Received: 20 December 2022 | Revised: 15 December 2023 | Accepted: 19 December 2023

DOI: 10.1111/jar.13201

REVIEW

JARID Journal of Applied Research in Intellectual Disabilities bild WILEY

A systematic review of research on staff training as an intervention to develop communication in children and adults with profound intellectual and multiple disabilities

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Abstract

Introduction: This paper aims to identify to what extent staff training interventions are successful in enhancing the development of communication skills in people with profound intellectual and multiple disabilities.

Methods: A systematic review was undertaken, conforming to PRISMA guidelines. English language, peer reviewed, empirical studies of staff training interventions to enhance the communication of people with profound intellectual and multiple disabilities were included. Databases Scopus, Web of Science, Proquest, Linguistics and Language Behaviour Abstracts (LLBA) and Medline were searched in July 2015 and updated in December 2022. Quality appraisal was conducted on 13 studies using Crowe's Critical Appraisal Tool (CCAT).

Results: Few good quality evaluations of interventions were found. Challenges to research rigour included the diversity of people with profound intellectual and multiple disabilities, small sample sizes, intervention intensity and the management of fidelity.

Conclusions: Manualised and bespoke interventions showed promise in improving staff communication and responsiveness.

KEYWORDS
communication, profound disabilities, staff training, systematic review

1 | BACKGROUND

Children and adults with profound intellectual disabilities are described by the American Association on Intellectual and Developmental Disabilities (AAIDD) (2010) as needing 'pervasive support … for every aspect of daily routines. They present with a diversity of intellectual, physical, sensory and communicative impairments' (Lyons & Arthur-Kelly, 2014, p. 445) and a level of cognitive development that is very low or untestable (Bellamy et al., 2010).

Terminology used for describing this group varies across and even within countries (Profound Intellectual and Multiple Disabilities (PIMD), Profound and Multiple Learning Disabilities (PMLD), Profound Intellectual Disabilities (PID)). To align with international terminology, in this paper, profound intellectual and multiple disabilities will be used. Communication in children and adults with profound intellectual and multiple disabilities is typically pre-symbolic (Dhondt et al., 2019). Hence, the role of communication partners in facilitating communication is particularly important (Hostyn & Maes, 2009; Matérne &

Holmefur, 2022). Frontline care staff impact the quality of support provided to people with intellectual disabilities (Mansell et al., 2008) and provide adults with intellectual disabilities with reasons to communicate, support their means of communication and offer opportunities for communication skills to be used functionally (Money & Thurman, 2002). The high support needs of these individuals imply a need for tailored staff training (Goldbart et al., 2014).

Diverse approaches are in use, with the aim of enhancing communication and interaction skills of children and adults with profound intellectual and multiple disabilities, their family carers and staff working with them for example Intensive Interaction, Objects of Reference and multi-sensory storytelling (Goldbart et al., 2014; Goldbart & Caton, 2010). These named approaches, among others, may be delivered indirectly through staff training. For the purposes of this paper, 'communication' is defined as 'two or more people working together and coordinating their actions in an ongoing response to each other and the context (Bunning, 2009, p. 48). Similarly, an 'interaction' does not necessarily have a 'task or an outcome focus' (Hewett & Nind, 2013). Although interactional behaviours such as play often precede the level of intentional communication, these are both valid forms of connecting with people with profound intellectual and multiple disabilities within a social context and may be used interchangeably in this review. Given the specific challenges experienced by children and adults with profound intellectual and multiple disabilities compared to those with mild and moderate intellectual disabilities, there has been particular attention to interventions addressing the communication and interaction strategies of a diverse range of staff, referred to in this paper as *indirect* interventions. There is, however, no consensus or established evidence base to support the use of any one or more of these approaches (Chadd et al., 2022).

Gormley et al. (2020) conducted a scoping review of general staff training and found that most studies evaluated training by looking at outcomes in terms of changes in staff skills or knowledge rather than changes in the people they supported. Principles for successful implementation of staff training programmes were identified in Bell et al. (2001) where sustainability was a key aspect in training their staff participants in a communication strategy (signing). They argued that training should lead to long term ongoing change. Remington (1998 in Bell, 2001, p. 93) outlined core requirements for sustainable change: 'contingency, clarity, consistency, co-ordination, community and continuity'. Bell et al. (2001) also listed management support, training that reflected staff reality, the importance of embedding changes into organisational policy and recognising staff's beliefs and attitudes as elements in an effective environment for sustainable change.

Two recent studies have reviewed the effectiveness of language and communication interventions for adults (but not children) across the range of intellectual disabilities (including adults with mild and moderate intellectual disabilities). Wood and Standen (2021) reviewed direct intervention (i.e., by a speech and language therapist or assistant $n = 10$) and indirect (i.e., through care staff $n = 1$) and found insufficient evidence for effectiveness. However, Van der Meer et al.'s (2017) review of training for care staff to work on communication identified that 'Staff training most frequently involved combinations of verbal instruction, role play, modelling, practice, and feedback' (p. 1279). They reported positive results from training which was multi-component and where practice and feedback were included in the training approach. They concluded that care staff can learn to deliver communication strategies, although the strength of evidence for their impact was mixed. The finding that only one of 22 identified studies provided certainty of evidence suggests some issues relating to research quality. Neither of these reviews (Wood & Standen, 2021; Van der Meer et al., 2017) disaggregated their data to show specific outcomes for people with profound intellectual and multiple disabilities. The present review aims to fill this gap in the literature. Maes et al. (2021) identified a number of challenges to high quality research with people with profound intellectual and multiple disabilities, several of which could pertain to communication intervention. These include low prevalence and high heterogeneity affecting sample sizes and difficulties in finding an appropriate control group, lack of appropriate data collection tools, and reservations concerning the applicability of general theoretical models, where models specific to people with profound intellectual and multiple disabilities do not exist.

The aim of this paper was to use a systematic review to appraise the current state of knowledge regarding staff training interventions to develop communication skills of children and adults with profound intellectual and multiple disabilities and to use these findings from the critical appraisal to identify ways to enhance future research.

1.1 | Research questions

1. To what extent has research been conducted investigating staff training interventions to develop the communication skills of children or adults with profound intellectual and multiple disabilities?
2. To what extent are staff training interventions successful in changing staff behaviour?
3. To what extent are staff training interventions successful in enhancing the development of communication skills in people with profound intellectual and multiple disabilities?
4. What are the methodological strengths and weaknesses of the existing research?

2 | METHOD

The systematic review was guided by the principles outlined in the Cochrane Collaboration methodology (Higgins & Green, 2011). The review process was informed by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA, 2009, http://www.prisma-statement.org/); an evidence-based minimum set of items for reporting in systematic reviews and meta-analyses.

2.1 | Search strategy

Development of the search strategy involved a three-stage process; the development of an inclusive set of search terms to maximise the

TABLE 1 Search terms.

'profound learning disabilit*' OR
'profound learning difficult*' OR
'profound* retard*' OR
PIMD OR
PMLD OR
'profound intellect*' OR
'profound and multiple' OR
'profound impair*' OR
'profound* mental* handicap*'
AND (communication OR interaction)

return of potentially valid studies (Table 1), identification of an appropriately broad set of databases, and the establishment of clear inclusion and exclusion criteria against which to map possible papers to generate an appropriate dataset for further analysis.

The search terms were informed by a preliminary review conducted by Ware et al. (2014) and from terminology used in papers known to be relevant. Historical changes and international differences in classifications and labels relating to the people with profound intellectual and multiple disabilities meant that a wide range of options needed to be included. A consideration of 'Medical Subject Headings' (MeSH terms) demonstrated that these would not be appropriate for the present review. The final search strategy was a combination of 'free text' terms with Boolean operators (in capitals) and truncations (*). This strategy is presented in Table 1.

The databases were selected to include papers from medical and allied health, educational, psychological and social care contexts. Those used were Scopus, Web of Science, Proquest, Linguistics and Language Behaviour Abstracts (LLBA) and Medline.

2.1.1 | Inclusion and exclusion criteria

The inclusion criteria were as follows:

- The study involves a training intervention addressed to members of staff. For the purpose of this study, 'staff members' were identified as all those people working closely with individuals with profound intellectual and multiple disabilities.
- Intervention with staff is intended to enhance the communication or interactions of children, young people or adults with profound intellectual and multiple disabilities.
- The intervention involves at least four participants; a minimum of two staff members to undertake training and who would then carry out communication activities or 'teaching' with at least two people with profound intellectual and multiple disabilities.
- Included papers also need to be English language, peer reviewed and involve the collection of primary empirical data.

Exclusion criteria were as follows:

- Studies where the intervention is solely and directly aimed at children, young people or adults with profound intellectual and multiple disabilities rather than their potential interaction/communication partner.
- The recipients of the training are not members of staff working with people with profound intellectual and multiple disabilities (e.g., family members, or staff solely working with cognitively more able clients).
- Studies where the intervention addresses linguistic structures, whether in speech, symbols or signs at the two-word level or above as this would indicate that the end users were functioning above the level associated with profound intellectual and multiple disabilities.
- Studies where data on participants with profound intellectual and multiple disabilities cannot be disaggregated from other participants with disabilities.
- Studies which solely included staff reflections as the primary data collected for effect measurement.

2.2 | Search procedure

Separate searches were conducted in July 2015 in electronic databases to identify appropriate studies published from the earliest entries of any of the databases until that point. The searches were subsequently updated in December 2022 when nine additional articles were identified.

Duplicates across the databases were removed, and the list of articles from the two searches were combined, leaving a single list of papers. Numbers are presented in the PRISMA flowchart (see Figure 1). Titles and abstracts were each reviewed by two or three authors for relevance and against the inclusion and exclusion criteria. There were very few disagreements, which were resolved by discussion; 58 papers were retained for full text consideration.

2.3 | Full text review and quality appraisal

The full text of papers that appeared to be relevant and that met the inclusion and exclusion criteria were reviewed against those criteria. Each paper was considered by two or three authors. The reasons for exclusion at this stage were noted. After all searches were completed, and revised to ensure that papers conformed to the inclusion/exclusion criteria, 13 out of the 58 articles were retained for inclusion in the review. The final 13 papers were hand-searched for other relevant papers. None were found.

The selection of quality appraisal tools required careful consideration as it needed to be appropriate to the type of content in the papers and a diversity of study designs. A scoring system was also required to enable comparison of methodological quality between studies using different designs. Following consideration of a range of tools, the *Crowe Critical Appraisal Tool (CCAT)* (Crowe, 2013) was identified as best meeting these requirements. In particular, this tool

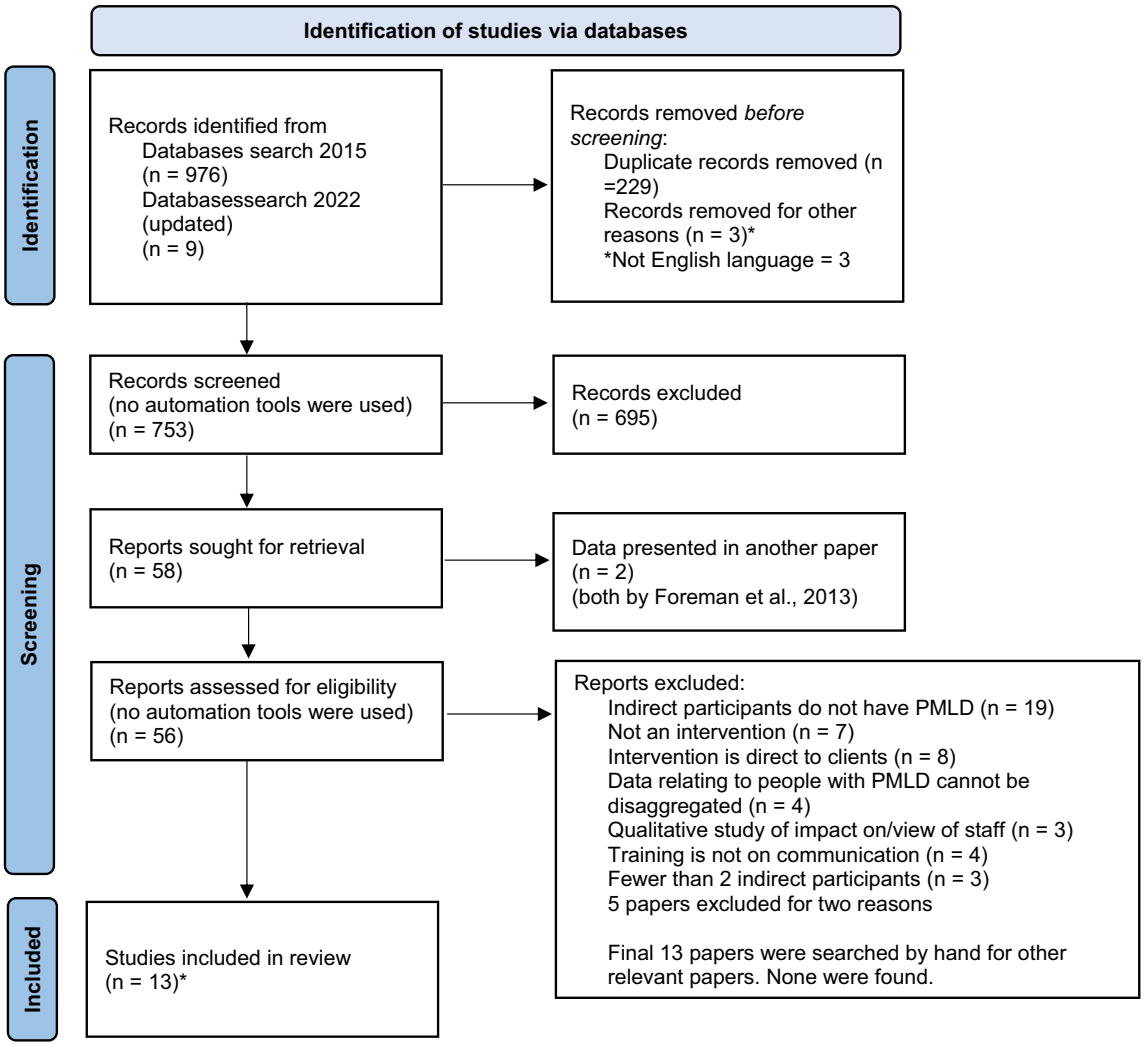

FIGURE 1 PRISMA flow diagram. * Reference lists in these studies were reviewed for inclusion. No additional studies were found. *Source*: From Moher et al. (2009). For more information, visit: http://www.prisma-statement.org/.

enabled studies of widely divergent designs to be appraised using the same instrument and scoring system, without reference to a notional 'gold standard'. Additional justification for this choice included the availability of a detailed manual for the CCAT, availability of information supporting its reliability (Crowe et al., 2011; Crowe et al., 2012) and validity (Crowe & Sheppard, 2011), the detailed approach it was seen to incorporate regarding methodological scrutiny, and its recent use in several studies (e.g., Corrigan et al., 2016; Donnelly et al., 2015).

The CCAT scores items in eight categories (Preliminary information, Introduction, Design, Sampling, Data collection, Ethics, Results and Discussion) on a 6-point scale (0–5), it does not give a specific overall 'cut off' score. Instead, it relies on a combination of the overall score, the score in specific categories, and the judgement of the appraiser. Ratings of the different categories are compiled into a final score which is then converted to a percentile score with 100% indicating the highest possible quality (see Table 2 for quality scores and percentage agreement (inter-rater reliability) for the articles retained in the review). Much of the information derived from the CCAT process can be found in Tables A1, B1, C1 and D1.

To calibrate quality assessment of the full texts, two papers with differing designs were appraised by all five authors, and differences resolved through discussion. The remaining papers were each appraised independently by two or three authors. Differences in the percentage scores between appraisers were, in all cases, small and resolved by discussion.

One intention of this study was the identification of methodological challenges with the aim of enhancing future research. Accordingly, all included papers were retained, with the outcomes of critical appraisal being used qualitatively to inform this discussion.

2.3.1 | Data extraction and synthesis

Because the included papers had a wide diversity of study designs, Lucas et al.'s (2007) approach to textual narrative synthesis was

TABLE 2 The CCAT checklist results for assessing the methodological quality of the included studies.

Authors (year)	Preliminaries (/5)	Introduction (/5)	Design (/5)	Sampling (/5)	Data collection (/5)	Ethical matters (/5)	Results (/5)	Discussion (/5)	Total (/40)	Total (%)	Rater agreement (%)
Barber (2008)	4	3	3	1	3	2	3	3	22	55	100
Bloomberg et al. (2003)	4	5	1	2	2	0	4	5	23	58	100
Damen et al. (2011)	4	5	4	3	3	3	4	4	30	75	89
Dobson et al. (2002)	3	3	2	2	2	0	3	3	18	45	100
Foreman et al. (2007)	4	5	3	2	4	1	3	5	27	68	88
Foreman et al. (2014)	5	5	4	3	3	2	5	4	32	80	90
Golden and Reese (1996)	4	3	2	3	1	2	4	3	22	55	100
Granlund et al. (1992)	3	4	4	4	4	0	3	4	26	65	97
Jones et al. (2002)	3	4	2	2	3	1	3	4	22	55	88
Nijs et al. (2018)	2	4	1	4	3	2	2	4	22	55	98
Realon et al. (2002)	3	3	3	1	3	0	1	3	17	43	82
Samuel et al. (2008)	5	4	4	3	4	0	5	4	29	73	86
Ware (1994)	3	4	2	2	3	1	3	3	21	53	84
Mean	3.62	4.00	2.69	2.46	2.92	1.08	3.31	3.77			

Note: 5 = highest level of rigour.

followed. The authors conducted data extraction, working to a consensus.

All papers were required to have staff members as recipients of the intervention; they are referred to as 'staff'. Most papers reported staff outcomes and many also included data on the children, young people and adults who were the indirect recipients of the intervention. They are identified as 'people with profound intellectual and multiple disabilities'.

Data were extracted from the papers (see Appendix A & Table 3) based on both PRISMA guidance (PRISMA, 2009) and the expertise and knowledge of the research team which informed the development of a theoretical framework.

The theoretical framework was developed from a number of sources to enable the research questions to be answered. Content extracted from the papers was informed by: (i) the existing research work of the authors (Ware et al., 2014) and others (e.g., Hostyn & Maes, 2009) which highlight the importance of assessing the evidence base for interventions that focus on social communication and interaction with people with profound intellectual and multiple disabilities; and (ii) research focusing on the requirements of staff training for people with intellectual and multiple disabilities (Bell, 2001; Landesman-Dwyer & Knowles, 1987; Remington, 1998).

The data extraction was done in an iterative way whereby initial information was extracted from 13 papers. Following this, the coding was refined and repeated to simplify, synthesise and make more accessible the findings for the reader of this paper.

Once the data were gathered into the supplemental table, key variables – decided on via agreement between the authors – were selected and collated into a single table summarising the key information used to inform the writing of the findings from the review (Table 3).

The five authors conducted independent quality assessment of the papers included in the review. A balanced incomplete block design was used when allocating two reviewers for each paper. This meant that all reviewers reviewed an equivalent number of papers. Each reviewer reviewed with each of the other reviewers at least once. The results of the quality appraisal and the data extraction are presented in Table 3, with more detail provided in Appendices A to D. Tabulated information was collated across the 13 studies into written accounts for inclusion in the findings. These were further checked by a minimum of two of the other authors for accuracy.

3 | RESULTS

3.1 | Background of included studies

3.1.1 | Country and setting

The 13 selected studies (Barber, 2008; Bloomberg et al., 2003; Damen et al., 2011; Dobson et al., 2002; Foreman et al., 2007, 2014; Golden & Reese, 1996; Granland et al., 1992; Nijs et al., 2018; Realon et al., 2002; Samuel et al., 2008; Ware, 1994) were published between 1991 and 2018. Studies were conducted in Australia ($n = 4$), UK ($n = 4$), USA ($n = 2$), Netherlands ($n = 1$), Netherlands and Belgium ($n = 1$), Sweden ($n = 1$). Most studies were conducted across multiple sites ($n = 11$) with two on a single site. Settings included mainstream and special schools ($n = 4$), day services ($n = 4$), residential services including supported community group homes, medium and large residential settings ($n = 7$) and parental homes ($n = 1$).

3.1.2 | Funding information

Funding was only mentioned for four studies and included Research Council Discovery Project (Australia), the Economic and Social Research Council (UK) and two which were University funded.

3.2 | Study objectives, participants and design

3.2.1 | Study objectives

Objectives of the articles varied; most aimed to facilitate change in both staff and people with profound intellectual and multiple disabilities ($n = 10$), one focussed solely on change in staff (Dobson et al., 2002) and two focussed primarily on people with profound intellectual and multiple disabilities (Barber, 2008; Foreman et al., 2014). Four of the studies aimed to enhance both communication and social interaction (Foreman et al., 2014; Realon et al., 2002; Samuel et al., 2008; Ware, 1994). Four (Barber, 2008; Damen et al., 2011; Golden & Reese, 1996; Nijs et al., 2018) focussed primarily on enhancing social interaction. Five (Bloomberg et al., 2003; Dobson et al., 2002; Foreman et al., 2007; Granlund et al., 1992; Jones et al., 2002) focussed primarily on enhancing communication between the staff member and person with profound intellectual and multiple disabilities.

3.2.2 | Participant characteristics

The 13 studies included between four and 100 staff (mean = 24.23, SD = 28.59) and between three and 102 (mean = 18.62, SD = 26.22) people with intellectual and developmental disabilities. All staff shared the main characteristic of undergoing training in communication to be able to implement their new skills in close regular work with people with profound intellectual and multiple disabilities. Staff participants in the studies reviewed included teachers, school support assistants, direct care staff (those with and without a level of certification for working in their role) and staff in health-related professions (e.g., occupational therapists, psychologist, nurses). Characteristics of people with profound intellectual and multiple disabilities were not always reported in detail, but they were included in all studies. Communication skills ranged from pre-intentional to those with emerging intentional communication skills. Ages ranged from 5 to 56. Although diagnoses were not always provided, participants with Rubinstein-Taybi syndrome, cerebral palsy, microcephaly, tuberous sclerosis,

TABLE 3 Summary information for the included studies (see supplementary Tables A1, B1, C1 and D1 for further details extracted from the papers).

Author, date & country	Study design	Study objectives	Intervention name or description	Staff: Outcomes studied and findings	People with profound intellectual and multiple disabilities: Outcomes studied and findings
Barber (2008) Australia	Quantitative Small Scale ($N = 3$) AB Design (with extended baseline)	To determine the effect of training staff in Intensive Interaction on five indicators of student involvement.	Published. Intensive Interaction (Firth et al., 2008).	Informal observation and reflective practices. No data presented.	Pre and post-intervention Video observations of 3 students' individual teaching sessions. Second by second rating of presence/absence of each of the five Indicators of Involvement. (adapted from Kellett & Nind, 2003). Increase in social behaviours and decrease in 'no interactive behaviour'. No statistical analysis. Many data points, but only 3 participants.
Bloomberg et al. (2003) Australia	Quantitative Group pre-post pre-experimental design	To evaluate the impact of the Picture It Program on staff and people with profound intellectual and multiple disabilities across knowledge, environment, assessment intervention	Published and manualised. Picture It: (adapted from Granlund and Olsson (1988) Ways to communicate—a staff training package). Addresses Communication, Cognition, Sensory Skills, Environmental Factors (Assessment and intervention strategies for these), review of Challenging behaviour.	Knowledge and Perceptions of Communication Skills: Some significant increase. Video observation coding staff initiations and responses: Significant increase in carers' initiations. Early Communication Skills Profile: Significant increase in knowledge regarding communication and intervention strategies. Goal Attainment Scale: All carers formulated appropriate communication goals.	The Triple C assessment (Bloomberg & West, 1999): Only used for identification. Video observation coding learner initiations and responses. Significant increase in responses. Positive but non-significant changes in initiation.
Damen et al. (2011) Netherlands	Quantitative Single case AB Design across participants.	To test the effectiveness of the Contact Programme across four specific quality measures of interaction.	Published and modified: Contact Programme (Janssen et al., 2003a, 2003b). (Modified) Addressed characteristics of behaviour: including initiatives, confirmation, reactions.	Proportion of initiatives by person with profound intellectual and multiple disabilities that were followed by either a confirmation or a reaction by the staff member and frequency of confirmation:	Responsiveness. confirmation or reaction to staff initiatives through video observation. No significant increase in responsiveness was observed.

(Continues)

TABLE 3 (Continued)

Author, date & country	Study design	Study objectives	Intervention name or description	Staff: Outcomes studied and findings	People with profound intellectual and multiple disabilities: Outcomes studied and findings
				On average, staff improved interactions compared with the stable baseline. Visual inspection showed improvements in confirmation, percentage of initiations responded to by staff members and affective mutuality. Rating scale for affective mutuality Social Validity Scale (adapted Seys, 1987): Significant increase from last baseline to first intervention occasion. BUT no further improvement later in the intervention period.	
Dobson et al. (2002) UK	Qualitative, Pre-experimental (Group, pre-, post.) Observational comment.	To evaluate the impact of staff training on communication (knowledge and skills) with people with profound intellectual and multiple disabilities.	Communication training programme based on that currently used with the parents, carers and educators of preschool children (Manolsen, 1992). Addresses attitude, practical skills and knowledge based around actual clients.	Video Observation of use of language, amount of language and style of interaction: Significant increase in number of utterances, acknowledgements and praise, open requests for information. Positive changes in interaction and communicative styles. No change in complexity of language used. Staff self-evaluation using Goal Attainment Scale: All staff had more than achieved expected outcomes.	Impact on people with profound intellectual and multiple disabilities not measured
Foreman et al. (2007) Australia	Quantitative AB design	To evaluate the effect of staff development in communication support on communicative involvement and alertness of people	Bespoke intervention. Enhance and maximise communication development of people with profound intellectual	Self-report pre and post intervention on skills, knowledge and concerns: Increased knowledge reported.	Partial interval observational measures of behaviour state, communication indicators, form and

TABLE 3 (Continued)

Author, date & country	Study design	Study objectives	Intervention name or description	Staff: Outcomes studied and findings	People with profound intellectual and multiple disabilities: Outcomes studied and findings
		with profound intellectual and multiple disabilities	and multiple disabilities through basic communication functions, assessment tools, ABC coding, interview protocols for parents, identifying goals, evidence based strategies.		function and social context. Awake-Active-Alert state increased by just under 5% on average. No change in staff-pupil interaction. Some changes in 'social context' variables.
Foreman et al. (2014) Australia	Quantitative, Small N multiple baseline design across participants	To evaluate the impact of communication partner training and mentor modelling on support for students with profound intellectual and multiple disabilities in special school compared with regular classes.	Bespoke intervention. Enhance interaction skills using in class mentoring 'mentor-modelling'. General communication programming assessment and strategies, followed by Individualised strategies for target students with reflection, review and revision where needed.	Video observation including communication interactions and strategies: Impact on staff not reported.	Measures of: (i) behaviour state and (ii) communicative interaction in children with profound intellectual and multiple disabilities. Variable patterns of outcome. 4 (of 8) children increased alert-awake-active behaviour state. and 4 (of 8) increased communicative interaction.
Golden and Reese (1996) USA	Quantitative Single Case Experimental Design ABA and Group: Quasi experimental with control.	To determine whether training in the use of the Mental Retardation/ Developmental Disabilities Adaptation of the Nursing Child Assessment Feeding Scale (MR/DD NFCAS) changes interactive behaviour between direct-care staff and adults with profound intellectual and multiple disabilities during meal time sessions.	Published and modified. University of Washington's nursing child assessment satellite training (NCAST). Barnard (1980). The nursing assessment feeding scale. Seattle, WA: University of Washington. Promotes awareness raising and positive interaction by emphasising role of the environment and caregivers in being sensitive and responsive to non-verbal cues to enhance cognitive and social emotional growth.	Direct observation during baseline treatment, and follow-up of: (a) instruction, (b) positive verbal attention, (c) positive nonverbal attention, (d) neutral attention: Increase in positive verbal behaviour. Slight increase in positive nonverbal behaviour.	Behaviours measured: engaging people, object engagement, non-compliance and self-stimulation. Little or inconsistent change in behaviour of people with profound intellectual and multiple disabilities.
Granlund et al. (1992) Sweden	Quantitative Quasi experimental pre- & post-test with control group.	To enhance the use of communication behaviours through staff training and supervision using a pyramidal model	Published and manualised. Ways to Communicate (Granlund & Olsson, 1988) Training included	Direct care staff: Social and Physical Environments Survey. Significant positive changes in interaction, creating	Early Social Communication Scale (ESCS) scores showed increases from baseline to follow-up (24

(Continues)

TABLE 3 (Continued)

Author, date & country	Study design	Study objectives	Intervention name or description	Staff: Outcomes studied and findings	People with profound intellectual and multiple disabilities: Outcomes studied and findings
			Communication & profound intellectual and multiple disabilities, analysis of pre-training assessment, collaborative problem-solving, goal attainment scaling and intervention planning.	communicative opportunities and communication goal setting. Self-rating scale of active intervention participation: Supervisors: Positive correlation between supervisors' problem solving input and communication opportunities offered by direct care staff.	students only) in responses to social interaction. Goal attainment scaling. Goal Attainment Scaling showed increases in frequency of use of existing skills and to a lesser extent, responding to communicative behaviours
Jones et al. (2002) UK	Quantitative Quasi experimental Pre-post group design. Qualitative staff interviews	To evaluate the use of a standard set of Objects of Reference with adults with profound intellectual and multiple disabilities	Published and manualised. Objects of Reference Ockleford, 1994, Objects of Reference (London: RNIB). A standard set of Objects of Reference used across clients. Training on responsive environments and communication development.	Semi structured interviews: Staff understood aspects of communication and felt they used Objects of Reference effectively, though concerned about time required.	Observation Scale devised as part of the project to record the use of the objects. All bar one participant made some gains in use of Objects of Reference. More able (proactive) clients made better progress. Gains were only in 1st 10 weeks
Nijs et al. (2018) Netherlands and Belgium	Quantitative Single Case Experimental design, Multiple baseline	To evaluate the effect of intervention on staff social scaffolding behaviours on peer-directed behaviours of people with profound intellectual and multiple disabilities	Bespoke training. Based on social scaffolding theory recognising interactions and peer-directed behaviours, intervention strategies, positioning, time, motivating activities, social scaffolding strategies.	Observed social scaffolding behaviour: Social scaffolding behaviours increased significantly.	Peer-directed behaviours as shown by persons with profound intellectual and multiple disabilities through video observation. 1. multiple peer-directed behaviours, 2. singular peer-directed behaviour, 3. all non-peer-directed behaviours. All participants showed increases in singular peer-directed behaviour but only significant for three participants. Percentage of time multiple peer-directed behaviours were present decreased.
Realon et al. (2002) USA	Quantitative Pre-experimental group	To evaluate a multifaceted environmental	Positive Environment Program (PEP)	Observations of interactions, engagement and	Direct observation of alertness,

TABLE 3 (Continued)

Author, date & country	Study design	Study objectives	Intervention name or description	Staff: Outcomes studied and findings	People with profound intellectual and multiple disabilities: Outcomes studied and findings
	Pre-, post- and follow-up	enrichment program (the Positive Environment Program) for people with profound intellectual and multiple disabilities and staff	Theoretical basis not stated. Training included importance of eye contact, providing positive comments, increasing and distributing interactions among people with profound intellectual and multiple disabilities, responding to a people with profound intellectual and multiple disabilities's attempts to communicate, and providing individualised leisure materials.	environment: Small increase in staff interactions with clients pre- to post-intervention. Availability of leisure material decreased slightly.	engagement and affect. Engagement, periods of time awake and happiness scores increased.
Samuel et al. (2008) UK	Quantitative Small N Quasi experimental interrupted time series multiple baseline across participants	To evaluate Intensive Interaction: 1. use of principles of Intensive Interaction 2. positive impact on a) communication and social abilities b) quality of the relationship between staff and people with profound intellectual and multiple disabilities	Published. Intensive interaction (Nind & Hewett, 2005)	Video observation at baseline and post-intervention (coded): Increases in staff use of mirroring and contingent responding. Postal questionnaire on staff expectations at 4 time points: Generally positive.	Video observation. Highly variable changes in communication and social abilities. PreVerbal Communication Schedule (Kiernan & Reid, 1987). PVCS scores showed improvements for all participants in positive interaction. Other categories more variable.
Ware (1994) UK	Quantitative, Small N design Modified multiple baseline across settings Qualitative (staff interviews)	To evaluate whether class-based staff training in creating a responsive environment enhances staff-people with profound intellectual and multiple disabilities interaction.	Bespoke intervention addressing (a) staff initiations, (b) adult response to child initiations, (c) allowing people with profound intellectual and multiple disabilities to take the lead in interactions.	Researcher-devised observations of interactive and communicative behaviour, and of engagement, using PLA check (adapted, Risley & Cataldo, 1975): Level of contingency-sensitive adult initiations increased in all periods of training. Decrease in variability between pupils/staff therefore a more contingency sensitive environment.	Direct observation. Clear progress in extent to which children with profound intellectual and multiple disabilities responded to staff initiations. Children's responses are associated with increases in staff Contingency Sensitive Initiations. Bayley Scales of Infant Development (1983). Bayley: Of 25 participants, 4 showed consistent increases, 11 showed little change, 10

(Continues)

TABLE 3 (Continued)

Author, date & country	Study design	Study objectives	Intervention name or description	Staff: Outcomes studied and findings	People with profound intellectual and multiple disabilities: Outcomes studied and findings
				Little change in opportunities for children with profound intellectual and multiple disabilities to lead interaction. Semi structured interviews: Staff reported increased self-esteem and job satisfaction.	showed changes in different directions.

epilepsy and additional visual, hearing and physical disabilities were included in the studies (see Appendix A for further details).

3.2.3 | Who collected the data

Data collection was carried out in five studies with researcher involvement (Barber, 2008; Bloomberg et al., 2003; Jones et al., 2002; Realon et al., 2002; Ware, 1994). Of these, two of the studies had another person also collecting data. Jones et al. (2002) worked together with staff and Realon et al. (2002) with a clinical psychologist.

Staff and 'other' health professionals were also data collectors in Dobson et al. (2002) (clinical psychologist and speech and language therapist). Samuel et al. (2008) relied on three independent observers to code the data as well as an assistant psychologist who also collected data. Others described using observers (though in some cases (Foreman et al., 2007, 2014; Damen et al., 2011) without detailing who these observers were) to code the collected data either independently (Damen et al., 2011; Nijs et al., 2018) or with training (Foreman et al., 2007, 2014; Golden & Reese, 1996). In three studies, the staff themselves were involved centrally in data collection, either by self-report or by also being trained (Granlund et al., 1992; Golden & Reese, 1996; Jones et al., 2002). The majority of the studies incorporated checks of inter-observer reliability which was reassuring and a strength across the body of literature reviewed. Processes of disagreement resolution were not always detailed but where they were there was evidence of thoughtful and rigorous processes primarily involving discussion to reach concordance. Challenges were evident in reaching a stable baseline in some studies.

3.2.4 | Study design

The studies reviewed often contained multiple components where staff trained were then viewed implementing this training with people with profound intellectual and multiple disabilities and outcomes for people with profound intellectual and multiple disabilities and staff were both assessed. Because of this, although this study is primarily concerned with staff training it is often challenging/impossible to disentangle the designs focussing on training staff from the designs focussing on the impact of this training on the people with profound intellectual and multiple disabilities and staff.

A number of the studies incorporated multiple designs ($n = 4$; Dobson et al., 2002; Golden & Reese, 1996; Jones et al., 2002; Ware, 1994). All 13 studies included were either solely quantitative ($n = 10$; Barber, 2008; Bloomberg et al., 2003; Damen et al., 2011; Foreman et al., 2007, 2014; Golden & Reese, 1996; Granlund et al., 1992; Nijs et al., 2018; Realon et al., 2002; Samuel et al., 2008) or mixed quantitative and qualitative studies ($n = 3$, Dobson et al., 2002; Jones et al., 2002; Ware, 1994). Commonality and variability in study design was evident across the studies with many small n or single case experimental designs ($n = 8$) of varying types (AB ($n = 3$; Barber, 2008; Damen et al., 2011; Foreman et al., 2007), ABA (Golden & Reese, 1996), multiple baseline ($n = 4$) across participant people with profound intellectual and multiple disabilities and staff (Foreman et al., 2014; Nijs et al., 2018; Samuel et al., 2008) and site (Ware, 1994) utilised in the included studies. Pre post pre-experimental designs ($n = 4$; Bloomberg, West & Iacono, 2003; Dobson et al., 2002; Jones et al., 2002; Realon et al., 2002) and quasi-experimental designs with a control group ($n = 2$; Granlund et al., 1992; Golden & Reese, 1996) were also used. Clarity, consistency and comprehensiveness with which study designs were articulated varied considerably across studies.

3.3 | Staff training interventions

Seven studies used formalised staff training interventions. These included Barber (2008) – Intensive Interaction, Bloomberg et al. (2003) – Picture-It, Damen et al. (2011) – Contact, Golden and Reese

(1996) – Nursing Child Assessment Satellite Training Model, Granlund et al. (1992) – Ways to Communicate, Realon et al. (2002) – Positive Environment Programme, Samuel et al. (2008) – Intensive Interaction). Six studies used bespoke-staff training interventions (Dobson et al., 2002; Foreman et al., 2007, 2014; Nijs et al., 2018; Ware, 1994, Jones et al., 2002).

3.3.1 | Training intervention delivery to staff

Though difficult to disentangle in the papers, the intervention delivery to staff appeared to take three broad forms: discrete training sessions on specific approaches; training on changing the communicative environments or a combination of the two. Examples of changes made in communication environments were physical: lighting and noise levels, or social: monitoring peer contact (Bloomberg et al., 2003).

Training on specific approaches: Three studies used sessions of specific training interventions: Barber (2008) – 10 weekly Intensive Interaction training sessions Nijs et al. (2018) – 10 weekly sessions training in a social scaffolding intervention; and Samuel et al. (2008) – who ran Intensive Interaction training; five sessions per week for 20 weeks.

Training to change the communication environments: Nine studies (Bloomberg et al., 2003; Damen et al., 2011; Dobson et al., 2002; Foreman et al., 2007, 2014; Golden & Reese, 1996; Granlund et al., 1992; Realon et al., 2002; Ware, 1994) trained staff on strategies for enhancing the communication environment.

Training that included a combination of both: Jones et al. (2002) added specific training sessions on Objects of Reference several times a day as environmental interventions.

Training content

For those training initiatives that were named, the training content was assumed to follow the named intervention, with the exception of those that were adapted (Damen et al., 2011; Golden & Reese, 1996; Jones et al., 2002). Though formal fidelity checks of adherence to named programmes were absent, some attempts to check fidelity were apparent (See below).

For the six articles (Dobson et al., 2002; Foreman et al., 2007, 2014; Jones et al., 2002; Nijs et al., 2018; Ware, 1994) that had described bespoke training, this involved delivery of information regarding: (i) the basic functions and introductory information about communication and how it develops in people with profound intellectual and multiple disabilities ($n = 4$); (ii) the assessment of communication and recognising communicative behaviours in people with profound intellectual and multiple disabilities ($n = 5$); (iii) theory and practice regarding specific and general strategies to improve communication with people with profound intellectual and multiple disabilities ($n = 5$); (iv) the importance of responsive communication environments ($n = 2$); and (v) planning and identifying communication goals ($n = 2$). In addition, one article mentioned training around attitudes. Finally, the content of training in two of the articles also focused on gathering information about communication with specific individuals with profound intellectual and multiple disabilities known to trainees and developing knowledge and skills relevant to those individuals.

Training duration

Training duration in terms of both training delivery (the amount of time spent on training and related communication support activities) and the overall duration of the training programme varied considerably across the studies. Training delivery ranged from 1 to 23 sessions. This did not include follow-up coaching or mentoring sessions. Units of delivery in terms of both time spent during sessions and the number of sessions delivered was not uniformly described across the studies, with variable levels of detail and clarity provided, leaving some confusion.

Training delivery mode

All interventions had multiple components integrated within their processes, which were detailed and explained with varying degrees of clarity and little consistency. Training was delivered using a variety of modes including didactic taught sessions ($n = 7$), group sessions ($n = 3$), joint problem-solving sessions ($n = 3$), workshops ($n = 3$), a professional development programme ($n = 1$) and training to criterion ($n = 1$). Role play and practice work ($n = 4$) and modelling ($n = 1$) were reportedly used in sessions and interdisciplinary training was mentioned in one article. Discussion sessions were sometimes incorporated into the training interventions ($n = 4$); as was individual coaching, supervision and mentoring ($n = 6$). Scheduled or structured (video) reflection, review and feedback sessions ($n = 8$) were often included in interventions. These were used to identify a communication focus, or to reflect on planning and implementation of goals with individual people with profound intellectual and multiple disabilities. Monitoring either by the trainee ($n = 1$) or another person within the organisation ($n = 1$) were mentioned. For one further study, the delivery mode was not detailed.

Pattern of delivery of training

Ten out of thirteen papers were identified as giving initial training combined with ongoing feedback (Barber, 2008; Bloomberg et al., 2003; Damen et al., 2011; Dobson et al., 2002; Foreman et al., 2007, 2014; Nijs et al., 2018; Realon et al., 2002; Samuel et al., 2008; Ware, 1994) with one caveat; the paper by Nijs et al. (2018) described only limited ongoing feedback to staff after training. Golden and Reese (1996) Granlund et al. (1992) and Jones et al. (2002) focused on providing initial training without any description of ongoing feedback. Granlund et al. (1992) was the only study that undertook a cascade training model.

Follow-up

No follow-up was reported for five of the 13 studies (Barber, 2008; Bloomberg et al., 2003; Damen et al., 2011; Foreman et al., 2007; Samuel et al., 2008). In one study (Realon et al., 2002), it was unclear whether or not there was any follow-up. The length of follow up for the other seven studies was 2 months or less in three studies

(Foreman et al., 2014; Golden & Reese, 1996; Nijs et al., 2018) between 3 and 6 months for two studies (Dobson et al., 2002; Ware, 1994) and 1 year in two studies (Granlund et al., 1992; Jones et al., 2002).

Where there was follow-up, positive changes in staff behaviour appeared to be maintained to some extent (Golden & Reese, 1996; Granlund et al., 1992; Jones et al., 2002), but in some cases, the extent to which changes in staff behaviour were maintained decreased over time (Golden & Reese, 1996; Granlund et al., 1992). Two studies reported that positive changes in the behaviour of people with profound intellectual and multiple disabilities were maintained to some extent at follow up (Foreman et al., 2014; Ware, 1994); other studies did not report on the extent to which changes in the behaviour of people with profound intellectual and multiple disabilities were maintained at follow up.

Fidelity and Acceptability measurement

Measurement of training intervention fidelity was not explicitly mentioned in any of the 13 studies. However, in four (Barber, 2008; Damen et al., 2011; Realon et al., 2002; Ware, 1994) there was an implicit attempt to maintain fidelity through training staff to criterion (Realon et al., 2002), or ongoing feedback to staff (Barber, 2008; Damen et al., 2011; Ware, 1994). Two additional studies (Bloomberg et al., 2003; Granlund et al., 1992) used a combination of collaboration and supervision which may have increased fidelity to the training intervention. No evidence in relation to fidelity was found in the remaining eight papers. Acceptability of training was checked in one study (Jones et al., 2002).

Management buy-in or support

Management support was evident in three studies, where the study was part of a service development (Dobson et al., 2002; Realon et al., 2002) or management were closely involved in its running (Granlund et al., 1992). Apart from this, support from management or senior staff was not stated explicitly but was evident in six studies where staff were released for training and other participation (Barber, 2008; Bloomberg et al., 2003; Damen et al., 2011; Foreman et al., 2007; Ware, 1994) and one where senior management involvement was reported in recruitment (Foreman et al., 2014). There was no evidence of management involvement in other studies. In Golden and Reese (1996), some staff expressed concern about potential management response to changes in staff practices, and in Nijs et al. (2018), this was discussed as a limitation.

3.4 | Outcome variables studied

3.4.1 | Outcome measures: Staff

Outcome measures related to changes in staff communication behaviours following training interventions were described in diverse ways. Six out of the 13 papers reported on changes in staff communication behaviour, and also described staff perceptions of behaviour change (Bloomberg et al., 2003; Damen et al., 2011; Dobson et al., 2002; Foreman et al., 2007; Samuel et al., 2008; Ware, 1994). Two papers (Golden & Reese, 1996; Nijs et al., 2018) reported only on changes in staff behaviour and one (Jones et al., 2002) reported only on staff perceptions of behaviour change. Two papers (Granlund et al., 1992; Realon et al., 2002) reported on changes in staff behaviour as well as changes to the organisation of space. The remaining two articles (Barber, 2008; Foreman et al., 2014) did not report any outcomes for measures of staff behaviours.

Measures of staff outcomes ranged along a continuum from those that attempted to formalise observations through the use of coding systems, surveys and pre-established scales to those that used informal ratings based on observation and reflection. Examples of formalised ratings included both Bloomberg et al. (2003) and Dobson et al. (2002) who implemented the Goal Attainment Scale completed by staff and both made use of video capture. Foreman et al. (2014) developed codes to identify specific partner interactions, Nijs et al. (2018) constructed a checklist to measure social scaffolding behaviours and Golden and Reese (1996) devised a checklist of specific observed staff behaviours that measured verbal, non-verbal and neutral attention.

Self-rating scales and systems were completed by staff in three of the studies. For example, Granlund et al. (1992) used the Social and Physical Environmental Scale and Foreman et al. (2007) used a self-reporting system that identified skills, knowledge and concerns. Informal measures were demonstrated by Barber (2008) who described using reflective practice with informal observations and feedback from staff. Similarly, Damen et al. (2011) used a subjective rating scale that measured the number of times confirmation and reaction was implemented by staff. Jones et al. (2002) and Ware (1994) were the only studies reviewed that described carrying out interviews with staff.

3.4.2 | Assessment outcome measures: People with profound intellectual and multiple disabilities

Similar to those used for staff outcomes, measures used to assess outcomes of the impact of staff training interventions on people with profound intellectual and multiple disabilities varied along a continuum of formal to informal methods with some researchers implementing published measures. Only one study (Dobson et al., 2002) did not describe any measures used with people with profound intellectual and multiple disabilities. Five of the 13 studies specified using video capture to collect observational data (Barber, 2008; Bloomberg et al., 2003; Damen et al., 2011; Nijs et al., 2018; Samuel et al., 2008). Published measures comprised use of the GAS and the Early Social Communication Scale (ESCS) by Granlund et al. (1992) the Bayley Scales used by Ware (1994) the Triple C used by Bloomberg et al. (2003) and the Pre-Verbal Communication Schedule (PVCS) used by Samuel et al. (2008). Published measures were often used in combination with coded observations of pre-identified behaviours (Samuel et al., 2008) or schedules of engagement and communicative behaviour (Ware, 1994).

Informal observational measures were evident in the descriptions by Realon et al. (2002) of the use of a happiness index alongside measures of engagement and alertness among people with profound intellectual and multiple disabilities. Nijs et al. (2018) focused on observations of peer and non-peer directed behaviours whereas Golden and Reese (1996) measured engagement with objects as well as people and such things as non-compliance and self-stimulation. Damen et al. (2011) specifically observed for the number of confirmations or reactions in people with profound intellectual and multiple disabilities, while Foreman et al. (2007) and Foreman et al. (2014) observed a range of behaviour states, communication and social behaviours.

3.5 | Impact of training

3.5.1 | Impact of training on staff

A positive impact of the training on staff was reported in all but two of the papers (Barber, 2008; Foreman et al., 2014), neither of which reported information on the impact on staff. In only six cases, however, were any of the changes in staff behaviour statistically significant (Bloomberg et al., 2003 – knowledge regarding communication strategies; Damen et al., 2011 – affective mutuality; Dobson et al., 2002 – number of utterances, level of praise, open requests, information provided, interpretation and acknowledgement, Granlund et al., 1992 – objectives, physical environment, individual stimulation, dyadic interaction, formulation of communication goals, Nijs et al., 2018 – social scaffolding behaviours, Ware, 1994 – contingency-sensitive staff initiations). A wide range of other impacts was reported, though these were either not statistically significant or their significance was not assessed; including increases/improvements in: knowledge about communication and communication strategies (Foreman et al., 2007; Jones et al., 2002); staff-client interaction (Realon et al., 2002); positive verbal behaviour (Golden & Reese, 1996); contingent responding (Damen et al., 2011; Ware, 1994); staff self-esteem and job satisfaction (Ware, 1994); and effective use of Objects of Reference (Jones et al., 2002). Samuel et al. (2008) reported that staff were able to use the techniques of Intensive Interaction, but there were limited data available in the paper.

3.5.2 | Impact of training on people with profound intellectual and multiple disabilities

A wide range of measures was used to determine the impact of staff training on people with profound intellectual and multiple disabilities in 12 of the studies. (More detail can be found in Table 3 and Appendices A–D). Dobson et al. (2002) did not report on outcomes for people with profound intellectual and multiple disabilities; of the remainder, some positive impact was found in all except Damen et al. (2011) and Golden and Reese (1996) where any changes were inconsistent. Barber (2008) Golden and Reese (1996) and Realon et al. (2002) presented graphical data but with no statistical analysis. Foreman et al. (2007) found small, non-significant increases in alertness; these were greater, though still variable in Foreman et al. (2014), with some students showing significant changes in alertness and communicative interaction. Realon et al. (2002) reported increased engagement, time awake and happiness scores but these were not assessed for significance. Bloomberg et al. (2003) found significant increases in responses but increases in initiations did not reach significance. Barber (2008) found increases in social behaviour and decreases in periods of no interactive behaviour, and Samuel et al. (2008) reported increases in social interaction measures supported by gains on the Preverbal Communication Schedule (Kiernan & Reid, 1987). Jones et al. (2002) found significantly increased use of Objects of Reference during the first 10 weeks only, with more able people with profound intellectual and multiple disabilities making the greatest gains. Nijs et al. (2018) reported some significant increases in 'singular peer directed behaviours'. Whilst Granlund et al.'s (1992) participants showed no positive statistically significant changes on the assessment used, 75% achieved or exceeded their communication goals. Ware (1994) found increases in children's responses to staff initiations. Children's responses were associated with increases in staff Contingency Sensitive Initiations.

4 | DISCUSSION

> **Research Question 1.** To what extent has research been conducted investigating staff training interventions to develop the communication skills of children or adults with profound intellectual and multiple disabilities?

This systematic review of staff training as a means of developing the communication skills of children and adults with profound intellectual and multiple disabilities yielded only 13 studies. Despite some confusion and lack of detail or clarity identified in accounts of the interventions delivered ($n = 5$), these 13 studies investigated a wide array of important aspects of the quality and quantity of interaction and communication. A common focus was on increasing staff sensitivity and responsiveness when interacting and communicating with people with profound intellectual and multiple disabilities. Unsurprisingly, given the developmental level of the indirect participants, the main focus of all but one of the studies was social interaction and/or communication rather the development of language or speech.

The types of study varied quite widely and were influenced by type and size of the setting (residential, day services, educational), with staff trained primarily being direct support staff, teaching assistants and teachers. The numbers of staff trained across the studies also varied, with only two larger scale studies ($N = 72$ and 100 staff) and the rest being smaller scale ($N = 2$–25).

All apart from four of the studies were unfunded and conducted by practitioners. Unfunded studies tended to be smaller tailored to the unique context and usually eclectic in their choice of approach(es). It also appears that without funding and cross-disciplinary methodological expertise, these studies were not as robustly devised as would be desirable (see below), with replication unfeasible in most cases.

> **Research Question 2.** To what extent are staff training interventions successful in changing staff behaviour?

Training was intended to alter staff practice. In some papers, how or whether changes in practice happened was unclear. In others (Barber, 2008; Jones et al., 2002; Nijs et al., 2018; Realon et al., 2002; Samuel et al., 2008; and Ware, 1994), the implementation of changes to staff practice was described. Staff training interventions involved a mixed approach (didactic sessions, plus discussion/problem solving sessions, focusing on the people with profound intellectual and multiple disabilities the staff were working with, and some form of on the job mentoring or supervision). This partially aligns with the findings of van der Meer et al. (2017). The majority of studies reported positive changes in staff behaviour.

Regarding the effectiveness of the staff training, only five demonstrated statistically significant findings in relation to staff communication and interaction behaviours.

The 'Contact' intervention (Jansen et al., 2003) enhanced staff affective mutuality in their relationships with people with profound intellectual and multiple disabilities.

The 'Ways to Communicate' intervention (Granlund & Olsson, 1988) produced significant improvements in staff ability to set goals and objectives for communication, utilise the physical environment, provide individual stimulation using objects and caregiver ability to successfully adjust their own communicative behaviours during dyadic interaction.

Some aspects of bespoke staff training also demonstrated statistically significant improvements in staff number of utterances, acknowledgement, open requests, information provided, interpretation and praise, social scaffolding and contingency sensitive initiation behaviours.

For other named staff training interventions, positive outcomes were reported in all but two of the papers. This review does not provide support for these training interventions based on an evidenced statistically significant change following intervention. These papers did not report or did not conduct statistical analyses often because they were small N studies. These interventions included Intensive Interaction, Objects of Reference, Picture It, the positive environment programme and the nursing child assessment satellite training model. Nor does the review support the effectiveness of the other bespoke interventions used in the remaining studies. However, a clinically meaningful change may not equate to a statistically significant one, hence future research should ensure adequate power and carefully identify what a meaningful change would be for staff, people with profound intellectual and multiple disabilities and carers. Training interventions commonly used in the UK (i.e., Intensive Interaction and Objects of Reference) require further large-scale evaluation to determine their efficacy for staff and people with profound intellectual and multiple disabilities.

> **Research Question 3.** To what extent is staff training successful in enhancing the development of communication in people with profound intellectual and multiple disabilities?

Van der Meer et al. (2017) reviewed training for care staff to provide communication input to people with intellectual disabilities with varying support needs (from mild to moderate and severe). This review aligns with their findings that training is multi-component often with practice and feedback included. It also supports their finding that strength of evidence does not provide certainty around which training intervention will provide the greatest positive impact. Contrary to the findings of Gormley et al. (2020), all but one of the studies included in this review did investigate communication outcomes for people with profound and multiple intellectual disabilities. The diversity of intervention content, delivery modes and outcome measures make it difficult to draw conclusions across the 13 studies regarding optimal staff training interventions for improving communication with children and adults with profound intellectual and multiple disabilities. Nonetheless, 10 of the studies do report positive changes in outcome measures for children and adults with profound intellectual and multiple disabilities, although not all were statistically significant. Very broadly, positive change was found in the following aspects; increases in alertness and engagement (Foreman et al., 2007, 2014; Realon et al., 2002; Ware, 1994), increases in social interaction (Barber, 2008; Nijs et al., 2018; Samuel et al., 2008) and increases in communicative responses (Bloomberg et al., 2003; Granlund et al., 1992). Developmental progression in communication was reported in only three studies (Jones et al., 2002; Samuel et al., 2008; Ware, 1994).

There was no consistency across the studies in the outcomes selected, their operationalisation, or how they were reported. This is problematic, as changes were only likely to be reported if the researchers were specifically looking at certain aspects or behaviours. There was no common theoretical conceptual underpinning or outcome variables across the studies reviewed. Hence, researcher understandings or philosophical position may have influenced their choices. This accords with the findings of Maes et al. (2021) that general theoretical models may not be applicable to studies working with people with profound intellectual and multiple disabilities. Approximately half (seven) of the studies included a follow up to the training, and only two looked at whether changes in the behaviour of people with profound intellectual and multiple disabilities were maintained. Thus, based on the evidence reviewed, it is not possible to comment on the long-term effectiveness of staff training interventions in enhancing communication with people with profound intellectual and multiple disabilities. As Bell et al. (2001) reported, sustainability is a key aspect of successful staff training, the lack of consistent medium to long term

follow-up identified across the studies needs to be addressed in future intervention studies.

> **Research Question 4.** What are the methodological strengths and weaknesses of the existing research?

Issues of quality were evident in this review as in Van der Meer et al. (2017) and Wood and Standen (2021) both of which included papers investigating communication intervention for people with mild and moderate intellectual disabilities. This review confirms and extends the finding of Hutchinson and Bodicoat (2015) who state that the studies they reviewed (only in relation to Intensive Interaction) were 'limited by the quality of reporting and difficulties conducting good quality, ethically sound research with participants with PMID' (p. 437). In comparison, this study reviewed a much broader range of interventions and found the same quality issues to be apparent.

Due to the variability across the studies, it is difficult to discern specific methodological strengths and weaknesses. Nonetheless, below we provide a summary based on the average scores for each aspect of the methods (Table 2). The methodology sections of the paper were the weakest aspects of these studies compared with the rationale, results and discussion sections.

Strengths of individual studies included provision of information regarding: (i) inclusion and exclusion criteria; (ii) detailed accounts of the data collection processes including why they were suitable; (iii) the settings, personnel, materials and processes included. Specific weaknesses identified in the methodologies of the papers included: (i) lack of justification for research design and interventions chosen; (ii) insufficient detail regarding the sampling method, suitability of the sample size, and intervention delivery; (iii) lack of quality checking within the studies in relation to the reliability and validity of outcome measures chosen, management of non-participation and withdrawal, and potential for confounds and bias within the studies; and (iv) lack of accounts of the ethical processes embedded within the studies.

4.1 | Study design limitations in reviewed articles

The gold standard for exploring standard intervention effectiveness is to utilise randomised designs with a control group (Hariton & Locascio, 2018) embedded fidelity checks for the intervention and well validated and reliable pre-post measurement of variables of interest (Sibbald et al., 1998). However, a number of methodological issues arose when endeavouring to enact studies where the success of training interventions were indirectly measured by improvement in communication with participants with profound intellectual and multiple disabilities. Achieving adequate power may be difficult as there are fewer people with profound intellectual and multiple disabilities to draw on and hence fewer staff working with them. Establishing the equivalence of groups of people with profound intellectual and multiple disabilities following randomisation may be challenging due to heterogeneity of people with profound intellectual and multiple disabilities. There are also few measures sufficiently sensitive to detect the small changes and advances that may be seen. Matching of control and treatment groups is recommended but challenging (Austin, 2008; Kover & Atwood, 2013). Cluster randomisation may help to reduce the likely confound of control and intervention staff working in the same setting.

Eleven of the 13 studies collected observational data. Maes et al. (2021) discuss in detail the complex issues around how observers of people with profound intellectual and multiple disabilities should be chosen and trained. They suggest that a combination of observers with experience of people with profound intellectual and multiple disabilities should collect data, but they should not know whether the participants are receiving input from trained staff or whether they are in the control group. They advocate that family members and others who know the particular individuals well might be the best compromise.

4.2 | Measurement of change in outcomes

Approaches to change in staff behaviour following training were variable in their approach and focus. One future endeavour which would support future research would be to collate and evaluate the differing methods of outcome measurement for staff training interventions to inform and harmonise future research endeavour. It is difficult to measure outcomes of changes in communication and interaction in people with profound intellectual and multiple disabilities. This is because change is often small, difficult to detect or measure and slow to occur (Brady et al., 2018; Chadwick et al., 2019). Alongside more sensitive measurement tools there is a need for future longitudinal research to identify meaningful change over time for this population and those who support them.

4.3 | Protection from study bias

Few protections from bias were evident in the studies reviewed. Control groups or conditions were not always evident in studies. Without a control group, it is difficult to be sure that changes seen in people with profound intellectual and multiple disabilities are the result of the intervention and not maturation or chance. However, ethical and pragmatic issues arise when withholding intervention from those in the control condition and when attempting to randomise to a control condition within a single setting. For those in the treatment group, achieving a stable baseline measurement may also be difficult. Hence, a longer baseline measurement phase may need to be built into future research, or use of multiple baseline small scale research designs may be politic.

One area of strength across the studies was the inclusion of inter-observer reliability checks. Funding providers should be cognisant of the time and resourcing required to achieve a stable baseline, concordance in observers, fidelity in staff and environmental communication intervention studies with people with profound intellectual and multiple disabilities.

Contamination of those in the control condition who may be supported by an individual who is also enacting the intervention condition for another individual within the same setting may also be a challenge. As mentioned, cluster randomisation may be a solution but equivalence of people with profound intellectual and multiple disabilities across settings is not always guaranteed, as they are often within settings with others with intellectual disabilities who do not have profound intellectual and multiple disabilities.

4.4 | Clarity around study participants and settings

Level of detail about the people with profound intellectual and multiple disabilities was sometimes lacking in the studies. Level of cognitive impairment and fulfilment of criteria for profound intellectual and multiple disabilities was not always reported. More robust reporting of the characteristics, levels of support need for participants with profound intellectual and multiple disabilities and any screening conducted is indicated. It is operationally and contextually challenging to run robust research in this research area with this population. Drop out due to illness and mortality did not appear extensive in the studies reviewed, though is a particular issue for studies including people with profound intellectual and multiple disabilities. Clarity is also required around staff targeted within studies (e.g., tenure, roles and responsibilities) and more clarity and clearer description of organisational settings where studies take place and levels of organisational support and buy in for studies set in services.

4.5 | Clarity about method, interventions and outcomes

A number of reporting issues were evident in the studies included in the review. Methodological accounts within some studies are not sufficiently detailed lacking the necessary specificity to enable replication. Future use of more robustly designed and reported single case and small N experimental design (e.g., multiple baseline studies) would enhance the evidence base and better facilitate replication. In addition, although it is evident that some studies collected staff outcome data, they failed to report any analysis of these outcomes. Future studies would benefit from systematic accounts of implementation or training intervention objectives.

As expected, staff training interventions were often complex. Nonetheless they still could be better defined and specified with clearer accounts of the theoretical and philosophical underpinnings of the research. Mapping of training intervention onto specific outcomes (e.g., cognitive, environmental, social interactional, behavioural) with the predicted mechanisms of change would be useful.

Outcomes investigated demonstrated the complexity of communication, interaction and conducting research with this population. Operationalisation should be individualised but consistent in approach. Multiple measures for organisation, staff, environment and the person with profound intellectual and multiple disabilities were often included. Communication always occurs in a partnership, as shown in the studies reviewed here, therefore, it is likely that future research will need to incorporate multiple outcomes.

4.6 | Benefits and challenges of practitioner research

Practitioner researchers knew the study settings and had managerial support which facilitated some studies. Practitioner-based research can enable real world knowledge of the individual participants to be brought to research investigations. This may enable better consideration and identification of salient bespoke individual change. However, the lack of blinding of observations in these studies may further increase risk of bias.

4.7 | Recommendations and future directions

Future recommendations have been added throughout the discussion at appropriate points. A number of the findings from this review point to the need for robust well designed longitudinal studies which mitigate for the dangers of attrition, maturation and contamination between groups, and include a medium to long-term follow up of staff, training interventions and the communication changes or developments of the people with profound intellectual and multiple disabilities with whom they work. Such studies are only likely to be viable if they are funded and if ongoing support is provided to the staff who are being trained. We recommend that funding should be available for well-designed quasi-experimental studies in order to identify those staff-training programmes which result in long-term ongoing change for both staff and people with profound intellectual and multiple disabilities.

4.8 | Limitations of the systematic review

One limitation of this review was the lack of incorporation of publication bias from the inception of the study. Given the authors' knowledge of the field we hypothesise that little further research would be available and what does exist is likely of lower quality than the papers included in the review, typically single case reports and narrative accounts. Nonetheless, publication bias should be a consideration in future reviews when a larger corpus of research evidence pertaining to communication and people with PMLD is available. As the review had been started before 2019 and conducted over a long period of time, it was not permissible to register it with PROSPERO as would now be expected. It would have been unethical to pretend that data extraction had not commenced as stated on the following link: https://www.crd.york.ac.uk/prospero/#aboutregpage. This is a limitation of the study although the review has followed the latest guidance on systematic reviews.

5 | CONCLUSION

This review found tentative support for efficacy of training in enacting positive change in the communication and interaction of staff working with people with profound intellectual and multiple disabilities. However, there is still insufficient evidence that changes in staff behaviour as a result of staff training are linked to positive changes in the communication and/or social interaction of people with profound intellectual and multiple disabilities. More evidence that any changes in behaviour are maintained over the longer term is a particular need.

ACKNOWLEDGEMENTS

The authors would like to thank Dr Elizabeth Anderson and Dr Andrea Tan for their input on an earlier version of this systematic review.

FUNDING INFORMATION

£3,000 awarded from the Learning Disabilities and Autism Network (LDAN) to Dr Jean Ware (2012) for *transferring and establishing good practice for people with PMLD on communication and interaction in education, health and social care provision* which supported early work on this review.

CONFLICT OF INTEREST STATEMENT

All contributing authors confirm that they have no conflict of interest in the preparation of this article.

DATA AVAILABILITY STATEMENT

Data sharing not applicable to this article as no datasets were generated or analysed during the current study.

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How to cite this article: Ware, J., Buell, S., Chadwick, D. D., Bradshaw, J., & Goldbart, J. (2024). A systematic review of research on staff training as an intervention to develop communication in children and adults with profound intellectual and multiple disabilities. *Journal of Applied Research in Intellectual Disabilities*, *37*(2), e13201. https://doi.org/10.1111/jar.13201

APPENDIX A

TABLE A1 Study background information.

Author, date & country	Study design	Study objectives	Sample size (staff)	Staff characteristics	Sample size (people with PIMD)	Characteristics of people with PIMD	Study setting & country
Barber (2008) Australia	Quantitative Small Scale ($N = 3$) AB Design (with extended baseline)	To determine the effect of training staff in Intensive Interaction on five indicators of student involvement.	8	3 Teachers 5 Support assistants	3[a]	Ages: 2–18 years Participants were included if they demonstrated combinations of apparent social isolation and pre-intentional or emerging intentional communication.	Special developmental School. Melbourne, Australia
Bloomberg et al. (2003) Australia	Quantitative Group pre-post pre-experimental design	To evaluate the impact of the Picture It Program on staff and people with PIMD across knowledge, environment, assessment intervention	16 (14 completed the project)	6 Carers with postsecondary certificates in disability studies, 10 Carers without this certificate	6[a]	Ages: 23–53 All pre-intentional stages of communication on Triple C: Early Intentional Stage 4: 1 Pre-Intentional Stage 3: 5 Pre-Intentional Stage 2: 2 Rubinstein-Taybi syndrome: 1 Cerebral Palsy: 7 Visual Impairment: 5	Community day services and Residential Unit (6), Parental Home (1), Hostel (1). Melbourne, Australia
Damen et al. (2011) Netherlands	Quantitative Single case AB Design across participants.	To test the effectiveness of the Contact Programme across 4 specific quality measures of interaction.	72	Minimum of 7 Caregivers for each person with PIMD	12	Ages:13–54 years Moderate ID: 2 Severe ID: 5 Profound ID and Visual impairment: 5	Group homes Netherlands
Dobson et al. (2002) UK	Qualitative, Pre-experimental (Group, pre-, post.) Observational comment.	To evaluate the impact of staff training on communication (knowledge and skills) with people with PIMD	9	4 Centre Officers, 5 Care Assistants	9	Ages: 20–38 years Physical disability: 9 Visual impairment: 3 Hearing impairment:1 Pre-intentional communication: 5 Intentional communication: 4 Verbal: 1	3 day-centres, Northern England, UK
Foreman et al. (2007) Australia	Quantitative AB design	To evaluate the effect of staff development in communication support on communicative involvement and alertness of people with PIMD	12	6 teachers; 6 aides	6	Ages: not reported Multiple and severe intellectual disability and high levels of support needs.	3 special schools New South Wales, Australia

TABLE A1 (Continued)

Author, date & country	Study design	Study objectives	Sample size (staff)	Staff characteristics	Sample size (people with PIMD)	Characteristics of people with PIMD	Study setting & country
Foreman et al. (2014) Australia	Quantitative Small N multiple baseline design across participants	To evaluate the impact of communication partner training and mentor modelling on support for students with PIMD in special school compared with regular classes.	16	8 teachers 8 aides	8	Ages: 5–13 All met 3 of 4 criteria: dependence on others to meet basic daily needs; absence of verbal skills; sensory loss; severe motoric difficulties. All at least 3 SD below mean on communication and socialisation on Vineland II	4 special education and 4 mainstream classrooms NSW Australia
Golden and Reese (1996) USA	Quantitative SCED ABA and Group: Quasi experimental with control.	To determine whether training in the use of the MR/DD NFCAS changes interactive behaviour between direct-care staff and adults with PIMD during meal time sessions.	23	8 direct care staff, and 9 educational assistants or teachers, 5 developmental technicians, 1 certified social worker, 1 registered nurse.	23[a]	Ages: 25–55 IQs below 20 All non-verbal/ unintelligible, non-ambulatory (One third).	Large residential facility (1000 direct-care staff and 900 residents approx.). Smaller 15-bed community facility in USA
Granlund et al. (1992) Sweden	Quantitative Quasi experimental pre- & post-test with control group.	To enhance the use of communication behaviours through staff training and supervision using a pyramidal model	100	100 direct care staff	102[a] Intervention group: 64 Control group: 38	Ages: all over 23 years All profound intellectual disability Motor 39%, Visual 31% & Multiple 19%, impairments	Institutional wards, group-homes and day-activity centres in Sweden
Jones et al. (2002) UK	Quantitative Quasi experimental Pre-post group design. Qualitative staff interviews	To evaluate the use of a standard set of Objects of Reference with adults with PIMD	9	All key workers and care assistants	13	Ages: 20–55 years Epilepsy: 10 Visual impairment: 4 Ambulant: 7 (2 with support) All pre-intentional communicators	Two day-centres UK
Nijs et al. (2018) Netherlands and Belgium	Quantitative Single Case Experimental design, Multiple baseline	To evaluate the effect of intervention on staff social scaffolding behaviours on peer-directed behaviours of people with PIMD	4	Direct care staff	8[a]	Ages: 5;11 to 36;9 years. Mean = 17.5 Reported hearing loss: 1, visual impairment: 2, Severe motor impairment: 8	Residential facilities in Flanders, Belgium.

(Continues)

TABLE A1 (Continued)

Author, date & country	Study design	Study objectives	Sample size (staff)	Staff characteristics	Sample size (people with PIMD)	Characteristics of people with PIMD	Study setting & country
Realon et al. (2002) USA	Quantitative Pre-experimental group Pre-, post- and follow-up	To evaluate a multifaceted environmental enrichment program (the Positive Environment Program) for people with PIMDand staff	11	Direct care staff	19	Ages: 19–44 years Mean developmental age of 5 months (Range 1.9–11.9 mths). All non-ambulatory with one or more of microcephaly, seizures, cerebral palsy, epilepsy, contractures, visual impairments, and auditory deficits. None had conventional communication	State residential care facility, North Caroline, USA
Samuel et al. (2008) UK	Quantitative Small N Quasi experimental interrupted time series multiple baseline across participants	To evaluate Intensive Interaction: 1. use of principles of Intensive Interaction 2. positive impact on (a) communication and social abilities (b) quality of the relationship between staff and people with PIMD	12	1 team leader and 11 support staff	4	Ages: 23–56 years Developmental age: 3 months – 14 months 3 with a diagnosis of Cerebral Palsy; 1 with Tuberous Sclerosis	Supported housing; 4 bungalows in different towns in UK
Ware (1994) UK	Quantitative Small N design Modified multiple baseline across settings Qualitative (staff interviews)	To evaluate whether class-based staff training in creating a responsive environment enhances staff-learner interaction.	25	Teachers, assistants, therapists and nurse (Breakdown not provided)	29[a]	Ages 3–19 (approx.) in classes for learners with PMLD All assessed on Bayley as having profound ID.	PMLD classes of 2 special schools in London, UK
			Total 315		Total 242		

Note: ID = Intellectual disability; PIMD = Profound Intellectual and Multiple Disability PMLD = Profound and Multiple Learning Disabilities.

[a]Original participant numbers reduced for varying reasons including: Barber (11) – researcher selection; Bloomberg (8) – staff drop out for selected people with PIMD; Golden & Reese (24) – staff leaving; Granlund (113) – illness, changes in living conditions; Nijs (16) – Staff lacked time, illness of people with PIMD Ware (38) – mortality of people with PIMD moved out of area, irregular attendance, joining class studied after original data collection commenced).

APPENDIX B

TABLE B1 Details of study interventions.

Author & date	Name or description of staff training	Duration and delivery of straining staff	Design of training
Barber (2008)	Published. Intensive Interaction (Firth et al., 2008).	*Duration*: 10 weekly sessions for all school staff followed by a 12-week baseline. Individual coaching during the 30-week intervention period. Actual amount per staff member unknown. *Delivery mode*: Group training followed by individual coaching. 10-session programme of training at after-school seminars. These seminars outlined the principles, characteristics and key features of the approach of II. In situ coaching for the 8 directly involved staff following the 12-week baseline. Reflection assisted by start-stop video technique to analyse interactions.	Initial staff training, coaching and ongoing feedback
Bloomberg et al. (2003)	Published and manualised. Picture It: (adapted from Granlund and Olsson (1988) Ways to communicate – a staff training package). Addresses Communication, Cognition, Sensory Skills, Environmental Factors (Assessment and intervention strategies for these), review of Challenging behaviour.	*Duration*: 1 day's training per month over 6 months (6 days of training). Assignments and 1–2 supervisory visits occurred between monthly training sessions. *Delivery mode*: Collaborative 6-step problem-solving model (Granlund & Olsson, 1988). Included didactic sessions and interactive taught and group problem solving. Discussion and reflection during supervisory visits to shape behaviour change in communication partner.	Initial staff training, coaching and ongoing feedback
Damen et al. (2011)	Published and modified: Contact Programme (Janssen et al. 2003 a,b). (Modified) Addressed characteristics of behaviour: including initiatives, confirmation, reactions.	*Duration*: 1 day preliminary training plus four individual video-feedback sessions over 9 weeks, followed by group discussion. Baseline data collection duration varied between 5 and 9 weeks. *Delivery Mode*: (1) Preliminary group sessions to determine and clarify the question of the caregivers; (2) Interaction analysis based on information collected from the group and from observations; (3) intervention sessions consisting of a group session to analyse the interaction and four individual video-feedback sessions (over 9–10 weeks); and (4) evaluation.	Initial staff training and ongoing feedback
Dobson et al. (2002)	Communication training programme based on that currently used with the parents, carers and educators of preschool children (Manolsen, 1992). Addresses attitude, practical skills and knowledge based around actual clients.	*Duration*: 39 h of training workshops over 6 months. *Delivery mode*: Joint problem-solving approach. Complex interdisciplinary training contract, multiple components at different levels, Includes self-monitoring. This presentation format uses presentations, role play, practical exercises and the self-examination of one's own practice through video recordings in naturalistic settings.	Initial staff training and ongoing feedback

(Continues)

TABLE B1 (Continued)

Author & date	Name or description of staff training	Duration and delivery of straining staff	Design of training
Foreman et al. (2007)	Bespoke intervention. Enhance and maximise communication development of learners through basic communication functions, assessment tools, ABC coding, interview protocols for parents, identifying goals, evidence based strategies.	*Duration*: 3 half-day sessions *Delivery mode*: Taught workshops with no contact between sessions (Sessions 1 Basic communication concepts (Session 2: Setting programme goals and evidence based teaching strategies (Session 3: evaluation and debriefing	Initial staff training
Foreman et al. (2014)	Bespoke intervention. Enhance interaction skills using in class mentoring 'mentor-modelling'. General communication programming assessment and strategies, followed by Individualised strategies for target students with reflection, review and revision where needed.	*Duration*: Fortnightly sessions for between 14 and 46 weeks (7–23 sessions). MB design means that amount of mentoring varies across staff participants, so duration cannot be computed. *Delivery mode*: Professional development programme incorporating: (I) theory; (ii) strategy instruction; (iii) modelling; (iv) practice with feedback; (v) general feedback & (vi) Follow up.	Initial staff training and ongoing feedback
Golden and Reese (1996)	Published and modified. University of Washington's nursing child assessment satellite training (NCAST). Barnard, K. (1980). The nursing assessment feeding scale. *Seattle, WA: University of Washington*. Promotes awareness raising and positive interaction by emphasising role of the environment and caregivers in being sensitive and responsive to non-verbal cues to enhance cognitive and social emotional growth.	*Duration*: 2.5 days of training 2 consecutively then a 2-week break before final half day. Study conducted over 12 months: (4 months of initial training and observations, 6 month wait; 2 months maintenance observation). Data collection throughout the project. Observation of 12 to 15 1-to-1 interactions (2–4 periods of 20 randomly selected mins broken into 10-second obs./10 second recording). *Delivery mode*: Didactic training delivered by 1st author with one half day feedback session. There was no practice of interaction skills, no feedback and no performance management.	Initial staff training
Granlund et al. (1992)	Published and manualised. Ways to Communicate (Granlund & Olsson, 1988) Training included Communication & PIMD analysis of pre-training assessment, collaborative problem-solving, goal attainment scaling and intervention planning.	*Duration*: 8 h didactic training & role-play. plus 4 h a month (7 times in 1 year for direct staff, 8 times for supervisors)). *Delivery mode*: Each session had discussion, feedback, direct input, joint planning for individual clients. After the 12 months, 8 h on content & effects of training.	Ongoing training and feedback delivered through a cascade model
Jones et al. (2002)	Published and manualised. Objects of Reference Ockleford (1994), Objects of Reference (London: RNIB). A standard set of Objects of Reference used across clients. Training on responsive environments and communication development.	*Duration*: 6 months staff training & preparing resources. Actual duration cannot be computed. *Delivery mode*: not known.	Initial training
Nijs et al. (2018)	Bespoke training. Based on social scaffolding theory recognising interactions and peer-directed behaviours, intervention strategies, positioning, time, motivating activities, social scaffolding strategies.	*Duration*: 2-h initial training plus feedback session 3 weeks later. *Delivery mode*: Didactic, discussion of video of clients, design of new activity through discussion.	Initial training with limited ongoing feedback

TABLE B1 (Continued)

Author & date	Name or description of staff training	Duration and delivery of straining staff	Design of training
Realon et al. (2002)	Positive Environment Program (PEP) Theoretical basis not stated. Training included importance of eye contact, providing positive comments, increasing and distributing interactions among learners, responding to a learner's attempts to communicate, and providing individualised leisure materials.	*Duration*: includes 1 × 45 min classroom session over 2 weeks, (unclear whether this is for all, or repeated for different staff members) plus individualised verbal feedback to 100% mastery of programme elements. *Delivery mode*: Didactic session plus individualised verbal feedback, plus individual specific training to criterion regarding the components of the PEP programme conducted over a 2-week period. Informal monthly monitoring and staff incentives (certificates).	Initial training and ongoing feedback
Samuel et al. (2008)	Published. Intensive interaction (Nind & Hewett, 2005)	*Duration*: Half day training plus brief reflective conversation at least weekly, for 20 weeks plus optional support group. *Delivery mode*: Half day formal workshop plus guidance book plus at least weekly, brief reflective conversation with assistant psychologist and optional support group.	Initial training with limited ongoing feedback
Ware (1994)	Bespoke intervention addressing (a) staff initiations, (b) adult response to child initiations, (c) allowing learner to take the lead in interactions.	*Duration*: Approx. 8 × 1 h, but varies across staff participants. *Delivery mode*: Didactic sessions, time between for practice, used examples of own interactions with learners, generic positive feedback but specific feedback to individuals on how to improve performance.	Initial training with ongoing feedback

APPENDIX C

TABLE C1 Study outcomes and findings.

Author & date	Staff outcomes studied	Staff outcome measures *and findings*	Outcome studied *and findings* for people with PIMD
Barber (2008)	No staff outcome measures reported	Informal observation and reflective practices. *No data presented.*	Pre and post-intervention Video observations of 3 students' individual teaching sessions. Second by second rating of presence/absence of each of the five Indicators of Involvement. (adapted from Kellett & Nind, 2003). *Increase in social behaviours and decrease in 'no interactive behaviour'.* *No statistical analysis. Many data points, but only 3 participants.*
Bloomberg et al. (2003)	Changes in behaviour or practices. Staff perceptions of communicative behaviour.	Knowledge and Perceptions of Communication Skills: *Some significant increase.* Video observation coding staff initiations and responses: *Significant increase in carers' initiations.* Early Communication Skills Profile: *Significant increase in knowledge regarding communication and intervention strategies.* Goal Attainment Scale: *All carers formulated appropriate communication goals.*	The Triple C assessment (Bloomberg & West, 1999): *Only used for identification.* Video observation coding learner initiations and responses. *Significant increase in responses. Positive but non-significant changes in initiation.*
Damen et al. (2011)	Changes in behaviour or practices Staff perceptions of communicative behaviour	Proportion of initiatives by person with PIMD that were followed by either a confirmation or a reaction by the staff member and frequency of confirmation: *On average, staff improved interactions compared with the stable baseline.* *Visual inspection showed improvements in confirmation, percentage of initiations responded to by staff members and affective mutuality.* Rating scale for affective mutuality Social Validity Scale (adapted, Seys, 1987): *Significant increase from last baseline to first intervention occasion.* *BUT no further improvement later in the intervention period.*	Responsiveness. confirmation or reaction to staff initiatives through video observation. *No significant increase in responsiveness was observed.*
Dobson et al. (2002)	Changes in behaviour or practices Staff perceptions of communicative behaviour	Video Observation of use of language, amount of language and style of interaction: *Significant increase in number of utterances, acknowledgements and praise, open requests for information.* *Positive changes in interaction and communicative styles. No change in complexity of language used.* Staff self-evaluation using Goal Attainment Scale: *All staff had more than achieved expected outcomes.*	Impact on people with PIMD not measured

TABLE C1 (Continued)

Author & date	Staff outcomes studied	Staff outcome measures *and findings*	Outcome studied *and findings* for people with PIMD
Foreman et al., (2007)	Changes in behaviour or practices Staff perceptions of communicative behaviour	Self-report pre and post intervention on skills, knowledge and concerns: *Increased knowledge reported.*	Partial interval observational measures of behaviour state, communication indicators, form and function and social context. *Awake-Active-Alert state increased by just under 5% on average. No change in staff-pupil interaction. Some changes in 'social context' variables.*
Foreman et al. (2014)	Changes in behaviour or practices	Video observation including communication interactions and strategies: *Impact on staff not reported.*	Measures of: (i) behaviour state and (ii) communicative interaction in children with PIMD. *Variable patterns of outcome. 4 (of 8) children increased alert-awake-active behaviour state. and 4 (of 8) increased communicative interaction.*
Golden and Reese (1996)	Changes in behaviour or practices	Direct observation during baseline treatment, and follow-up of: (a) instruction, (b) positive verbal attention, (c) positive nonverbal attention, (d) neutral attention: *Increase in positive verbal behaviour.* *Slight increase in positive nonverbal behaviour.*	Behaviours measured: engaging people, object engagement, non-compliance and self-stimulation. *Little or inconsistent change in behaviour of people with PIMD*
Granlund et al. (1992)	Changes in behaviour or practices Changes made to organisation of time/space/routine	Direct care staff: Social and Physical Environments Survey. *Significant positive changes in interaction, creating communicative opportunities and communication goal setting.* Self-rating scale of active intervention participation: Supervisors: *Positive correlation between supervisors' problem solving input and communication opportunities offered by direct care staff.*	Early Social Communication Scale (ESCS). *ECSC scores showed increases from baseline to follow-up (24 students only) in responses to social interaction.* Goal attainment scaling. *Goal Attainment Scaling showed increases in frequency of use of existing skills and to a lesser extent, responding to communicative behaviours*
Jones et al. (2002)	Staff perceptions of communicative behaviour	Semi structured interviews: *Staff understood aspects of communication and felt they used Objects of Reference effectively, though concerned about time required.*	Observation Scale devised as part of the project to record the use of the objects. *All bar one participant made some gains in use of Objects of Reference. More able (proactive) clients made better progress. Gains were only in 1st 10 weeks*
Nijs et al. (2018)	Changes in behaviour or practices	Observed social scaffolding behaviour: *Social scaffolding behaviours increased significantly.*	Peer-directed behaviours as shown by persons with PMLD through video observation. 1. multiple peer-directed behaviours, 2. singular peer-directed behaviour, 3. all non-peer-directed behaviours. *All participants showed increases in singular peer-directed behaviour but only significant for 3 participants.* *Percentage of time multiple peer-directed behaviours were present decreased.*
Realon et al. (2002)	Changes in behaviour or practices. Changes made to organisation of time/space/routine	Observations of interactions, engagement and environment: *Small increase in staff interactions with clients pre- to post-intervention. Availability of leisure material decreased slightly*	Direct observation of alertness, engagement and affect. *Engagement, periods of time awake and happiness scores increased.*

(Continues)

TABLE C1 (Continued)

Author & date	Staff outcomes studied	Staff outcome measures *and findings*	Outcome studied *and findings* for people with PIMD
Samuel et al. (2008)	Changes in behaviour or practices Staff perceptions of communicative behaviour	Video observation at baseline and post-intervention (coded): *Increases in staff use of mirroring and contingent responding.* Postal questionnaire on staff expectations at 4 time points: *Generally positive*	Video observation. *Highly variable changes in communication and social abilities.* PreVerbal Communication Schedule (Kiernan & Reid, 1987). *PVCS scores showed improvements for all participants in positive interaction. Other categories more variable.*
Ware (1994)	Changes in behaviour or practices Staff perceptions of communicative behaviour	Researcher-devised observations of interactive and communicative behaviour, and of engagement, using PLA check (adapted, Risley & Cataldo, 1975): *Level of contingency-sensitive adult initiations increased in all periods of training.* *Decrease in variability between pupils/staff therefore a more contingency sensitive environment.* *Little change in opportunities for children with PIMD to lead interaction.* Semi structured interviews: *Staff reported increased self-esteem and job satisfaction.*	Direct observation. *Clear progress in extent to which children with PIMD responded to staff initiations. Children's responses are associated with increases in staff Contingency Sensitive Initiations.* Bayley Scales of Infant Development (1983). *Bayley: Of 25 participants, 4 showed consistent increases, 11 showed little change, 10 showed changes in different directions.*

APPENDIX D

TABLE D1 Additional background and methodological information.

	Funder	Who collected and analysed the study data	Follow-up (length, measures)	Assessment of staff intervention Fidelity	Management/ Organisational study support
Author & date	Funder (and any related constraints)	Who collected and analysed the data?	Follow-up (Length, measures)	Assessment of Staff Intervention Fidelity	Organisational & Management support/buy in
Barber (2008)	None reported	Author gathered and analysed data.	None reported	Checks on quality of delivery conducted. Implied by 'ongoing coaching through discussion of videos'.	Yes, time-released
Bloomberg et al. (2003)	None reported	Course leaders, who are also the researchers and staff participants.	None reported	None Reported. Implied via collaborative problem-solving approach and supervisory visits of the course leaders.	Yes, time-released
Damen et al. (2011)	None reported	Coach and staff arranged observational data collection. 12 raters independently did the coding.	None reported	None reported, implied via interaction coaches trained and supervised by original developers of programme.	Yes, time-released

TABLE D1 (Continued)

	Funder	Who collected and analysed the study data	Follow-up (length, measures)	Assessment of staff intervention Fidelity	Management/ Organisational study support
Author & date	**Funder (and any related constraints)**	**Who collected and analysed the data?**	**Follow-up (Length, measures)**	**Assessment of Staff Intervention Fidelity**	**Organisational & Management support/buy in**
Dobson et al. (2002)	None reported, within training contract	Clinical psychologist and speech and language therapist independently examined the video recordings gathered by staff. GAS – self report by staff.	Yes, 6 months	None reported	Yes, formal support/buy in evident
Foreman et al. (2007)	Funding support by University of Newcastle, Australia.	2 researchers, including author.	None reported	None reported	Yes, time-released
Foreman et al. (2014)	Funded by the Australian Research Council Discovery Project	7 trained observers.	Yes, 4 weeks	Checklist given to staff as fidelity check of training implementation.	Yes, recruitment support
Golden and Reese (1996)	None reported	Staff participants trained to observe and rate other staff in pairs.	Yes, 2 months	None reported	None reported
Granlund et al. (1992)	None reported	Staff and supervisors gathered data. Unclear for people with PMLD. Researchers conducted analysis.	Yes, 12 months	None reported implied via in service training and supervision.	Yes, formal support/buy in evident
Jones et al. (2002)	None reported	Staff collected the data independently. Semi-structured interviews conducted by first author. First author conducted the analysis.	Yes, 12 months (informal)	Training acceptability checked.	None reported
Nijs et al. (2018)	None reported	Staff gather observational data. Data coded by three independent observers	Yes, 6 weeks	None reported	None reported
Realon et al. (2002)	Funded through North Carolina University Masters programme	One of the authors (unspecified). Psychologists acted as second observer.	Unclear if a follow up assessment for trainees occurred. Assessments at month 20 and month 28, but only one set of post training findings reported.	Checklist of understanding of PEP components. Staff trained to 100% correct on checklist. Awarded PEP certificates to each other.	Yes, formal support buy in evident
Samuel et al. (2008)	None reported	Assistant psychologist gathered observational data. Author, assistant psychologist and students coded data.	None, reported	None reported	None reported
Ware (1994)	Economic & Social Research Council UK	Two researchers collected and coded the data, included author.	Yes, 4–5 months	Checks on quality of delivery. Continued individualised feedback after end of training.	Yes, time released