in group A, there was a delayed overall increase in negative affect after the third session.

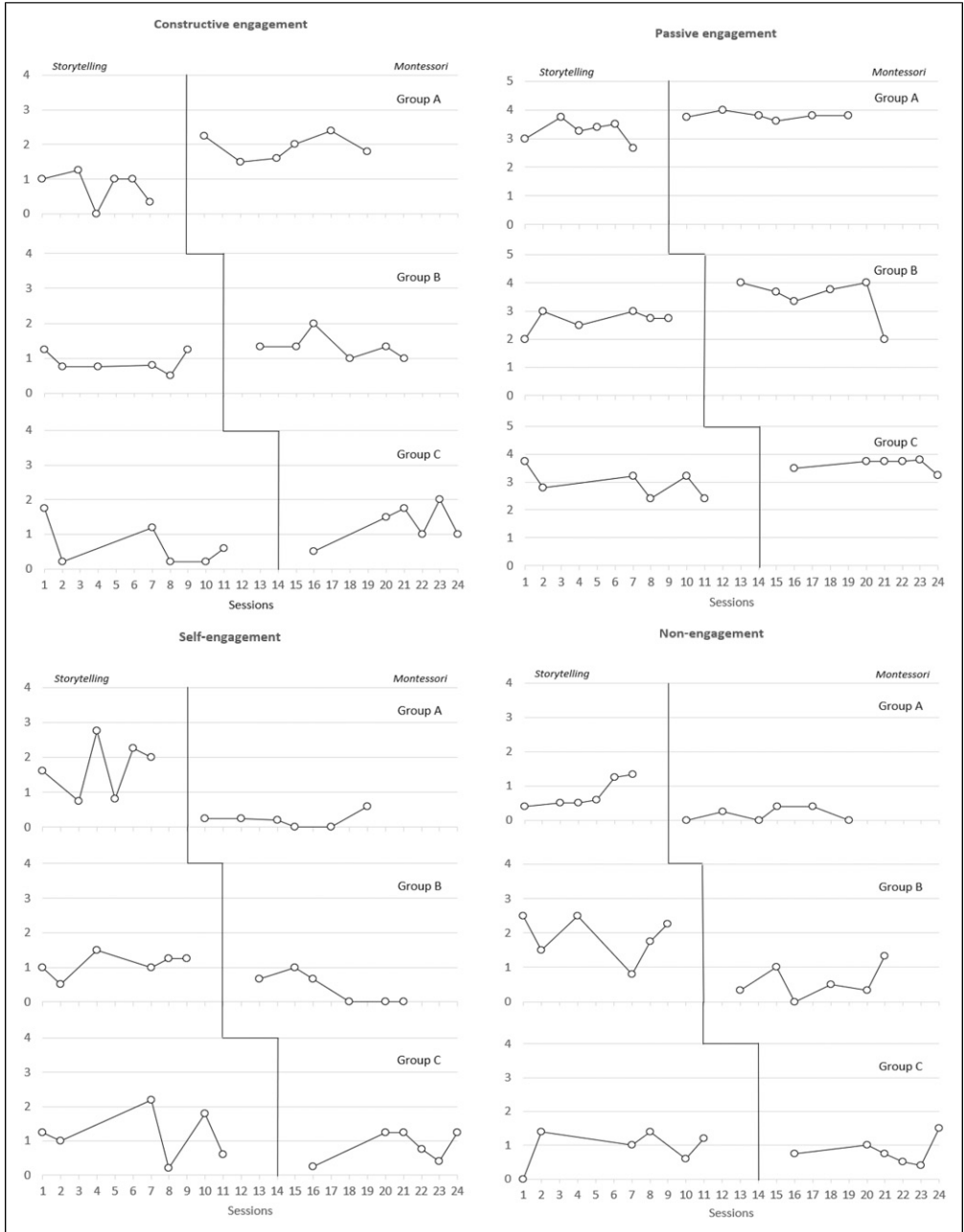


Figure 2. Level of engagement across each group.

**Responsive behaviours.** As opposed to groups A and C, group B did not exhibit a significant change in responsive behaviour levels, despite a prominent peak observed at session 16 (Figure 4). Trends and changes in trends were very variable from one group to another.

### Statistical analyses

The results of the statistical analyses based on individual observations of the participants are presented in Table 2. In accordance with the visual analysis, activity-related verbal interactions were significantly higher during the Montessori-based activities compared to those of storytelling ( $p < .0001$ ). No activity effect was observed for off-topic verbal interactions ( $p = .44$ ). All engagement variables were also significant confirming the visual analyses (all  $ps < 0.0056$ ). Precisely, levels of constructive engagements and passive engagements were higher during the Montessori-based activities while self-engagement and non-engagement were lower ( $ps < 0.0001$ ). Pleasure affect was higher for this condition compared to storytelling. There was no significant group effect observed for negative affect ( $p = .41$ ) or for responsive behaviours ( $p = .014$ ). Note that the effect sizes obtained were moderate to large (ranging from 0.46 to 1.66).

### Social validity

The majority of the participants and facilitators expressed their enjoyment, at the end of both phases. However, at the end of the study, all three caregivers expressed a preference for offering the Montessori-based reading group activity instead of the storytelling activity in the future.

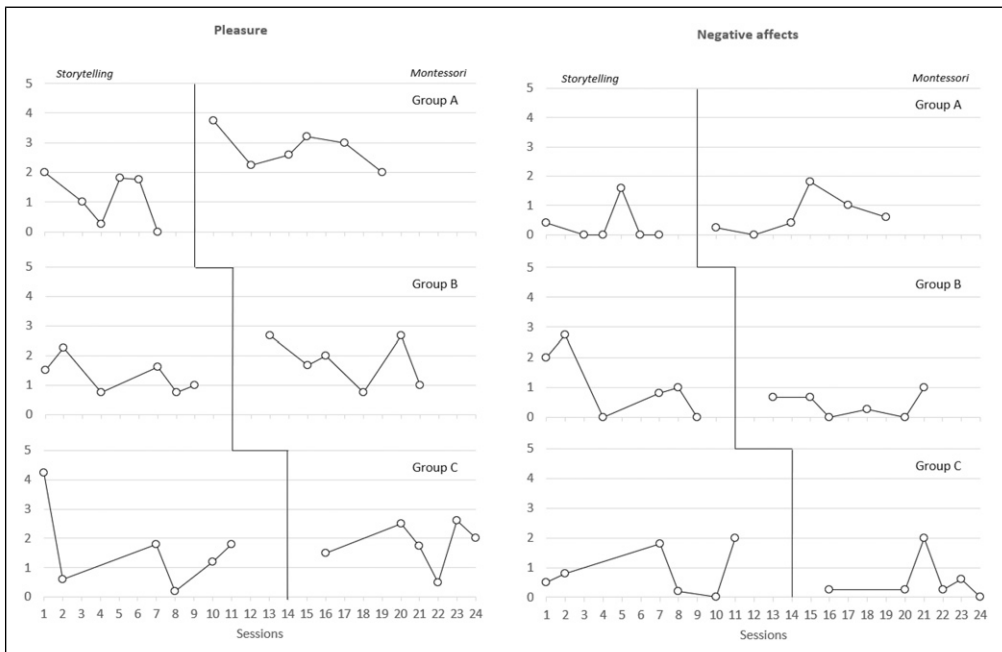


Figure 3. Affect across each group.

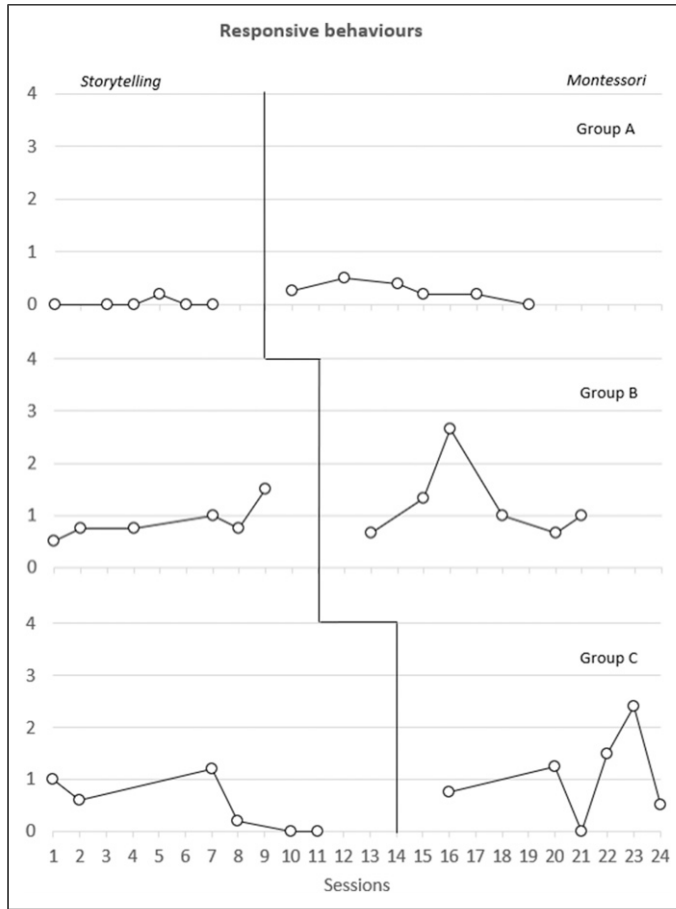


Figure 4. Responsive behaviours across each group.

Table 2. Results of between-case standard mean difference analyses performed on group data.

Variables	BC-SMD	Effect size	(SE)	(95% CI)	p-value
Verbal interactions					
Activity-related	14.47	1.66	(0.36)	(0.91 – 2.40)	< 0.0001
Off-topic	0.22	0.12	(0.16)	(-0.19 – 0.44)	0.44
Engagement					
Constructive engagement	0.81	0.92	(0.14)	(0.64 – 1.20)	< 0.0001
Passive engagement	0.68	0.68	(0.15)	(0.68 – 0.97)	< 0.0001
Self-engagement	-0.81	-0.75	(0.14)	(-1.03 – -0.46)	< 0.0001
Non-engagement	-0.66	-0.53	(0.13)	(-0.78 – -0.27)	< 0.0001
Affects					
Pleasure	0.84	0.46	(0.21)	(0.15 – 0.96)	0.0055
Negative affects	-0.24	-0.13	(0.15)	(-0.42 – 0.18)	0.41
Responsive behaviours	0.51	0.46	(0.20)	(0.06 – 0.86)	0.014

Note. p-value lowering at ≤ .0056 for multiple comparison.

## Discussion

Our results support the hypothesis that the Montessori-based reading group activity promotes more verbal exchanges than a traditional storytelling activity. The statistical analysis aligns with the visual analysis, suggesting a functional relationship between the introduction of the Montessori-based activity and the increase in activity-related interactions. This finding holds significance as it addresses a primary goal of group activities in retirement homes: fostering social interaction among participants. This may prove challenging, given the difficulties encountered by residents in initiating and maintaining interactions during group activities (Wood et al., 2005). Verbal interactions were encouraged in both conditions by following the current recommendations for group activities, i.e. setting up groups of 4–5 people and using the establishment’s carers as group leaders/facilitators (Aasgaard et al., 2017; Adlbrecht et al., 2021; Campo & Chaudhury, 2012). The Montessori principles add a dimension to the activity by inviting the participants to prepare and carry out the activity by themselves, thus creating numerous opportunities for interaction among them by placing them in a more active role. Additionally, some characteristics of the Montessori books, such as their organisation from the simplest to the most complex and the limited amount of information per page, may contribute to increased verbal exchanges (Stevens et al., 1998). These features may help lighten the cognitive load on working memory compared to the storytelling activities. While storytelling requires participants to retain auditory and verbal information as the story progresses to integrate it coherently, the Montessori-based reading activities provide all necessary information visually, supported by auditory-verbal input, without needing to memorise it from one page to the next. This may allow participants to engage in more verbal exchanges as they are less overloaded by the activity itself (Bayles, 2003).

During phase B, fewer off-topic exchanges were expected because of increased focus on the Montessori-based reading activity, resulting in fewer unrelated comments. However, this study did not yield significant findings regarding this variable. Nonetheless, this form of interaction remained infrequent across the sessions.

A functional relationship between the introduction of Montessori-based activities and an increase in constructive engagement was found with the visual analysis and the statistical analyses. This result is in line with those of several studies on the subject, involving the same population (Camp & Skrajner, 2004; Chan et al., 2021; Jarrott et al., 2008; Judge et al., 2000; Lee et al., 2007; van der Ploeg et al., 2013).

Regarding self-engagement and non-engagement, visual analyses and statistical analyses yielded divergent conclusions. Despite this discrepancy, literature frequently characterises these types of engagements with similar ambiguity, where the positive effects of Montessori are inconsistently reported (Camp & Skrajner, 2004; Chan et al., 2021; Jarrott et al., 2008; Judge et al., 2000; Lee et al., 2007; van der Ploeg et al., 2013). However, the statistical method employed aligned well with our study design, ultimately supporting the conclusion that the Montessori-based activity exerts a positive influence on reducing levels of both self-engagement and non-engagement (Chen et al., 2023).

Diverging from the studies mentioned earlier, passive engagement increased following the introduction of the Montessori-based activity. One proposed hypothesis suggests that participants experienced heightened engagement, leading to a decrease in non-engagement and self-engagement in favour of a more activity-driven level of engagement. An additional explanation, not disregarding the initial one, focuses on the nature of the Montessori-based activity. When one participant reads aloud, the others are presumed to be mentally reading or listening, potentially categorised as passive engagement in the scoring process. Although constructive engagement is often the goal in

Montessori-based activity, in group reading, passive engagement demonstrates valuable listening skills and facilitates meaningful interactions among participants.

With regard to positive affect, the visual analyses showed unequal patterns, yet the overall trend and the statistical analysis supported a functional relationship between Montessori-based activity and an increase in the expressed positive affect. Literature lacks a consensus on the impact of Montessori-based activities on positive affect, with studies either favouring Montessori (Lin et al., 2009; Orsulic-Jeras et al., 2000; van der Ploeg et al., 2013), or finding no significant difference between phases (Hindt et al., 2018; Jarrott et al., 2008).

In relation to negative affect, its reduction following the introduction of Montessori-based activity was only observed in groups B and C. The statistical analysis corroborates this absence of significant effect. It is crucial to note that, similar to several studies, the proportion of negative affect expressed remained very low, regardless of the type of activity (Chan et al., 2021; Hindt et al., 2018; Jarrott et al., 2008; Orsulic-Jeras et al., 2000).

Regarding responsive behaviours, the visual analysis showed a distinct change in trends for only two out of the three groups, which prevents us from concluding a functional relationship between the introduction of the Montessori-based activity and any reduction in responsive behaviours. The statistical analysis did not yield significance; however, it approached significance levels. It should be reminded that responsive behaviours were very rare during the storytelling activity and also quite unseen during the Montessori-based activity. Therefore, a possible floor effect was considered when comparing responsive behaviour levels between phase A and B, as well as a low range of variance leading to absence of significance. However, both visual and statistical analyses suggested an unexpected rise in responsive behaviours during phase B. One study documented behaviours during activities tailored to individual skill levels and personalities, reporting a decrease in agitation during activity implementation compared to period of inactivity (Kolanowski et al., 2005). Our current study challenges previous reports that indicated a reduction in responsive behaviours following the implementation of Montessori-based individualised activities and of the Montessori method applied on an institutional scale (Roberts et al., 2015; van der Ploeg et al., 2013). Likewise, it seems to contradict the Unmet Needs Model, according to which engagement in a pleasant and adapted activity would reduce behavioural manifestations (Cohen-Mansfield et al., 2015).

Behaviours were not scored using a standardised tool, potentially introducing inaccuracies. Some behaviours observed were socially inappropriate but not disruptive or clearly responsive. For instance, a participant with inhibition difficulties excessively talked during the Montessori-based activity and continued reading beyond their designated turn. Prompting participants during these sessions enabled assessors to identify potential lapses in social appropriateness, sometimes perceived as disruptive behaviour. Notably, no aggressive behaviour occurred in any session. In the event of a resurgence of behaviours likely to interfere with the activity, the facilitators should collectively reflect on possible adjustments to the activity, as it may not be fully adapted to the individual. In our previous example, it would have been wise to modify or simplify the material. This could involve adding cues to the material, such as highlighting the words 'next reader', incorporating a 'stop reading' cue, or simply providing a gesture cue. We also acknowledge the possibility that the group composition might not have been optimal, as certain personalities or symptoms might have hindered the effective implementation of the Montessori-based activity (Cohen-Mansfield et al., 2017).

The study has several limitations. Firstly, some residents had to travel a considerable distance to attend sessions in the activity room located outside their regular unit, at times hindering their participation. Furthermore, visual distractions occurred during sessions, but practical constraints prevented recording and measuring their influence on engagement and emotions. Lastly, contrary to expectations, responsive behaviours did not decrease during phase B, highlighting the importance of

replicating this study and systematically assessing participants' behaviours in comparable activities for future research.

Overall, our findings substantiate the efficacy of Montessori-based activity in several benefits for individuals with moderate to severe cognitive impairment. While this type of activity proves to be a practical option for caregivers in nursing homes, positively impacting multiple participants simultaneously, it should be supplemented by a person-centred care approach, such as the institutional-level implementation of the Montessori philosophy (Erkes & Bayard, 2023).

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## Declaration of conflicting interests

Cécile Bourgeois is employed by *Fondation Partage & Vie*, under a contract supported by the *Association Nationale de la Recherche et de la Technologie*. Pr. Claude Jeandel is employed by *Fondation Partage & Vie* as medical advisor and is involved with the coordination of the research project and the deployment of the Montessori Method in several institutions of the company. Jérôme Erkes, Ph.D, is Director of Research for the training company AG&D Montessori Lifestyle. All were involved in the study design, but among them only Cécile Bourgeois was involved in the collection, analysis, interpretation of data.

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## Ethical statement

### *Ethical approval*

The research project adhered to the principles outlined in the Helsinki Declaration and received approval from the Ethics Committee at Université Paul Valéry Montpellier 3 (IRB 00013307). Before the study and prior to every session, participants were fully briefed about the study, their freedom to leave the activity at any time, the video recording and provided verbal consent. Legal guardians of all participants provided written consent, containing detailed information about the project, intervention, assessments (including video recording), and the option for participants to withdraw from the study at any point.

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## Data availability statement

The raw data, analysis code, and materials used in this study are not openly available but are available upon request to the corresponding author. The data are not publicly available due to privacy or ethical restrictions. No aspects of the study were pre-registered. Data and materials for this study have not been made publicly available.

## Supplemental Material

Supplemental material for this article is available online.

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