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Review

"Speaking into the Virtual Void?"—An Evidence Review of Virtual Reality for Communication Assessment, Interaction and Training in Dementia

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Abstract

Background/Objectives: Communication decline is a hallmark of dementia, yet speech-language outcomes remain marginal in much of the virtual reality (VR) dementia literature. This evidence review synthesises empirical work on how VR has been used to support, train, or assess communication in dementia, positioning VR as a communication platform rather than only a cognitive tool. **Methods**: A structured search (2000–2025) across CINAHL, PubMed, PsycINFO, Scopus, and Web of Science was supplemented by reference list checking. Eleven empirical studies met eligibility criteria, spanning immersive and non-immersive VR used with people living with dementia, and VR-based communication training for caregivers, care staff, and clinicians. Findings were synthesised thematically through an explicit communication lens. **Results**: Evidence most consistently supports VR as a scaffold for communicative engagement and participation. Immersive and shared VR experiences commonly elicited increased verbal involvement, shared attention, and interactional responsiveness during or immediately after sessions, particularly when content was socially meaningful and appropriately paced. A second strand of work uses VR simulation to train communication partners, with participants reporting high acceptability and perceived improvements in confidence and strategy use, although behavioural transfer to real-world care is rarely measured. Assessment-oriented studies and stakeholder perspectives highlight VR's potential to elicit functional behaviour in context and to complement clinic-based assessment, but communication validity is typically inferred rather than operationalised using standardised measures. **Conclusions**: VR shows early promise for dementia communication care, especially as an adjunct that structures interaction, supports participation, and scales communication training. Progress now depends on communication-specific intervention design, agreed outcome metrics capturing discourse and functional participation, and implementation studies addressing accessibility, cultural-linguistic diversity, and transfer to everyday care.

Keywords: virtual reality; dementia; communication; speech-language pathology; caregiver training; clinician education; ecological validity; immersive technology; cultural and linguistic diversity; bilingualism

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1. Background

1.1. Communication Decline as a Core Feature of Dementia

Communication decline is a defining and pervasive feature of dementia, affecting spoken language, discourse organisation, pragmatic competence, and the ability to engage

meaningfully with others across everyday contexts [1]. These changes often emerge early in the disease course and progress alongside cognitive, behavioural, and functional decline [2], therefore shaping not only diagnostic trajectories but also quality of life, social participation, and care relationships [3]. Difficulties with word finding, comprehension, conversational turn-taking, topic maintenance, and non-verbal signalling frequently disrupt interactions between people living with dementia and their carer as their main communication partners [4], as a result, contributing to frustration, withdrawal, behavioural distress, and increased caregiver burden [5].

Importantly, dementia is not a unitary condition but encompasses a range of neurodegenerative disorders with distinct cognitive and linguistic profiles. For example, Alzheimer's disease is commonly associated with early lexical–semantic impairment, whereas frontotemporal dementia is more often characterised by discourse, syntactic, and executive-related communication changes. These differences have direct implications for how communication is assessed and supported.

Despite the centrality of communication to dementia care, speech-language pathology perspectives remain under-represented [6], particularly in technology-assisted dementia research. Interventions are commonly framed in terms of global cognition, memory, or behavioural symptoms, while communication outcomes are treated as secondary, proxy, or implicit indicators rather than primary targets [7]. This gap is consequential, given that communication is both a functional outcome in its own right and a mechanism through which many psychosocial and non-pharmacological interventions exert their effects [8].

1.2. Virtual Reality in Dementia Research

Over the past two decades, virtual reality (VR) technologies have attracted increasing attention in dementia research, driven by advances in immersive hardware, reductions in cost, and growing interest in ecologically valid assessment and intervention environments, that is, contexts designed to approximate real-world communication demands, social interactions, and environmental conditions encountered in everyday dementia care rather than decontextualised clinic-based tasks [9–13]. A substantial body of reviews and meta-analyses has now examined VR-based interventions across mild cognitive impairment (MCI) and dementia populations, with primary emphases on cognitive outcomes, mood, quality of life, activities of daily living, and behavioural symptoms [14–16].

Recent studies, e.g., refs. [17,18] consistently report small-to-moderate positive effects of VR and related digital interventions on domain-specific cognition, particularly memory, attention, executive function, and processing speed, with the strongest evidence emerging in MCI samples. Other studies synthesise VR and serious games as components of broader digital health or neurotechnological ecosystems, often grouping VR with computerised cognitive training, augmented reality, and sensor-based platforms [19–23]. Collectively, these syntheses establish VR as a feasible and potentially beneficial modality for cognitive stimulation and rehabilitation, while also highlighting substantial heterogeneity in intervention design, outcome measures, and methodological quality.

Importantly, however, the dominant organising constructs across these reviews are cognitive and neuropsychological. Language and communication are typically subsumed under broad cognitive domains, reported inconsistently, or omitted altogether. Even when language outcomes are included, they are rarely analysed in terms of functional communication, discourse, or interactional competence. As a result, the existing literature offers limited insight into how VR may support communication in dementia beyond indirect effects on cognition or engagement.

1.3. The Overlooked Role of Communication in VR-Based Dementia Care

The relative neglect of communication is striking, given that many VR interventions are, by design, communicative contexts [24]. Immersive environments require users to interpret instructions, comprehend narratives, engage with simulated scenarios, and interact with caregivers or clinicians before, during, and after VR exposure [25]. In home-based and dyadic applications, VR experiences often function as shared activities that scaffold conversation, reminiscence, and joint attention [26]. In training contexts, VR is increasingly used to teach caregivers and health professionals how to communicate more effectively with people living with dementia, targeting verbal and non-verbal interaction strategies rather than cognition per se [27].

Emerging research also suggests that VR may enhance verbal engagement, conversational participation, and interaction quality, facilitate caregiver understanding and empathy, and offer ecologically valid platforms for assessing functional communication demands across the lifespan [28,29]. Clinician and stakeholder perspectives further indicate that VR-based tools may address some limitations of traditional clinic-based assessments by embedding communication within realistic, meaningful tasks [13]. Yet these communication-relevant applications remain dispersed across disciplines and publication venues, and they have been systematically under-synthesised from a speech-language or communication-centred perspective.

1.4. Rationale and Aims of the Current Review

Against the backdrop, there is a clear need for a focused synthesis that examines VR in dementia through the lens of communication. Such a review is timely for three reasons. First, the evidence base has emerged to the point where communication-relevant studies can be meaningfully compared, even if heterogeneity precludes meta-analysis. Second, the growing emphasis on person-centred, participation-based dementia care demands closer attention to communication as a primary outcome. Third, advances in immersive and home-based VR technologies have expanded the range of contexts in which communication can be supported, assessed, and trained.

The present review, therefore, aims to provide a structured evidence synthesis of empirical studies published between 2000 and 2025 that examine the use of VR in relation to speech, language, and communication in dementia. Specifically, it addresses four interrelated domains: (a) VR-supported communication engagement and participation; (b) language and discourse outcomes within VR-mediated contexts; (c) VR-based communication training for caregivers and clinicians; and (d) the role of VR in ecologically valid assessment and implementation within dementia care pathways. In doing so, as summarised in Table 1, this review synthesises critical empirical evidence, explicitly differentiates itself from existing cognition-centred and MCI-focused syntheses, and instead positions communication as both a target and a mechanism of VR-based intervention.

By integrating evidence across assessment, intervention, and training contexts, this review aims to clarify what VR currently offers for dementia communication care, identify critical gaps in outcome measurement and study design, and outline directions for future research and clinical innovation. In doing so, it seeks to advance a more communication-centred understanding of VR's role in dementia care, aligned with the priorities of clinicians, caregivers, and people living with dementia.

Table 1. Current Syntheses on Virtual Reality in Cognitive Impairment and Dementia and Gaps.

Review Focus	Population Emphasis	Primary Outcomes Synthesised	Treatment of Communication	Inclusion of Caregiver or Clinician Training	Relevance to Dementia Communication Care
Cognitive outcomes of VR and serious games [20,22,23]	Predominantly MCI; mixed cognitive impairment groups	Memory, attention, executive function, and global cognition	Language is subsumed under cognition; functional communication is rarely analysed	Not included	Indirect communication inferred from cognitive change
VR and digital neurorehabilitation [19,21]	Broad neurological populations, including dementia	Cognitive rehabilitation, motor function, activities of daily living	Communication is implicit, framed as engagement or participation	Rarely included	Limited; communication is not a primary analytic focus
VR for screening and diagnosis [18]	Preclinical Alzheimer's disease, MCI	Diagnostic sensitivity, ecological validity of cognitive tasks	Communicative demands of tasks are not examined	Not included	Peripheral assessment framed cognitively
mHealth and VR in Alzheimer's disease [17]	Alzheimer's disease and related dementias	Cognition, quality of life, behavioural symptoms	Communication outcomes are inconsistently reported	Not included	Partial; communication treated as secondary outcome
Gaps the present review aims to address	Dementia across care contexts	Communication participation, language and discourse, interactional competence	Communication is treated as the primary outcome and mechanism	Explicitly included	Direct, speech-language, and care-relevant focus

Note. Existing reviews are cited illustratively to indicate dominant trends rather than exhaustively catalogued. The present review is distinguished by its communication-centred analytic framework, its focus on dementia rather than mild cognitive impairment, and its inclusion of caregiver and clinician communication training.

2. Methods

This review was conducted as a structured evidence review with thematic synthesis, an approach well-suited to examining complex, emerging interventions where study designs, outcome measures, and theoretical orientations are heterogeneous [30]. The purpose of the review was not to estimate pooled effect sizes, but to examine how virtual reality has been conceptualised and applied in relation to communication in dementia, including assessment, intervention, and training contexts. A meta-analytic approach was, therefore, not appropriate, given substantial variation in VR modalities, participant characteristics, communicative targets, and outcome operationalisation across studies [31]. Similar challenges have been noted in prior reviews of VR-based dementia interventions, where conceptual synthesis has been required to advance interpretive clarity beyond quantitative aggregation [21].

2.1. Search Strategy and Study Identification

A systematic search of the literature was undertaken to identify empirical studies examining the use of virtual reality in relation to speech, language, or communication in

dementia. Searches were conducted across major health and behavioural science databases, including CINAHL, PubMed, PsycINFO, Scopus, and Web of Science, and covered the period from 2000 to 2025. This time frame was selected to capture the emergence and development of interactive and immersive virtual reality technologies capable of supporting communication-relevant assessment, intervention, and training. Search terms combined constructs related to dementia and virtual reality with communication-relevant terms. Virtual reality-related terms included *virtual reality*, *immersive technology*, *immersive environment*, *simulation*, and *VR*. Dementia-related terms included *dementia*, *Alzheimer's disease*, and *neurocognitive disorder*. Communication-related terms included *communication*, *speech*, *language*, *discourse*, *interaction*, *engagement*, *pragmatics*, *caregiver communication*, and *communication training*. Terms were adapted as required to accommodate database-specific indexing and controlled vocabulary.

Following the removal of duplicate records, titles and abstracts were screened for relevance. A full-text review was undertaken for potentially eligible articles to confirm inclusion. Eligibility screening and study selection were conducted by a single researcher, guided by predefined inclusion and exclusion criteria. Decisions at each stage were documented to ensure consistency in application of eligibility criteria. Reference lists of relevant reviews and included studies were also examined to identify additional papers. Studies were eligible for inclusion if they met three core criteria. First, participants included people living with dementia, either alone or in dyadic contexts involving caregivers or clinicians. Second, virtual reality was used as part of an assessment, intervention, or training activity, including immersive and non-immersive formats. Third, communication-related outcomes were reported or could be meaningfully inferred from study aims, intervention design, or outcome measures.

Communication was interpreted broadly to encompass verbal and non-verbal interaction, discourse participation, functional communication, communicative engagement, and the use of communication strategies by caregivers or clinicians [32,33]. Studies were excluded if VR was used solely for non-communicative motor or physical rehabilitation, or if the intervention involved passive exposure without interactional relevance. Review articles, meta-analyses, protocols, and conference posters were excluded from the thematic synthesis but retained as contextual or background literature to inform interpretation and discussion. A total of eleven empirical studies were included in the final analysis and discussion.

2.2. Data Extraction and Study Characteristics

Data extraction was guided by a structured framework designed to foreground communication as the primary analytic lens [34]. For each included study, information was extracted on study design, participant characteristics, VR modality, communication focus, principal findings, and reported implications or limitations. Rather than functioning as a quantitative summary, these data were used to map the scope and nature of the evidence base and to support thematic synthesis [35]. In addition, communication-relevant elements were extracted systematically, including the communicative targets of the VR application, the interactional demands embedded within tasks, the outcome measures used to capture communication or engagement, and any reported implications for communication practice. Implementation-related features, such as facilitation procedures, accessibility considerations, and reported limitations, were also documented. This framework supported comprehensive and consistent extraction across heterogeneous studies and enabled synthesis of findings according to communicative function rather than technological format alone.

2.3. Synthesis and Quality Considerations

Thematic synthesis [35,36] was undertaken to examine how communication has been addressed across VR applications in dementia. Extracted data were organised into four analytic domains that align with the aims of the review: VR-supported communication engagement and participation; language and discourse outcomes within VR contexts; VR-based communication training for caregivers and clinicians; and assessment and implementation considerations relevant to dementia communication care. These domains were developed iteratively, informed by communication-focused dementia research and by gaps identified in existing VR reviews that prioritise cognitive outcomes over interactional and functional communication constructs [23].

Synthesis focused on identifying recurring patterns, conceptual trends, and points of divergence across studies, rather than on aggregating outcomes [37]. Therefore, attention was given to how communication was defined, operationalised, and interpreted, as well as to the contexts in which VR appeared to facilitate or constrain communicative participation.

Given the exploratory and emergent nature of the evidence base, formal risk-of-bias scoring was not applied [38]. The included studies varied widely in design, aims, and outcome operationalisation, with many representing feasibility or pilot investigations for which conventional risk of bias tools offer limited interpretive value. Instead, methodological quality was considered narratively during synthesis, with explicit attention to study design, sample size, outcome specificity, reporting transparency, and acknowledged limitations. This proportionate approach was adopted to support interpretive rigour while avoiding the application of tools not well suited to the diversity and developmental stage of the literature. This approach was adopted to avoid over-weighting early-stage studies while still acknowledging limitations that affect generalisability and clinical translation [39].

In addition to thematic synthesis, an integrative conceptual analysis was undertaken to examine how recurring findings across domains related to one another. Patterns identified in the Results, including the role of VR affordances in shaping engagement, interactional participation, training processes, and assessment contexts, were iteratively mapped to develop a communication-centred conceptualisation of virtual reality in dementia care. This process aimed to synthesise empirical findings into a coherent explanatory framework rather than to propose a de novo theoretical model.

3. Results

The empirical studies included in this review represent a diverse but thematically coherent body of work that examines how virtual reality has been used to support communication in dementia. Figure 1 summarises the identification, screening, eligibility assessment, and inclusion of studies for the present evidence review.

Across studies, communication was addressed variably as an explicit outcome, an inferred indicator of engagement, or a mechanism through which broader therapeutic or training effects were realised. Also, dementia subtype was variably reported, with many studies involving mixed or non-specified dementia samples. As a result, findings are synthesised at the level of communication function and interactional process rather than by diagnostic subtype. Thematic synthesis revealed four interrelated domains, beginning with VR-supported communication engagement and participation.

An overview of the characteristics of the 11 included studies is provided in Table 2. The table summarises key features of each study, including design, population, VR modality, communication focus, main findings, and identified gaps or limitations. The table is intended to summarise the diversity of the evidence base and to support interpretation of the results, rather than to serve as an analytic comparison in its own right.

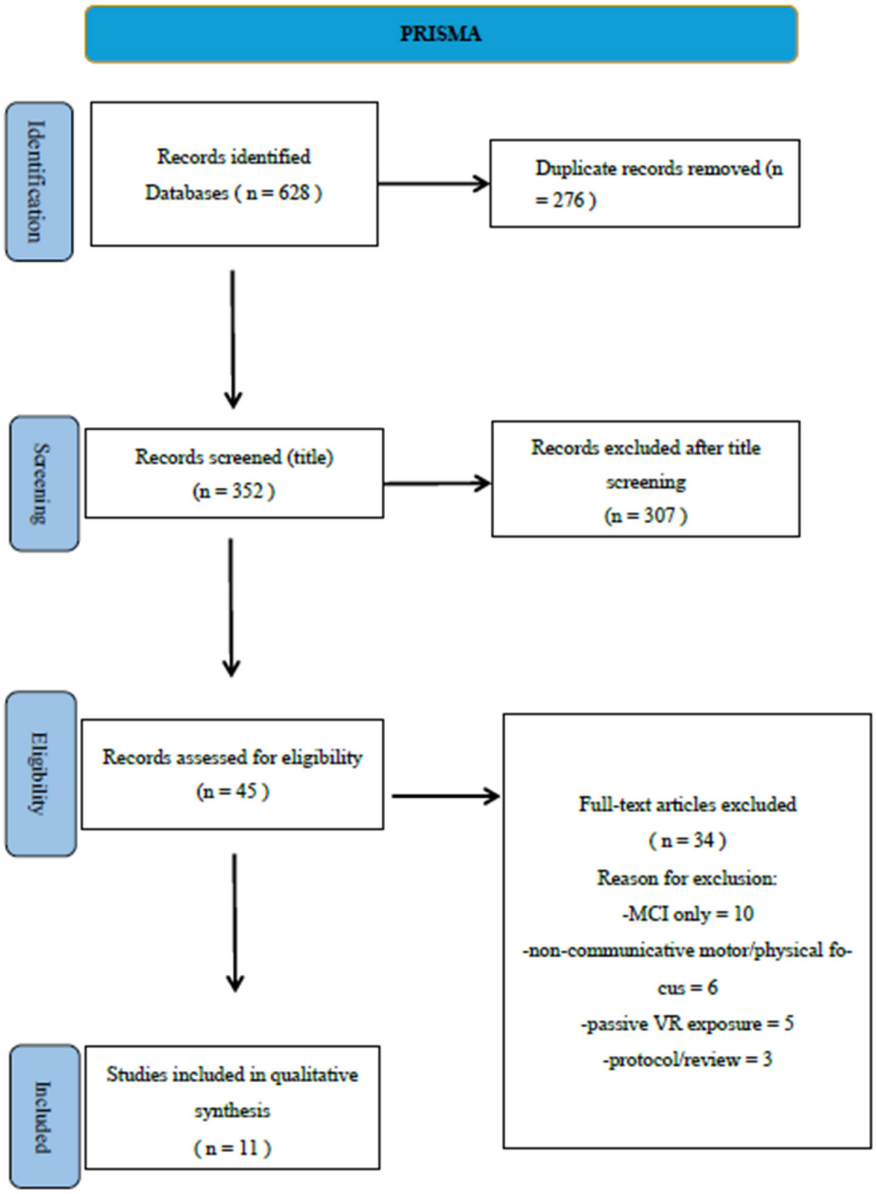


Figure 1. PRISMA flow diagram detailing study identification and selection.

Table 2. Study Characteristics.

Study	Design	Population	VR Modality	Communication Focus	Main Findings	Implications (Theoretical/Practical)	Gaps/Limitations
Flynn et al. [10]	Feasibility study	Dementia	Non-immersive VR	Interaction during virtual tasks	VR elicited engagement and task-related communication	Early indication that virtual environments can scaffold interaction	Outdated technology; no standardised communication measures
Garcia et al. [11]	Pilot study	Dementia	Desktop VR	Verbal interaction	Participants showed increased participation during VR activities	Supports VR as an engagement tool in dementia care	Small sample; limited outcome reporting
Tarnanas et al. [40]	Longitudinal (diagnostic) study	MCI	Immersive-like VR	Functional task communication	VR tasks differentiated cognitive profiles	Highlights the ecological assessment potential	Communication outcomes indirect; cognition-focused

Table 2. *Cont.*

Study	Design	Population	VR Modality	Communication Focus	Main Findings	Implications (Theoretical/Practical)	Gaps/Limitations
Wen et al. [41]	Intervention study	Dementia	Immersive VR	Social engagement	Increased verbal engagement during VR sessions	VR may support social participation	Short-term outcomes only
Afifi et al. [9]	Feasibility study	Dementia	Immersive VR	Conversational engagement	VR-supported sessions improved interaction quality	Demonstrates the feasibility of VR-mediated communication	No control group; limited follow-up
Yondjo & Siette [13]	Qualitative study	Clinicians	Immersive VR	Diagnostic interaction	Clinicians valued the ecological validity of VR	Supports VR as an assessment adjunct	Implementation barriers identified
Gómez-Morales et al. [42]	Pilot (intervention) trial	Caregivers	Immersive VR	Communication training	Improved perceived communication competence	VR is useful for caregiver training	Self-report outcomes
Kim et al. [43]	Feasibility study	Clinicians	Immersive VR + AI	Simulated interaction	High acceptability of VR training	Supports scalable training models	No behavioural outcome data
Saryazdi et al. [44]	Feasibility study	Dementia + caregivers	360° VR	Dyadic interaction	VR facilitated shared experiences	Supports dyadic communication	Small sample
Yao et al. [12]	Intervention study	MCI	Immersive VR	Functional communication	Improved task-related interaction	Suggests early-stage applicability	Short duration
Lenoir et al. [45]	Pilot study	Care staff	Immersive VR	Non-verbal communication	Improved confidence in interaction strategies	Training utility for care staff	No patient outcomes

3.1. VR-Supported Communication, Engagement and Participation

Across the studies, VR was most consistently associated with enhanced communication engagement, understood as increased verbal involvement, interactional responsiveness, or shared participation during communicative activity [9–11]. Engagement-related outcomes were reported across settings, including residential care, community contexts, and dyadic interactions involving caregivers [40,41]. While engagement was often framed as a feasibility or well-being indicator, it reflects a foundational dimension of functional communication in dementia.

Immersive VR experiences appeared to provide external structure and shared reference points that supported interaction, particularly when content was meaningful or socially oriented. Studies using experiential or scenario-based VR reported increased verbal output, conversational turn-taking, and interactional reciprocity during or immediately following VR sessions, e.g., ref. [9], which suggests that VR can scaffold communicative participation even in the presence of cognitive and linguistic decline. In dyadic contexts, VR functioned as a mediating activity that reduced interactional load by anchoring conversation in a shared environment, therefore, supporting joint attention and topic maintenance.

Engagement effects were also observed in institutional care settings, where VR exposure was associated with increased alertness, affective expressiveness, and social responsiveness. For example, Kim et al. [43] reported increases in affective expressiveness and social engagement during nature-based VR experiences, as measured through observational

ratings and staff reports. Similarly, Afifi et al. [9] observed heightened verbal involvement and responsiveness during and immediately following VR sessions in structured care environments. Although these outcomes were typically captured using observational or proxy measures rather than formal communication assessments, they are directly relevant to functional communication, as engagement and affective availability are prerequisites for interaction.

Several studies further suggested that positive affective responses may mediate communicative participation. In Kim et al. [43], increased calmness and interest during VR exposure coincided with greater willingness to vocalise and attend to communication partners, supporting the interpretation that engagement can function as a pathway through which VR supports communication. However, engagement was not uniformly enhanced across all VR applications. Comparative findings from Wong et al. [46] indicated that immersive VR did not consistently outperform conventional or non-immersive group-based cognitive stimulation approaches when accessibility and sensory demands were not optimally adapted. In these contexts, communication gains were comparable across formats, highlighting that VR alone does not guarantee improved communicative participation and underscoring the importance of person-centred design and accessibility.

However, engagement was not uniformly enhanced across all VR applications. Comparative studies indicated that immersive VR did not necessarily outperform conventional or non-immersive formats when content accessibility and sensory demands were not carefully adapted. In interventions integrating VR into structured therapeutic programmes, for example, communication gains were sometimes comparable to those observed in traditional formats, which highlights that VR alone does not guarantee improved communicative participation [47]. These findings underscore the importance of person-centred design and accessibility in determining whether VR facilitates or constrains communication.

3.2. Language and Discourse Outcomes Within VR Contexts

In contrast to engagement-related findings, direct evidence addressing language and discourse outcomes was limited and uneven. Only a small subset of studies explicitly examined linguistic or discourse-level performance, e.g., ref. [40], and where such outcomes were reported, they were often embedded within broader cognitive or functional tasks rather than treated as primary endpoints. This pattern reflects a broader tendency in the VR literature to privilege cognitive constructs over communication-specific measures.

Studies that incorporated task-based or ecologically oriented VR environments suggested that communication demands were inherent to task performance, requiring comprehension, instruction-following, and interactional coordination. In diagnostic and task-based applications, VR tasks were shown to differentiate cognitive profiles, with communicative performance implicated indirectly through task completion and interactional behaviour [40]. However, communication was not operationalised independently from cognition, therefore, limiting conclusions about language-specific change.

Where language outcomes were assessed more directly, improvements were inconsistent and context-dependent. In group-based or adapted therapeutic interventions, functional communication gains were sometimes observed, but these were not always accompanied by improvements in discrete language measures such as word comprehension or verbal fluency [46]. Overall, the evidence indicates that while VR environments engage communicative processes, they are rarely designed or evaluated with sufficient specificity to capture changes in language or discourse.

3.3. Virtual Reality-Based Communication Training for Caregivers and Clinicians

A distinct subset of studies examined VR as a platform for communication training rather than direct intervention with people living with dementia. These studies targeted caregivers, direct care workers, and clinicians, using simulated interactions to develop communication strategies, empathy, and confidence in dementia care contexts. Communication training was typically framed as a professional competency outcome rather than as a behavioural outcome for people with dementia.

Simulation-based VR training was consistently reported as acceptable and engaging, with participants valuing the opportunity to practise communication strategies in realistic, low-risk environments. Studies involving immersive VR scenarios with simulated patients demonstrated perceived improvements in communicative competence, confidence, and interaction management [43]. Similarly, caregiver-focused interventions reported enhanced understanding of communication challenges and increased self-reported communication effectiveness following VR training [42].

Notably, outcomes in this domain were predominantly self-reported or observational, with limited evidence linking training participation to measurable changes in real-world communication behaviour. Nonetheless, the findings suggest that VR holds promise as a scalable training tool for communication-focused dementia care, particularly where traditional training opportunities are limited. The emphasis on interactional competence rather than cognitive knowledge distinguishes this strand of the literature from cognition-centred VR interventions.

3.4. Assessment and Ecological Validity in Dementia Communication Care

Several studies highlighted the potential of VR to support assessment through ecologically valid tasks that approximate real-world communication demands. Tarnanas et al. [40] demonstrated that performance in immersive, task-based VR environments differentiated cognitive profiles in individuals with dementia, with task success requiring comprehension of instructions, interactional coordination, and adaptive communication. Although communication was not measured as a discrete outcome, these interactional demands positioned VR tasks as functionally communicative assessment contexts rather than decontextualised cognitive tests.

More recent work has reinforced this assessment potential from a clinical perspective. In a mixed-methods study, Yondjo and Siette [13] reported that clinicians perceived VR-based tasks as useful for eliciting naturalistic behaviour, including communication and interactional responses, that were not readily observable in standard clinic-based assessments. Together, these studies suggest that VR may complement traditional assessment by embedding communicative demands within meaningful, context-rich activities, although explicit operationalisation of communication validity remains limited.

4. Discussion

This review synthesised empirical evidence on the use of virtual reality in dementia with a specific focus on communication, which encompasses engagement and participation, language and discourse outcomes, caregiver and clinician training, and assessment-related applications. The findings suggest that VR-supported engagement may function as a pathway through which communication is facilitated, rather than an outcome independent of interaction. Empirical studies included in this review demonstrate that increases in affective expressiveness, alertness, and responsiveness during VR exposure are often accompanied by greater verbal participation and interactional involvement [9,43]. This interpretation is also consistent with broader communication frameworks in dementia,

which emphasise affective availability and shared attention as prerequisites for interaction and discourse participation [48].

4.1. What Virtual Reality Currently Offers for Dementia Communication

Across studies, the most robust and consistent contribution of VR lies in its capacity to support communicative engagement. Immersive and semi-immersive VR environments were frequently associated with increased verbal involvement, shared attention, and interactional responsiveness, particularly when experiences were meaningful and socially oriented. From a communication perspective, these engagement-related effects are not peripheral outcomes but central indicators of functional participation. Engagement enables interaction, and interaction underpins relationships, care quality, and personhood in dementia [49].

VR appears to support engagement by reducing the cognitive and interactional demands of conversation. The apparent acceptability and perceived utility of VR-based communication training align with emerging evidence that simulation-based learning can enhance communication confidence and strategy awareness among caregivers and clinicians, even when behavioural transfer requires additional support [13,21]. These findings reinforce the importance of pairing VR training with guided reflection and real-world coaching to promote sustained changes in communicative practice. Shared virtual environments provide external structure and common reference points that anchor communication, easing demands on memory, lexical retrieval, and topic management. In dyadic contexts, this scaffolding effect may redistribute communicative effort between partners, further allowing caregivers or clinicians to support interaction more effectively. Similar mechanisms have been proposed in broader dementia care research, where shared activities and environmental supports are recognised as facilitators of communication, but VR offers a technologically mediated extension of these principles [50].

Beyond direct engagement, VR also shows promise as a platform for communication training. Studies involving caregivers, direct care workers, and clinicians consistently reported high acceptability and perceived usefulness of VR-based simulation for practising interaction strategies. Importantly, these implications extend to bilingual and culturally and linguistically diverse contexts, where communication breakdowns may be exacerbated by language mismatch and culturally incongruent interactional norms. Prior work has highlighted the need for culturally responsive, language-aware approaches to dementia communication care [6], while research in immersive learning environments demonstrates that culturally grounded VR content can meaningfully shape engagement and interpretation [51]. Together, this suggests that VR design and implementation must account for language preference, cultural relevance, and interactional expectations if equitable communication support is to be achieved. These findings align with a growing recognition that communication difficulties in dementia are relational rather than solely individual, and that training communication partners is a critical component of effective intervention. VR-based training offers opportunities to rehearse communication strategies in realistic yet low-risk environments [52], potentially addressing gaps in traditional education and professional development.

4.2. The Limited Evidence for Language and Discourse Change

In contrast to engagement and training outcomes, evidence for direct language or discourse change associated with VR remains sparse. Few studies explicitly targeted linguistic skills, and where language outcomes were reported, they were often embedded within broader cognitive or functional measures [7,8]. This pattern reflects the broader

orientation of VR research in dementia toward cognition and rehabilitation, rather than communication as a distinct clinical domain.

Importantly, the absence of strong language-specific findings should not be interpreted as evidence that VR lacks relevance for language intervention. Rather, it highlights a misalignment between the communicative processes engaged by VR tasks and the outcomes typically measured. Many VR applications inherently require comprehension, instruction-following, narrative understanding, and pragmatic coordination [53], yet these processes are rarely operationalised or assessed explicitly. Without targeted outcome measures, potential language-related benefits may remain invisible.

This gap has implications for future research design. If VR is to be meaningfully integrated into speech-language pathology practice, studies must articulate clearer links between task demands and communication constructs and employ outcome measures that capture change at the level of discourse, pragmatics, and functional communication. Such measures are more likely to reflect real-world communicative competence than isolated language tasks, particularly in dementia.

4.3. Reconceptualising Virtual Reality as a Communication Platform

One of the key contributions of this review is to reframe VR not simply as a cognitive or rehabilitative tool, but as a communication platform. Across intervention, training, and assessment contexts, communication functioned as a mechanism through which VR exerted its effects, even when it was not labelled as such. This reconceptualization aligns with contemporary views of communication in dementia as situated, relational, and context-dependent. Figure 2 illustrates a communication-centred conceptualisation of virtual reality in dementia care, synthesising how VR affordances support interactional processes across intervention, training, and assessment contexts.

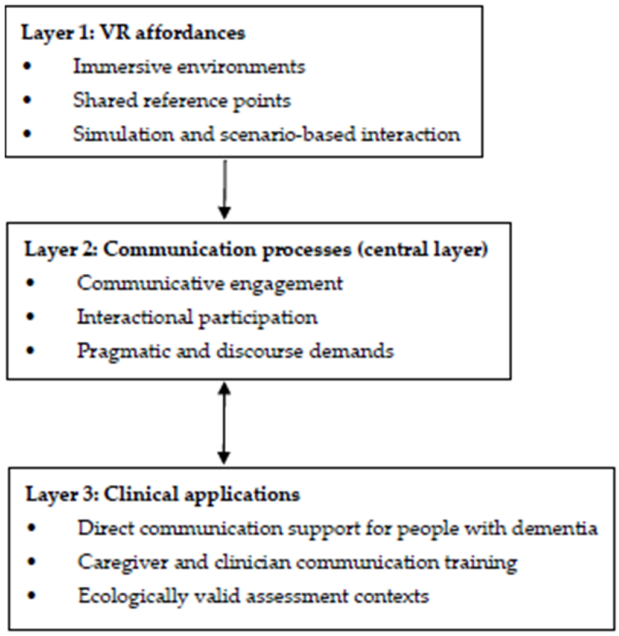


Figure 2. Communication-centred conceptualisation of virtual reality in dementia care.

Note: This figure presents a communication-centred conceptualisation of virtual reality in dementia care, organised across three analytically distinct but interrelated layers. Layer 1 (VR affordances, i.e., the practical features of virtual reality systems that enable or shape user interaction, such as immersive visual environments, shared points of reference, and the ability to simulate everyday situations) represents the core technological features of virtual reality that are relevant to communication, including immersive environments,

shared reference points, and simulation- or scenario-based interaction. These affordances shape how users perceive, engage with, and orient to communicative contexts.

Layer 2 (Communication processes) constitutes the central analytic layer of the model and captures the interactional mechanisms through which virtual reality exerts its effects. These processes include communicative engagement, interactional participation, and the pragmatic and discourse demands embedded within VR activities. Communication is positioned here as both an outcome and a mediating mechanism linking technology to clinical impact.

Layer 3 (Clinical applications) reflects how communication processes enabled by virtual reality are realised in practice. This layer includes direct communication support for people living with dementia, communication training for caregivers and clinicians, and the use of ecologically valid assessment contexts in which functional communication can be observed.

The single downward arrow from Layer 1 to Layer 2 indicates that VR affordances enable and constrain communication processes by shaping interactional conditions. The bidirectional arrows between Layer 2 and Layer 3 indicate a reciprocal relationship in which communication processes inform clinical application, while clinical contexts and goals, in turn, shape how communication is elicited, supported, and interpreted within virtual environments.

Building on the thematic synthesis presented in Section 3, Figure 2 presents a communication-centred conceptualisation of virtual reality in dementia care. The model was developed by integrating synthesised findings across domains, including evidence that VR affordances structure communicative engagement and participation, support communication training for caregivers and clinicians, and enable ecologically oriented assessment contexts. Rather than representing a speculative framework, the conceptualisation reflects an analytic synthesis of how communication-related mechanisms recur across heterogeneous VR applications in the reviewed studies.

From this perspective, VR's value lies less in its capacity to deliver isolated exercises and more in its ability to create environments that support interaction. These environments can be used to elicit communicative behaviours, to practise interactional strategies, and to observe communication in context. Such uses resonate with person-centred and participation-based models of care, in which the goal is not to normalise language performance but to support meaningful engagement and interaction [54].

This reframing also clarifies the role of VR in assessment. Rather than replacing standardised tools, VR-based tasks may complement them by providing ecologically valid contexts in which functional communication can be observed. Clinician perspectives suggest that such contexts can reveal strengths and challenges not captured in decontextualised testing [55], although methodological development is needed to translate these observations into systematic assessment practices.

4.4. Implementation and Accessibility Considerations

The findings also underscore the importance of implementation and accessibility in determining whether VR supports or constrains communication. Engagement benefits were not universal, and in some cases, immersive VR introduced sensory or cognitive demands that limited participation [51]. These challenges are particularly salient in dementia populations, where sensory impairment, fatigue, and unfamiliarity with technology are common.

Successful applications tended to involve careful adaptation of content, pacing, and delivery, as well as the presence of supportive communication partners. These factors highlight the need for interdisciplinary collaboration in VR development, involving

speech-language pathologists, clinicians, technologists, and end users. Without such collaboration, there is a risk that VR tools will prioritise technological novelty over communicative accessibility.

4.5. Implications for Clinical Practice and Future Research

The current evidence base does not yet justify VR as a stand-alone speech-language intervention for people living with dementia. Its most defensible near-term clinical role is as an adjunct that structures interaction, providing shared reference points that reduce the demands of initiating and sustaining conversation. This positioning leads to a practical shift in how VR is selected and used. Clinicians and services can prioritise VR experiences that are socially meaningful, narrative-rich, and easy to follow, pairing exposure with guided interaction rather than treating VR as an isolated "dose" of stimulation. In a therapy or care routine, VR works best when it is embedded within a communication plan, with explicit goals linked to participation, interaction quality [56], and relationship support rather than narrow linguistic accuracy. Where services have limited access to speech pathologists, VR can still be implemented safely as a supported engagement activity, but it should be framed as a structured context for communication, with staff coached to facilitate turn-taking, repair, and topic continuity. Interpretation of these findings must also take into account the heterogeneity of dementia presentations. Communication demands, breakdown patterns, and responsiveness to VR-based supports are likely to differ across dementia subtypes. For instance, VR applications that scaffold lexical retrieval or shared semantic context may be more relevant in Alzheimer's disease, whereas approaches emphasising discourse organisation, sequencing, and interactional structure may better align with the communication profiles seen in frontotemporal dementia. The limited subtype-specific reporting in the current evidence base constrains more fine-grained conclusions and highlights a priority for future research.

VR-supported training for caregivers, care staff, and clinicians appears particularly promising, but it should be treated as skills training rather than awareness-raising. The studies in this review largely rely on acceptability and self-report outcomes; therefore, the clinical takeaway is to implement VR training alongside competency-based teaching and structured debriefing. Debriefing is the mechanism that makes training clinically useful, linking what was practised in simulation to everyday interaction challenges, the person's stage of dementia, and practical constraints in home or residential settings [57]. Services adopting VR training can strengthen implementation by integrating follow-up observation or coaching in real interactions, ensuring that perceived gains translate into measurable behaviour change.

Importantly, culturally and linguistically diverse contexts should be treated as core use cases rather than add-ons, aligning with the identity, equity, and language choice issues highlighted in bilingual dementia care [6]. In practice, VR content and training need to accommodate language preference and code-switching, and enable interpreter-mediated or family-mediated participation when needed, particularly considering the complexities of second language learning [58] of populous languages that are typologically different from English, e.g., Arabic [59], French [60], Spanish [61], Japanese [62], or the Chinese languages [63–65]. Outcomes should be sensitive to culturally shaped interactional norms, avoiding narrow assumptions about eye contact, turn-taking, and "appropriate" conversational style [32]. Culturally meaningful VR design is feasible, with VR education research demonstrating that immersive experiences can shape knowledge acquisition and user perceptions when cultural content is foregrounded [51]. Translating this principle to dementia communication care suggests a clear development pathway, co-designing culturally and linguistically relevant VR scenarios with communities, clinicians, and people

living with dementia, then testing whether culturally anchored scenarios produce stronger and more equitable communication participation gains than generic content.

Research is now at a point where feasibility findings should be treated as a floor rather than an endpoint [66]. Next-generation studies need to specify a communication theory of change, making explicit which VR affordances are expected to influence which communicative processes. Communication outcomes should be operationalised directly, moving beyond proxy indicators such as general "engagement" [67]. Priority outcomes include discourse (coherence, informativeness, narrative structure), pragmatics (contingency, repair, topic management), interactional participation (turn distribution, initiations, responsiveness), and person-centred measures of communicative confidence and agency. These outcomes also align better with what families and care teams value, which is sustained participation and relational connection [68]. Trials should report intervention dose, partner involvement, facilitation procedures, and accessibility adaptations so that clinicians can judge transferability across contexts.

4.6. Limitations

Several limitations should be considered when interpreting the findings of this review. First, the empirical evidence base remains small and methodologically heterogeneous. Some included studies were feasibility or pilot investigations with limited sample sizes, and others had short intervention periods or diverse outcome measures. These features constrained direct comparison across studies and precluded quantitative synthesis. In addition, eligibility screening and study selection were conducted by a single researcher, which may introduce selection bias despite the use of predefined criteria and systematic documentation.

Second, communication was often not operationalised as a primary outcome. In several studies, communicative change was inferred from engagement, task performance, or proxy measures rather than assessed using explicit language or discourse-based metrics. As a result, conclusions regarding language-specific effects of virtual reality should be interpreted cautiously.

Third, variability in VR modalities, content design, and delivery contexts introduced additional complexity. Immersive, semi-immersive, and non-immersive platforms were grouped under the broad category of virtual reality, despite differing sensory, cognitive, and interactional demands. This diversity limits the ability to attribute observed effects to specific technological features.

These limitations, nevertheless, reflect the early developmental stage of the field rather than deficiencies of individual studies. They highlight the need for more targeted, theoretically grounded research that explicitly integrates communication constructs into the design and evaluation of VR-based dementia interventions.

In addition to limitations of the evidence base, the design of the present review warrants consideration. This study was conducted as a structured evidence review with thematic synthesis rather than a systematic or scoping review and therefore does not aim to provide exhaustive coverage or quantitative comparison of effects. Eligibility screening, data extraction, and synthesis were undertaken by a single author, which may introduce selection or interpretive bias despite the use of predefined criteria and systematic documentation. While single-author reviews are common in invited and conceptually oriented syntheses, this approach necessarily limits opportunities for independent verification of study selection and interpretation. These design choices reflect a deliberate emphasis on communication-centred synthesis over procedural breadth and should be considered when interpreting the scope and generalisability of the conclusions.

5. Conclusions

Communication decline lies at the heart of the lived experience of dementia, yet it has remained marginal in much of the VR literature, which has largely prioritised cognitive outcomes and early disease stages. This review addressed that gap by synthesising empirical evidence on the use of VR in dementia through a communication-centred lens, encompassing engagement and participation, language and discourse processes, caregiver and clinician training, and ecologically oriented assessment.

The findings demonstrate that VR is already contributing to dementia communication care, albeit in indirect and uneven ways. Its most consistent value lies in supporting communicative engagement and interaction, providing shared contexts that scaffold participation and reduce interactional demands. Virtual reality also shows promise as a scalable platform for training communication partners and for embedding assessment within meaningful, real-world activities. However, direct evidence for language-specific change remains limited, therefore, reflecting a broader lack of communication-focused design and measurement rather than an absence of communicative potential.

By repositioning VR as a communication platform rather than solely a cognitive tool, this review advances a conceptual shift with practical implications for speech-language pathology and dementia care. Future research must move beyond feasibility to develop theoretically grounded interventions, define communication outcomes explicitly, and evaluate sustained impacts on participation and interaction across care contexts. Aligning technological innovation with communication-centred frameworks will be essential if virtual reality is to meaningfully enhance the quality of life and relationships of people living with dementia.

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Abbreviations

The following abbreviations are used in this manuscript:

MCI	Mild cognitive impairment
VR	Virtual reality

References

1. Banovic, S.; Zunic, L.J.; Sinanovic, O. Communication Difficulties as a Result of Dementia. *Mater. Sociomed.* **2018**, *30*, 221–224. [CrossRef]
2. Klimova, B.; Kuca, K. Speech and language impairments in dementia. *J. Appl. Biomed.* **2016**, *14*, 97–103. [CrossRef]
3. Hockley, A.; Moll, D.; Littlejohns, J.; Collett, Z.; Henshall, C. Do communication interventions affect the quality-of-life of people with dementia and their families? A systematic review. *Aging Ment. Health* **2023**, *27*, 1666–1675. [CrossRef] [PubMed]
4. Dooley, J.; Bailey, C.; McCabe, R. Communication in healthcare interactions in dementia: A systematic review of observational studies. *Int. Psychogeriatr.* **2015**, *27*, 1277–1300. [CrossRef] [PubMed]
5. Ballard, C.; Lowery, K.; Powell, I.; O'Brien, J.; James, I. Impact of Behavioral and Psychological Symptoms of Dementia on Caregivers. *Int. Psychogeriatr.* **2000**, *12*, 93–105. [CrossRef]
6. Han, W. Navigating Language in Dementia Care: Bilingualism, Communication, and the Untapped Potential of Speech-Language Pathologists. *J. Dement. Alzheimer's Dis.* **2025**, *2*, 36. [CrossRef]
7. Warren, A. Behavioral and Psychological Symptoms of Dementia as a Means of Communication: Considerations for Reducing Stigma and Promoting Person-Centered Care. *Front. Psychol.* **2022**, *13*, 875246. [CrossRef]
8. Woodward, M. Aspects of communication in Alzheimer's disease: Clinical features and treatment options. *Int. Psychogeriatr.* **2013**, *25*, 877–885. [CrossRef]

9. Afifi, T.; Collins, N.L.; Rand, K.; Fujiwara, K.; Mazur, A.; Otmar, C.; Dunbar, N.E.; Harrison, K.; Logsdon, R. Testing the Feasibility of Virtual Reality With Older Adults With Cognitive Impairments and Their Family Members Who Live at a Distance. *Innov. Aging* **2021**, *5*, igab014. [CrossRef]
10. Flynn, D.; van Schaik, P.; Blackman, T.; Femcott, C.; Hobbs, B.; Calderon, C. Developing a Virtual Reality–Based Methodology for People with Dementia: A Feasibility Study. *Cyberpsychol. Behav.* **2003**, *6*, 591–611. [CrossRef]
11. Garcia, L.J.; Rebolledo, M.; Metthé, L.; Lefebvre, R. The Potential of Virtual Reality to Assess Functional Communication in Aphasia. *Top. Lang. Disord.* **2007**, *27*, 272–288. [CrossRef]
12. Yao, Y.; Hasan, W.Z.W.; Jiao, W.; Dong, X.; Ramli, H.R.; Norsahperi, N.M.H.; Wen, D. ChatGPT and BCI-VR: A new integrated diagnostic and therapeutic perspective for the accurate diagnosis and personalized treatment of mild cognitive impairment. *Front. Hum. Neurosci.* **2024**, *18*, 1426055. [CrossRef] [PubMed]
13. Yondjo, J.; Siette, J. "VR is the future": Perspectives of healthcare professionals on virtual reality as a diagnostic tool for dementia status in primary care. *BMC Med. Inform. Decis. Mak.* **2024**, *24*, 9–10. [CrossRef] [PubMed]
14. Gkintoni, E.; Vassilopoulos, S.P.; Nikolaou, G.; Vantarakis, A. Neurotechnological Approaches to Cognitive Rehabilitation in Mild Cognitive Impairment: A Systematic Review of Neuromodulation, EEG, Virtual Reality, and Emerging AI Applications. *Brain Sci.* **2025**, *15*, 582. [CrossRef]
15. Gao, Y.; Liu, N. Effects of digital technology-based serious games interventions for older adults with mild cognitive impairment: A meta-analysis of randomised controlled trials. *Age Ageing* **2025**, *54*, afaf080. [CrossRef]
16. Freitag, F.; Brucki, S.M.D.; Barbosa, A.F.; Chen, J.; de Oliveira Souza, C.; Valente, D.F.; Chien, H.F.; Bedeschi, C.; Voos, M.C. Is virtual reality beneficial for dual-task gait training in patients with Parkinson's disease? A systematic review. *Dement. Neuropsychol.* **2019**, *13*, 259–267. [CrossRef]
17. Kruse, C.S.; Sen, K.; Armenta, V.; Hubbard, N.; Brooks, R. Leveraging mHealth and Virtual Reality to Improve Cognition for Alzheimer's Patients: A Systematic Review. *Healthcare* **2022**, *10*, 1845. [CrossRef]
18. Tian, Y.; Kuruvilla, M.V.; Park, M. The use of virtual reality in screening for preclinical Alzheimer's disease: A scoping review protocol. *PLoS ONE* **2023**, *18*, e0282436. [CrossRef]
19. Catania, V.; Rundo, F.; Panerai, S.; Ferri, R. Virtual Reality for the Rehabilitation of Acquired Cognitive Disorders: A Narrative Review. *Bioengineering* **2023**, *11*, 35. [CrossRef]
20. Gómez-Cáceres, B.; Cano-López, I.; Aliño, M.; Puig-Perez, S. Effectiveness of virtual reality-based neuropsychological interventions in improving cognitive functioning in patients with mild cognitive impairment: A systematic review and meta-analysis. *Clin. Neuropsychol.* **2023**, *37*, 1337–1370. [CrossRef]
21. Maggio, M.G.; Maresca, G.; De Luca, R.; Stagnitti, M.C.; Porcari, B.; Ferrera, M.C.; Galletti, F.; Casella, C.; Manuli, A.; Calabrò, R.S. The Growing Use of Virtual Reality in Cognitive Rehabilitation: Fact, Fake or Vision? A Scoping Review. *J. Natl. Med. Assoc.* **2019**, *111*, 457–463. [CrossRef]
22. Yang, Q.; Zhang, L.; Chang, F.; Yang, H.; Chen, B.; Liu, Z. Virtual Reality Interventions for Older Adults With Mild Cognitive Impairment: Systematic Review and Meta-Analysis of Randomized Controlled Trials. *J. Med. Internet Res.* **2025**, *27*, e59195. [CrossRef] [PubMed]
23. Yu, J.; Wu, J.; Liu, B.; Zheng, K.; Ren, Z. Efficacy of virtual reality technology interventions for cognitive and mental outcomes in older people with cognitive disorders: An umbrella review comprising meta-analyses of randomized controlled trials. *Ageing Res. Rev.* **2024**, *94*, 102179. [CrossRef] [PubMed]
24. Gandall, L.; Sanchez Peral, C. The Effects of Using VR Technologies as Intervention Methods for Children with ASD—A Literature Review. *Proc. Hum. Factors Ergon. Soc. Annu. Meet.* **2025**, *69*, 1758–1763. [CrossRef]
25. Ajeet Gokani, H.; Sommerlad, A.; Jawharieh, H.; Ang, C.S.; Huntley, J. Carers and professionals' views on using virtual reality in dementia care: A qualitative study. *Dementia* **2025**, *24*, 71–90. [CrossRef]
26. Lu, Z.; Wang, W.; Yan, W.; Kew, C.L.; Seo, J.H.; Ory, M. The Application of Fully Immersive Virtual Reality on Reminiscence Interventions for Older Adults: Scoping Review. *JMIR Serious Games* **2023**, *11*, e45539. [CrossRef]
27. Appel, L.; Ali, S.; Narag, T.; Mozeson, K.; Pasat, Z.; Orchanian-Cheff, A.; Campos, J.L. Virtual reality to promote wellbeing in persons with dementia: A scoping review. *J. Rehabil. Assist. Technol. Eng.* **2021**, *8*, 20556683211053952. [CrossRef]
28. Han, W.; Wang, T.; Takizawa, Y.; Pill, S. Virtual Reality as a Mediating Tool in Addressing Social Communication Disorder: Current Understanding and Implementation Strategies. *Languages* **2025**, *10*, 226. [CrossRef]
29. Han, W.; Wang, T. From Motor Skills to Digital Solutions: Developmental Dysgraphia Interventions over Two Decades. *Children* **2025**, *12*, 542. [CrossRef]
30. Flemming, K.; Noyes, J. Qualitative Evidence Synthesis: Where Are We at? *Int. J. Qual. Methods* **2021**, *20*, 1609406921993276. [CrossRef]
31. Granados-Duque, V.; García-Perdomo, H.A. Systematic review and meta-analysis: Which pitfalls to avoid during this process. *Int. Braz. J. Urol.* **2021**, *47*, 1037–1041. [CrossRef]

32. Xiao, L.D.; Chen, L.; Han, W.; Meyer, C.; Müller, A.; Low, L.F.; Brijnath, B.; Mohammadi, L. Optimising social conditions to improve autonomy in communication and care for ethnic minority residents in nursing homes: A meta-synthesis of qualitative research. *Nurs. Inq.* **2022**, *29*, e12469. [CrossRef]
33. Liang, Y.; Han, W. Source text pre-editing versus target text post-editing in using Google Translate to provide health services to culturally and linguistically diverse clients. *Sci. Eng. Health Stud.* **2022**, *16*, 22050009.
34. Xue, L.; Gong, Y.; Pill, S.; Han, W. Communication Disorders and Mental Health Outcomes in Children and Adolescents: A Scoping Review. *Healthcare* **2025**, *13*, 1807. [CrossRef] [PubMed]
35. Ahmed, S.K.; Mohammed, R.A.; Nashwan, A.J.; Ibrahim, R.H.; Abdalla, A.Q.; Ameen, B.M.M.; Khdhir, R.M. Using thematic analysis in qualitative research. *J. Med. Surg. Public Health* **2025**, *6*, 100198. [CrossRef]
36. Thomas, J.; Harden, A. Methods for the thematic synthesis of qualitative research in systematic reviews. *BMC Med. Res. Methodol.* **2008**, *8*, 45. [CrossRef]
37. Fendt, J. Embracing emergence in qualitative meta-analysis: A guide to higher-order synthesis. *Methodol. Innov.* **2025**, *18*, 143–167. [CrossRef]
38. Baldwin, J.R.; Pingault, J.B.; Schoeler, T.; Sallis, H.M.; Munafò, M.R. Protecting against researcher bias in secondary data analysis: Challenges and potential solutions. *Eur. J. Epidemiol.* **2022**, *37*, 1–10. [CrossRef]
39. Carmona, C.; Baxter, S.; Carroll, C. Systematic review of the methodological literature for integrating qualitative evidence syntheses into health guideline development. *Res. Synth. Methods* **2021**, *12*, 491–505. [CrossRef]
40. Tarnanas, I.; Schlee, W.; Tsolaki, M.; Müri, R.; Mosimann, U.; Nef, T. Ecological Validity of Virtual Reality Daily Living Activities Screening for Early Dementia: Longitudinal Study. *JMIR Serious Games* **2013**, *1*, e1. [CrossRef]
41. Wen, D.; Lan, X.; Zhou, Y.; Li, G.; Hsu, S.-H.; Jung, T.-P. The Study of Evaluation and Rehabilitation of Patients With Different Cognitive Impairment Phases Based on Virtual Reality and EEG. *Front. Aging Neurosci.* **2018**, *10*, 88. [CrossRef] [PubMed]
42. Gómez-Morales, A.; Coon, D.W.; Joseph, R.P.; Pipe, T. Through Alzheimer's Eyes: A Virtual Pilot Intervention for Family Caregivers of People with Dementia. *Clin. Gerontol.* **2024**, *47*, 846–861. [CrossRef] [PubMed]
43. Kim, S.; Fields, N.; Roye, J. Empowering Dementia Communication via Virtual Reality AI-Driven Simulations. *Proc. AAAI Symp. Ser.* **2024**, *4*, 163–167. [CrossRef]
44. Saryazdi, R.; Appel, L.; Lewis-Fung, S.; Carsault, L.-A.; Qi, D.; Garcia-Giler, E.; Campos, J.L. VRx@Home protocol: A virtual reality at-home intervention for persons living with dementia and their care partners. *BMJ Open* **2024**, *14*, e085442. [CrossRef]
45. Lenoir, H.; Pino, M.; Dacunha, S.; Rigaud, A.-S. Feasibility, user satisfaction, and knowledge improvement after a VR training program for healthcare professionals managing behavioral and psychological symptoms of dementia (BPSD): Protocol for the FORMSPC-REALVI single-arm pre-post study. *PLoS ONE* **2025**, *20*, e0325910. [CrossRef]
46. Wong, W.W.S.; Tsang, H.T.; Luk, C.L.; Chiu, A.T.S. Effects of applying virtual reality in Cognitive Stimulation Therapy (CST) on cognition and functional communication of people with concurrent dementia and visual impairment: An initial study. *Alzheimer's Dement.* **2023**, *19*, e070728. [CrossRef]
47. Grassini, S.; Laumann, K.; Rasmussen Skogstad, M. The Use of Virtual Reality Alone Does Not Promote Training Performance (but Sense of Presence Does). *Front. Psychol.* **2020**, *11*, 1743. [CrossRef]
48. Kempler, D.; Goral, M. Language and Dementia: Neuropsychological Aspects. *Annu. Rev. Appl. Linguist.* **2008**, *28*, 73–90. [CrossRef]
49. McPherson, R.; Resnick, B.; Boltz, M.; Kuzmik, A.; Galik, E.; Kim, N.; Zhu, S. The association between patient engagement and quality of care interactions among acute care patients with dementia. *Geriatr. Nurs.* **2024**, *57*, 117–122. [CrossRef]
50. Li, B.; Zhou, L.; Hoshino, J. Collaborative VR environment for supporting food culture learning. *Entertain. Comput.* **2025**, *55*, 100979. [CrossRef]
51. Christopoulos, A.; Styliou, M.; Ntalas, N.; Stylios, C. The Impact of Immersive Virtual Reality on Knowledge Acquisition and Adolescent Perceptions in Cultural Education. *Information* **2024**, *15*, 261. [CrossRef]
52. Qawqzeh, Y.; Shraah, A.A.; Rizwan, A.; Sánchez-Chero, M.; More, L.A.V.; Shabaz, M. Exploring the effectiveness of virtual reality-based training for sustainable health and occupational safety in industry 4.0. *Sci. Rep.* **2025**, *15*, 28930. [CrossRef] [PubMed]
53. Yudintseva, A. Virtual reality affordances for oral communication in English as a second language classroom: A literature review. *Comput. Educ. X Real.* **2023**, *2*, 100018. [CrossRef]
54. DiLollo, A.; Favreau, C. Person-centered care and speech and language therapy. *Semin. Speech Lang.* **2010**, *31*, 90–97. [CrossRef]
55. Mills, J.; Duffy, O. Speech and Language Therapists' Perspectives of Virtual Reality as a Clinical Tool for Autism: Cross-Sectional Survey. *JMIR Rehabil. Assist. Technol.* **2025**, *12*, e63235. [CrossRef]
56. Radianti, J.; Majchrzak, T.A.; Fromm, J.; Wohlgenannt, I. A systematic review of immersive virtual reality applications for higher education: Design elements, lessons learned, and research agenda. *Comput. Educ.* **2020**, *147*, 103778. [CrossRef]
57. Abegglen, S.; Greif, R.; Balmer, Y.; Znoj, H.J.; Nabecker, S. Debriefing interaction patterns and learning outcomes in simulation: An observational mixed-methods network study. *Adv. Simul.* **2022**, *7*, 28. [CrossRef]

58. Han, W. *Universal Grammar and the Initial State of Second Language Learning: Evidence of Chinese Multidialectal Children's Acquisition of English at the Syntax-Semantics Interface*; Springer: Singapore, 2020.
59. Versteegh, C.H.M. *The Arabic Language*, 2nd ed.; Edinburgh University Press: Edinburgh, UK, 2014.
60. Lodge, R.A. *Exploring the French Language*; Routledge: London, UK, 2016.
61. Gironzetti, E.; Lacorte, M. *The Routledge Handbook of Multiliteracies for Spanish Language Teaching: Multimodalidad e Interdisciplinariedad*, 1st ed.; Taylor & Francis Group: Oxford, UK, 2024.
62. Kuroda, S.Y. Whether We Agree or Not: A Comparative Syntax of English and Japanese. In *Japanese Syntax and Semantics: Collected Papers*; Kuroda, S.Y., Ed.; Springer: Dordrecht, The Netherlands, 1992; pp. 315–357.
63. Han, W.; Shi, D. Topic and Left Periphery in Shanghainese. *J. Chin. Linguist.* **2016**, *44*, 29–60.
64. Han, W.; Shi, D. The Evolution of ɦi^{23}kã^{34} 'he says' in Shanghainese. *Lang. Linguist.* **2014**, *15*, 479–494.
65. Han, W. *Word Order Typology: Topic and Topic Marker Structure*; Shanghai Foreign Language Education Press: Shanghai, China, 2013.
66. Teresi, J.A.; Yu, X.; Stewart, A.L.; Hays, R.D. Guidelines for Designing and Evaluating Feasibility Pilot Studies. *Med. Care* **2022**, *60*, 95–103. [CrossRef]
67. Hanbury, A.; Mafirakureva, N.; Chicken, N.; Bailey, L. Evaluating change in a pressured healthcare system: A cross-sectional study of implementation outcomes using routine data indicators and proxies. *Implement. Sci. Commun.* **2023**, *4*, 96. [CrossRef]
68. Hemle Jerntorp, S.; Jakobsson, J.; Axelsson, M.; Carlson, E.; Aho, A.C. Family members' experience of involvement in the patient care process on an interprofessional training ward: A qualitative interview study. *J. Interprof. Educ. Pract.* **2025**, *39*, 100742. [CrossRef]

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