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1 RUNNING HEAD: Scoping review: Intervention outcomes for school-aged children

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3 A scoping review of intervention outcomes for school students with communication

4 difficulties

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- 25 Key words: ICF, school-aged students, intervention, communication difficulties, outcomes,
26 outcome measurement

27

ABSTRACT

28 *Purpose:* For speech-language pathologists (SLPs) working in schools, outcome
29 measurement is an important element of practice, enabling us to evaluate the efficacy of our
30 service provision and guiding future decision-making, funding and resource allocation. When
31 selecting outcomes to measure, it is helpful to consider both the level at which change may be
32 occurring and the extent or impact of that change. The primary aim of this review was to
33 identify the outcomes measured in intervention studies for school-aged children with speech,
34 language and communication difficulties (SLCD), using the *International Classification of*
35 *Functioning, Disability and Health* (ICF; WHO, 2001) to classify the outcomes. A second
36 aim was to identify tools used in research studies to measure the outcomes.

37 *Method:* A systematic search of five databases was undertaken to identify papers reporting
38 outcomes for children who had received intervention targeting SLCD. Articles written in
39 English and published between January 2000 and August 2021 were included. The
40 Taxonomy for Categorising Outcome Measures for SLCD (TAXCOMS) was created to
41 enable a review of outcomes and measurement tools.

42 *Results:* There were 125 papers included in the final review. Most papers ($n=109$, 87.2%)
43 reported on studies that included outcome measures that captured changes at Body Function
44 level, while approximately half captured Activity level change. Only 24 (19.2%) explored
45 changes to Participation.

46 *Conclusion:* Change at the Body Function or Activity levels does not always reflect change at
47 the Participation level. Measuring outcomes at the Participation level enables SLPs to
48 determine the real world impact of the adjustments they have recommended or intervention
49 they have provided. However, in order to measure outcomes at the Participation level, we
50 need the tools for capturing those changes for school-aged students with SLCD.

INTRODUCTION

51

52 Children have a right to education and a right to receive supports that will enable them to
53 develop to their full potential and achieve their educational goals. This is recognized in two
54 Articles of the Convention of the Rights of the Child (UNICEF, 1989): Articles 28 and 29. In
55 many countries these rights are integrated into government documents that guide the
56 provision of education. For instance, in Australia, educational goals have been articulated in
57 the Alice Springs (Mparntwe) Education Declaration (2019), signed by the Coalition of
58 Australian Governments (COAG), which states two goals for education in Australia: 1) that
59 the education system promotes excellence and equity; and 2) that children will become
60 confident and creative individuals, successful lifelong learners, and active and informed
61 members of the community (p.4).

62 Australian curriculum documents, developed to enact the vision of the Alice Springs
63 (Mparntwe) Education Declaration (2019), recognize both explicitly and implicitly the role of
64 speech, language and communication for participation and success in educational settings.
65 Research too, has long identified the link between communication skills and learning as well
66 as academic attainment (e.g., Eadie, 2022; Johnson et al., 2010). It follows, therefore, that
67 children with speech, language and communication difficulties (SLCD) might have reduced
68 participation in a range of school activities (Daniel & McLeod, 2017).

69 SLCDs are not uncommon among school-aged students. In Australia, they have been
70 identified by teachers as the second most prevalent area of learning need in a study of 14,500
71 primary and secondary school students, with only specific learning needs being more
72 commonly identified (McLeod & McKinnon, 2007). Students with a history of SLCD are
73 significantly more likely than same-aged peers to have difficulty with literacy, numeracy and
74 approaches to learning (Harrison et al., 2009; McCormack et al., 2011; Tambyraja et al.,
75 2020), and to self-report less enjoyment of school and higher instances of bullying (Esteller-

76 Cano et al., 2021; McCormack, et al., 2011). Researchers predict significant costs associated
77 with SLCD, based on decreased academic achievement, workforce participation and lost
78 wages; however, intervention has the potential to reduce this impact (Cronin et al., 2020; Le
79 et al., 2022).

80 *Speech-language pathology services in the education system*

81 Speech-language pathologists (SLPs) are one of the professional groups employed by schools
82 to support students with SLCD through their expertise in identifying communication
83 adjustments, or through direct intervention targeting particular speech and language skills that
84 are below the expected level and/or impacting a student’s school achievement (ASHA, 2010).
85 Internationally, professional associations have published guidelines and/or statements to
86 facilitate the work of SLPs in schools. For instance, in 2022, Speech Pathology Australia
87 (SPA) released new documents to guide the work of SLPs in education. The *Practice*
88 *Guideline* (SPA, 2022a) states, “The aim of speech pathology services in education settings is
89 to improve educational outcomes and experiences for children by addressing a range of
90 barriers to access, participation and progress” (p. 9). The accompanying *Position Statement*
91 (SPA, 2022b) includes a number of principles that may guide SLPs’ practice, including the
92 need for evidence-based and outcome driven services, and the importance of working in
93 partnership with students, teachers and families to ensure positive outcomes are achieved.
94 Similarly, in the US, ASHA’s *Roles and responsibilities of speech-language pathologists in*
95 *schools* [Professional Issues Statement] recognizes that “SLPs, like all educators, are
96 accountable for student outcomes...data-based decision making, including gathering and
97 interpreting data with individual students, as well as overall program evaluation are essential
98 responsibilities”.

99 It is clear then, that to ensure alignment with the professional associations’ guidelines, it is
100 essential that SLPs measure outcomes. This will also ensure that SLPs are engaging in
101 evidence-based practice (i.e., using data from outcome measurements to inform practice), and
102 fulfilling the Code of Ethics of their professional association. Such Codes are typically
103 underpinned by principles such as beneficence and fairness/justice (i.e., seeking to benefit
104 others through our work and to provide services consistent with need) (SPA, 2020). Yet,
105 while the importance of measuring outcomes is known, there is a lack of clarity regarding the
106 outcomes that should be measured to evaluate the effectiveness of speech pathology services.

107 *The ICF and measuring outcomes*

108 The International Classification of Functioning, Disability and Health (ICF; WHO, 2001) is a
109 tool that may help guide outcome selection. It was designed as a health classification system
110 with a primary aim being “to provide a scientific basis for understanding and studying health
111 and health-related states, outcomes and determinants” (p.5). It has a number of recognised
112 applications, including as a research tool “to measure outcomes” and as a clinical tool for
113 “rehabilitation and outcome evaluation” (p.5).

114 Within the ICF, health and well-being are considered the result of functioning body structures
115 and systems, but also the consequence of being able to undertake activities and participate in
116 daily life (WHO, 2001). The ICF provides a list of body structures and systems, as well as a
117 list of activities/life situations in which we use those structures and systems. Together, they
118 ensure holistic consideration is given to the full range of domains that contribute to health
119 and wellbeing, and thus the outcomes that could be measured when examining the impact of
120 health service provision.

121 Research and commentaries have suggested specific domains within each component of the
122 ICF that apply to speech-language pathology practice (e.g., McLeod, 2006), which could be

123 used as a foundation for categorising and selecting the outcomes we measure to evaluate the
124 impact of our service provision on a school student’s health and wellbeing. However, a
125 challenge of using the ICF for this purpose is the overlap that seemingly exists, based on the
126 definitions provided, between some components and domains within the framework. For
127 instance, it may be difficult to distinguish between the *mental functions related to the*
128 *reception of language* (b1670 - defined as “specific mental functions of decoding messages
129 in spoken, written or other forms, such as sign language, to obtain their meaning” and an
130 activity such as *learning to read* (d140 – defined as “developing the competency to read
131 written material...such as recognizing characters and alphabets, sounding out word with
132 correct pronunciation...”) (cf. McCormack et al., 2012).

133 Furthermore, it may be difficult to determine the level being targeted, particularly within the
134 Activity and Participation component. While diagrammatic representation of the ICF
135 framework typically separates these two elements, the coding system does not, which can
136 make it difficult to use the system to explore and categorise Activity outcomes as distinct
137 from Participation outcomes. Yet, the definitions of these two elements within the ICF do
138 provide some scope for delineation.

139 According to the ICF, *Activity* is the “execution of a task or action by an individual” while
140 *Participation* is “involvement in a life situation” (WHO, 2001, p.14). Thus, the ICF suggests
141 we can look at an outcome and identify if it reflects *capacity* to execute an action in a
142 standardised environment, or *performance* in the actual context in which one lives and
143 participates. The gap between an individual’s capacity in a standardized environment and
144 performance in their actual context can then be considered to reflect environmental
145 differences, and so implementing environmental (social, physical, and attitudinal) changes
146 could lead to improved participation. This conceptualisation provides a helpful basis then for

147 operationalising the ICF codes within the Activity and Participation component so as to
148 create a system or taxonomy for categorising and guiding outcome selection.

149 Previous researchers have suggested outcome measurement tools that address different ICF
150 domains for children with speech impairment (McLeod & Threats, 2008) and for preschool
151 children with communication disorders (Cunningham et al., 2017). Baker et al. (2022) have
152 generated a taxonomy, the Speech Outcome Reporting Taxonomy (SORT), and used this to
153 review the types of data collected as outcomes in intervention research for children with
154 phonological impairment. Their taxonomy included eight different domains from those most
155 proximal to intervention targets (e.g., treatment data and generalization data) to those more
156 distal (e.g., activity and participation measures, quality of life measures and measures of
157 impact on others).

158 Their taxonomy was focused on the type of data collected as outcomes (e.g., treatment data,
159 generalization data, Quality of Life), rather than the type of skills being assessed as
160 outcomes. Furthermore, their study reported the results of applying this taxonomy, rather than
161 the process for doing so. Baker et al. (2022)'s results showed that only 11 of 220 papers (5%)
162 measure outcomes at a distal level (e.g., Activity and Participation), which may reflect the
163 challenges with defining what those outcomes look like and ways they may be measured.

164 In the literature, the lack of distinction between Activities and Participation domains means
165 that tools for measuring these components are usually grouped together, despite them being
166 distinct constructs (Threats & Worrall, 2004). One way of addressing this issue may be to
167 create a taxonomy or framework for differentiating between different levels and types of
168 outcomes. Within the current study, we aimed to create a taxonomy to categorise outcome
169 measures and to support the selection of outcome measures in clinical practice. We were then
170 able to address the following objectives:

171 Research Aim:

- 172 - To identify the outcomes measured in current intervention studies and categorise
- 173 these using a taxonomy based on the ICF.
- 174 - To identify tools for measuring outcomes at different levels for school-aged children
- 175 with SLCD.

176 METHOD

177 The scoping review followed a framework outlined by Arksey and O'Malley (2005) and
178 consistent with the PRISMA-ScR guidelines for reporting on scoping reviews (Peters et al.,
179 2021; Tricco et al., 2018). The procedure involved: 1) Identifying the research question; 2)
180 Identifying relevant studies; 3) Study selection; 4) Charting the data; and 5) Collating,
181 summarising and reporting the results. The research questions were outlined in the preceding
182 section and the results will be reported in the next section. The focus of this section is stages
183 2-4 of the review process.

184 *Identifying relevant studies*

185 A systematic search of five databases (Medline, CINAHL, PsychINFO, Embase, HaPI) was
186 undertaken in November 2021 to identify papers reporting outcomes for children who had
187 received intervention targeting SLCD. A multi-layered search strategy was employed in the
188 database searches to identify relevant papers. Limits were put in place to restrict the search to
189 scholarly papers (i.e., peer-reviewed) published from January 2000 to August 2021.

190 The search strategy and analysis were informed by previous research into outcome
191 measurement undertaken in speech pathology with other populations (e.g., Calder et al.,
192 2018; Cunningham et al., 2017; Eadie et al., 2006). Different terms referring to speech,
193 language and communication difficulties were used to capture relevant papers. Truncation

194 was used to ensure papers were not excluded due to morphological differences in terms. A
195 range of terms was also used to capture papers focused on the school-aged population, and
196 papers focused on measuring outcomes or effects of treatment (see Table 1 for a list of search
197 terms).

198 {Insert Table 1 here}

199 *Study selection*

200 Articles were included if the research design was an interventional study (randomised
201 controlled trial or quasi-experimental design) or single case research design, participants were
202 of school-age (defined as 5 to 18 years, or where attendance at school was explicitly stated in
203 the participant description); and where participants had speech, language and communication
204 difficulties (SLCD), defined as speech and/or language difficulties as a primary diagnosis
205 (that is, not secondary to another known condition). Articles written in English and published
206 between January 2000 and August 2021 were included.

207 The scoping review process is illustrated in Figure 1. Initially, papers were identified through
208 the database searches and duplicates were removed. Two researchers (authors 1 and 3)
209 screened the titles and abstracts of all papers for the participants' diagnosis and age-group,
210 and papers were removed where this did not match the inclusion criteria. The remaining
211 papers were then sourced to enable full-text review. Arksey and O'Malley (2005) have
212 suggested that inclusion and exclusion criteria can be revised throughout the study based on
213 increased familiarity with the literature. Thus, the research team (all authors) identified
214 further exclusion criteria for the scoping review to assist in narrowing and defining the focus
215 of the study. The reasons for exclusion and numbers of papers identified under each category
216 is provided in Table 2. The papers were then distributed among the research team to
217 determine eligibility and where appropriate to complete the full review.

218 {Insert Figure 1}

219 {Insert Table 2}

220 During the full-text screening, many papers ($n=607$) were excluded due to meeting one or
221 more of the exclusion criteria identified by the research team. Note that some papers met
222 more than one of these exclusion criteria but were not counted twice. Papers were excluded
223 using the first exclusion criterion identified. Following the screen, 125 studies remained to be
224 reviewed.

225 In selecting papers for the final review, the research team chose to focus on those that
226 included a direct intervention addressing speech and/or language difficulties of unknown
227 origin. As such, papers with outcomes impacting Body Structures and Contextual Factors
228 (Environmental and Personal) may have been excluded from the review (e.g., papers with
229 intervention targeting oral structural impairments or classroom adjustments alone). Given
230 this, in the section that follows the focus is on papers that measured outcomes that could be
231 aligned with domains from the ICF components of Body Functions, Activity, and
232 Participation.

233 *Charting the data*

234 Prior to the review, the team met to consider the elements that needed to be extracted and
235 reported from each of the 125 papers. The following information was recorded to enable a
236 summary of the literature accessed and reviewed: study design; population (including
237 country, clinical presentation, age range and sample size); intervention (including program,
238 target area, dosage, delivery method and time between pre- and post-outcome measurement)
239 and control group details (if applicable). The following information was recorded to enable
240 the research aims to be met: the skill/outcome being measured aligned with the operational

241 definitions provided in Table 3, and the measurement tool(s) (including age range, method of
242 administration, person and time for administration).

243 To ensure reliability of the data analysis, two members of the research team (authors 1 and 2)
244 reviewed the ICF categorisation of all outcomes across the 125 papers. After reviewing the
245 categorisation for approximately 20% of the papers, the research team members met to
246 identify discrepancies and discuss their justification for the ICF categories they had applied.
247 This led to the development and refining of operational definitions that could be applied to
248 the categorisation of outcome measures in subsequent studies, which we have named the
249 TAXCOMS (Taxonomy for Categorising Outcome Measurement for SLCD).

250 *TAXCOMS: Taxonomy for Categorising Outcome Measurement for SLCD*

251 The TAXCOMS (Taxonomy for Categorising Outcome Measurement for SLCD) was
252 developed specifically for this study to categorise each outcome of interest and each
253 measurement tool, using the ICF as a framework.. The TAXCOMS is presented in Table 3
254 and includes five common areas of speech pathology practice: speech, expressive language
255 (spoken), receptive language (spoken), expressive language (written), receptive language
256 (written – i.e., reading). Operational definitions are provided for three different outcome
257 levels associated with each: i.e., skills at a Body Function level which are discrete and
258 contained; tasks at an Activity level which integrate multiple Body Function skills and are
259 undertaken in a standardised setting; and performance at a Participation level which are
260 actions undertaken in a natural environment.

261 *{Insert Table 3}*

262 Previous research that has used the ICF as a framework to consider the association between
263 difficulties with speech and language functions and activities and participation (e.g.,

264 McCormack et al., 2009; 2011; McLeod, 2006; Washington, 2007) helped guide the
265 identification of relevant codes and operational definitions for each. The intention of the
266 research team was to enable differentiation between codes and levels to ensure they have
267 more clinical relevance and applicability. For instance, for the area of practice related to
268 “speech”, the Body Function code of *Articulation* was selected, alongside the Activity code
269 of *Speaking* and the Participation code of *Conversation*. For the range of practice area related
270 to “writing”, the Body Function code of *Expression of written language* was selected,
271 alongside the Activity code of *Learning to write* and the Participation code of *Writing*. Once
272 these had been identified, the ICF definitions were then operationalised to reflect how they
273 might be used in practice.

274 With the TAXCOMS, it was then possible to explore the degree to which those outcomes
275 have been reported in intervention research for school students with SLCD.

276 RESULTS

277 *Characteristics of research papers included in the review*

278 Many of the papers reported on single case studies or case series with fewer than 10
279 participants. However, some papers reported comparative research designs, randomised
280 control trials or pseudo-randomised control trials with larger sample sizes, ranging between
281 10 and 1156 participants. Studies were undertaken in the United States, Canada, United
282 Kingdom, Ireland, New Zealand, and Australia.

283 The participants had language difficulties (e.g., including reported diagnoses of
284 developmental language disorder, specific language impairment, low language, social
285 communication/pragmatic disorder, narrative difficulties, word-finding difficulties, receptive
286 and/or expressive language impairment) and/or speech difficulties (e.g., including reported

287 diagnoses of motor speech disorders, speech sound disorders, childhood apraxia of speech,
288 articulation disorder, phonological disorder). Some children in the studies identified
289 experienced additional communication difficulties including stuttering or difficulties with
290 reading comprehension. Within the studies, the participants ranged in age from 4 years to 18
291 years; however, the majority of studies focused on primary school aged participants.

292 Interventions reported in each study ranged from published intervention programs to
293 interventions designed by the authors to target the particular needs of the participant(s). The
294 frequency of delivery varied from daily, bi- or tri-weekly to one session per week; with
295 session durations ranging from 15 minutes to 1hr and 40 mins per day. The intervention
296 programs ran for 5 through to 21 weeks. Most were delivered by an SLP or student SLP, but
297 some were co-delivered with teachers and some were delivered by teachers or teaching
298 assistants alone. Some interventions were delivered to individuals, others to student pairs, and
299 others were small group or whole-class interventions. Most were delivered in person, but
300 some were computer-based or delivered online (via telehealth).

301 *Outcomes measured in intervention studies*

302 The first aim of this study was to identify the outcomes measured in current intervention
303 studies and categorise these according to the ICF. The operational definitions provided in
304 Table 3 were used to guide this categorisation and the results are presented in Table 4. The
305 most commonly measured outcomes in intervention studies for school-aged students with
306 SLCD aligned with domains described within the Body Functions component of the ICF
307 ($n=109$, 87.2%). Some papers also included measurement of outcomes aligned with Activity
308 domains ($n=61$, 48.8%), but few measured outcomes aligned with Participation domains
309 ($n=24$, 19.2%). It should be noted that in most papers multiple outcomes were measured and
310 so the total number of papers identified in each section is greater than 125.

311 *{Insert Table 4 here}*

312 *Examples of Outcomes and Measurement tools described in intervention studies*

313 The second aim of the study was to identify specific outcomes and examples of measurement
314 tools used in the intervention studies to evaluate outcomes across the different practice areas
315 (speech; spoken language -expressive and receptive; and written language - expressive and
316 receptive language) and the levels (Body Function, Activity, and Participation). In Table 5,
317 examples of outcome measurement tools found within the literature are categorised according
318 to the TAXCOMS. Table 5 demonstrates a working example of using the TAXCOMS,
319 provides examples of the outcomes and measurement tools using the ICF framework and
320 exemplifies how the research team completed the data analysis in this study using the
321 TAXCOMS. In the following sections, the results are broadly summarised.

322 *{Insert Table 5}*

323 *Body Functions*

324 In the *speech* area of practice, outcomes at the Body Function level considered accuracy of
325 phoneme production using measurement tools such as the Goldman Fristoe Test of
326 Articulation 2 (Goldman & Fristoe, 2000) or calculations of percentage of consonant correct
327 (PCC) based on conversation samples. In the *spoken language* area of practice, outcomes at
328 Body Function level focused on the use of discrete language skills (such as use of particular
329 morphological endings or knowledge of particularly vocabulary items). These were measured
330 through probes, standardised measures (e.g., Receptive and Expressive One-Word Picture
331 Vocabulary Tests; Brownell, 2010), or subtests within standardised measures (e.g., Clinical
332 Evaluation of Language Fundamentals Preschool 2 (CELF-P2) Word Structure subtest;
333 Semel et al., 2004). In the *written language* area of practice, outcomes at Body Function level

334 considered phonological awareness using formal and informal tools to measure skills
335 (including Letter-sound knowledge; rhyme identification; reading non-word lists). See Table
336 5 for further examples.

337 *Activity*

338 In the *speech* area of practice, Activity level outcomes considered intelligibility in phrases
339 and/or sentences, measured in structured tasks or by tools such as the Children’s Speech
340 Intelligibility Measure (Wilcox & Morris, 1999). In the *spoken language – expressive* area of
341 practice, Activity Level outcomes considered syntax, narrative and pragmatics via tools such
342 as the Bus Story (Renfrew, 1997) or Expression, Reception and Recall of Narrative
343 Instrument (ERRNI; Bishop, 2004) or subtests within tools such as the Formulating
344 Sentences subtest of the CELF-4 (Semel et al., 2003). Other tools included measures of oral
345 narrative story complexity (macro-structure), analysis of T units and use of target verbs in
346 semi-structured conversational task. In the *spoken language – receptive* area of practice,
347 Activity Level outcomes considered literal and inferential comprehension of passages/stories
348 through formal assessments such the ERRNI (Bishop, 2004), or subtests of tools such as the
349 Assessment of Comprehension and Expression (ACE 6-11 - Inferential comprehension of
350 spoken messages task; Adams et al., 2001) or Oral and Written Language Scales (OWLS:
351 Listening Comprehension; Carrow-Woolfolk, 2011), or informal tasks such as Idiom
352 interpretation and explanation or cloze activities. Other outcomes considered ability to follow
353 multi-step instructions via tools such as the CELF-4 (Concepts and Following Directions
354 Task; Semel et al., 2003).

355 In the *written language - expression* area of practice, outcomes at the Activity level
356 considered spelling and sentence construction/content as measured by single word spelling
357 lists and dictation or alternatively by analysis of particular elements of essays (e.g., planning,

358 vocabulary). In the *written language – receptive* area of practice, outcomes included
359 decoding accuracy measured by tasks such as single word reading lists and comprehension
360 (reading a story and answering questions) measured via standardised assessment tools such as
361 the Burt Reading Test (Gilmore et al., 1981) and Neale Analysis of Reading Ability (Neale,
362 1999).

363 *Participation*

364 In the *speech* area of practice, Participation level outcomes considered communication
365 success/breakdown during communication activities measured by self-reflection or feedback
366 from communication partners or observers. In the *spoken language - expression* area of
367 practice, outcomes considered pragmatic skills via tools such as the Analysis of Language
368 Impaired Children’s Conversation (ALICC) (Conversation Dominance, Loquacity,
369 Responsiveness, Response Prob, Prag Prob; Adams et al., 1981) used in real-world contexts
370 and interactions with others via tools such as the Strengths and Difficulties Questionnaire
371 (Goodman, 1997). Informal measures were through gathering perceptions of communication
372 partners (e.g., parents/ teachers). In the *spoken language – receptive* area of practice,
373 outcomes also considered pragmatics via the ALICC (Adams et al., 1981) or a test of
374 pragmatic skills during naturalistic play, and other rating scales completed by
375 parents/teachers such as the CELF4 Pragmatics Rating Scale (Semel et al., 2003) or
376 Children’s Communication Checklist-2 (Bishop, 2006) or clinician tools such as the
377 Behaviour Rating Inventory of Executive Function (BRIEF; Gioia et al., 2003). Other tools
378 included the creation of an observation profile and/or child portfolio (completed by parents to
379 identify strengths, difficulties and goal outcomes), parent perception forms (parents list
380 examples of improvement with their child) and the gathering of parent feedback on
381 generalisation of strategies outside the clinic (e.g., to other people/ settings/ activities).

382 In the *written language* area of practice, Participation level outcomes related to
383 expression (i.e., writing) were measured by assessment of a writing piece completed in the
384 classroom (artefact analysis) to explore language proficiency level; teacher rating of oral
385 language and literacy; written summaries of classroom content. Outcomes related to reception
386 (i.e., reading) at the Participation level were measured by retelling a story and evaluating
387 students' demonstrating understanding of key components.

388

389

DISCUSSION

390 The scoping review described in this paper aimed to explore the outcomes assessed and
391 measurement tools used in intervention studies with school aged students with SLCD in order
392 to identify the levels of attainment typically targeted and/or reported. The ICF was identified
393 as an appropriate framework for categorising the levels of outcomes; however, there was a
394 noted lack of consistency in how domains and definitions within the ICF had been used
395 previously. As such, operational definitions of relevant ICF domains were created and used in
396 the current review and presented in a taxonomy (TAXCOMS: Taxonomy of Communication
397 Outcome Measures) for children with SLCD which can be used to select outcome measures
398 and classify outcomes of speech-language pathology services for school-aged students.

399 *Outcomes measured*

400 As shown in Table 5, the majority of intervention studies included in this review measured
401 and reported outcomes at the level of Body Function and/or Activity, according to our
402 operational definitions. It is the nature of intervention studies that they are often conducted in
403 controlled environments, so outcomes at a Body Function and/or Activity level are likely the
404 most straightforward to measure. Furthermore, diagnosis of SLCD and identification of

405 intervention targets has typically been based on an assessment exploring Body Functions, and
406 therefore it is easy to reassess using the same measure to review change. However, given that
407 the ultimate aim of intervention in education settings is “to improve educational outcomes
408 and experiences for children” (SPA, 2022a), it is important that the effects of the intervention
409 extend to real-world settings (i.e., Participation level). This is consistent with the notion that
410 the ultimate goal of intervention is generalisation and that intervention goals about
411 generalisation should be explicit (“train to generalise”) rather than “train and hope” (Osnes &
412 Lieblein, 2003; Stokes & Baer, 1977).

413 It may be that change at a Participation level is difficult to measure within the timeframe of
414 most intervention studies. However, it would be beneficial for researchers routinely to
415 schedule post-intervention follow-up data collection of Participation level outcomes to
416 provide evidence that the intervention is effective in real-world activities and settings.

417 It may also be that a lack of tools for measuring participation outcomes is a factor in the lack
418 of measurement at this level reported in the research studies reviewed for this paper. From a
419 psychometric perspective, measures used to assess outcomes should have evidence of
420 responsiveness (i.e., sensitive to changes over time). Funding for the development of valid,
421 reliable, and responsive tools is needed to support SLPs to measure outcomes at the level of
422 participation.

423 When Activity or Participation related outcomes were targeted in the studies within this
424 scoping review, these focused on learning and applying knowledge and communication,
425 rather than social relationships. While a focus of education is using oral and written
426 communication for learning, school settings also provide places for students to use
427 communication to build and maintain friendships and social relationships. Particularly as
428 students enter the later primary and secondary school years, social interaction is a priority of

429 many young people and SLCD can impact this negatively (cf. Durkin & Conti-Ramsden,
430 2007; Forrest et al., 2018). Thus, it is important for the selection of outcomes at an Activity
431 and/or Participation level to include consideration of this element of education as well.

432 Another factor potentially impacting the measurement of outcomes at the level of
433 Participation may be the challenge of conceptualising what outcomes at this level look like,
434 and therefore, what measurement of outcomes at this level might entail. The operational
435 definitions and taxonomy (TAXCOMS) presented in this paper might provide a conceptual
436 foundation for future research, scholarly discourse and outcome measurement development.

437 Supporting students with SLCD at school often requires identification, implementation and
438 monitoring of reasonable adjustments, thus there is a need for intervention research that
439 measures related outcomes (i.e., Environmental Factors) in order to inform our practice. In
440 the current scoping review, studies investigating environmental outcomes were not captured
441 in the search criteria; however, it would be a valuable area for future research. Currently, it is
442 unclear if the lack of measurement of domains aligned with Participation/Environmental
443 Factors is due to a lack of tools to measure outcomes associated with these components. In
444 future research it is important to investigate outcome tools for environmental factors.

445 *Limitations and Future Directions for Research*

446 This review raises a number of avenues for future research, so the possibilities that follow are
447 not an exhaustive list. Instead, they reflect the breadth of areas to explore in this important
448 area of practice.

449 There is research exploring the use of outcome measurement in other fields of speech
450 pathology and with other populations (see Adair et al., 2018; Calder et al., 2018, Cunningham
451 et al., 2017, Eadie et al., 2006); however, there is little research that has explored if SLPs

452 working with school students with SLCD (with or without a diagnosis) are routinely
453 measuring outcomes, how they are measuring outcomes or what outcomes they believe are
454 important to measure to show progress and impact. A recent survey of SLPs across Australia,
455 New Zealand, the United Kingdom and Canada provided some insight into the tools being
456 used to measure outcomes for primary school students and the factors that influence choice of
457 tools (authors, in review). It would be helpful to expand such a survey to other countries and
458 capture those working with secondary school students as well. It would be interesting to see if
459 the taxonomy presented in the current paper could be applied to such research, or
460 alternatively whether the taxonomy had perceived/actual clinical value in supporting SLPs to
461 identify and administer outcome measurement.

462 This review revealed a number of researchers had chosen to measure outcomes using probes
463 they developed for the purpose. It would be interesting to explore the nature/content of those
464 probes further and the reason for their development, similar to the study undertaken by
465 Limbrick et al. (2013) to explore the nature and rationale behind the creation of informal
466 speech assessments.

467 In the future, it would be beneficial to review studies undertaken with children speaking
468 languages other than English also, and reviewing the outcomes measured within those.
469 Similarly, it would be helpful to consider studies that have been published in venues other
470 than peer-reviewed journals, to avoid the potential of publication bias influencing the data
471 gathered and reviewed. Finally, it may be of benefit to consider additional information about
472 the authors and funding of the research to acknowledge when this may have influenced the
473 measurement approaches used.

474 In order to guide our identification of the outcomes that should be measured following
475 intervention, it is important to consider the views of those receiving intervention and their

476 significant others. A qualitative study has begun the process of exploring client preferences –
477 that is, the outcomes desired by school students attending speech pathology service and
478 families. The themes that emerged from that study suggest the confidence and capacity to
479 participate might be more important than successful specific communication goals, and the
480 support and encouragement provided by the SLP is a key contributor to a positive experience
481 (authors, in preparation). Finally, it should be noted that this study identified outcome
482 measures but did not examine the evidence for use of the measures identified in intervention
483 studies so this scoping study (and the TAXCOMS presented here) doesn't provide
484 recommendations for which measures to use.

485

486 *Conclusion*

487 The ICF provides a useful framework for exploring the reported health outcomes for
488 individuals who have received intervention in clinical practice and/or research, and for
489 determining the level of improvement (i.e., improved function/skill; ability to use that
490 function/skill in a structured activity or use within everyday life activities). For instance,
491 speech-language pathology outcomes for school students may include changes to a student's
492 speech production, or changes to that student's ability to use those skills in life activities such
493 as participating in learning activities in class and social interactions in the playground. If the
494 goals of the Alice Springs (Mparntwe) Education Declaration (2019) are to be met, it is the
495 latter type of outcome that is of most interest. While research over the years has shown that
496 speech pathology intervention is effective at improving speech and language skills (Law et
497 al., 2003; National Academies of Sciences, Engineering, and Medicine, 2016). The results of
498 this review suggest most research has focused on measurement at that level of discrete
499 functions, or at the level of a structured activity. However, it is unclear whether these

500 improvements in speech and language skills translate to real-world, functional improvements
501 in a child's participation at school and educational outcomes. The taxonomy presented in this
502 paper (TAXCOMS: Taxonomy of Outcome Measures for children with SLCD) might assist
503 with identification of tools/strategies for measuring outcomes at a participation level, and
504 encourage those implementing intervention in research and clinical practice to consider how
505 and when they could gather this data and use it to inform their clinical decisions.

506

507

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510

511

DATA AVAILABILITY STATEMENT

512 The datasets generated during and/or analyzed during the current study are available from the
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670

Figure 1.

PRISMA flow diagram for new systematic reviews which included searches of databases, registers and other sources. Adapted from: Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., et al. (2021). The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *British Medical Journal*, 372(71). doi: 10.1136/bmj.n71.