Research Article

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Scoping review of research methodologies across language studies with deaf and hard-of-hearing multilingual learners

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Abstract: In recent years, research interest in both multilingual learners and, more specifically, in immigrant populations has increased. This is also true for students who are d/Deaf and hard of hearing (d/Dhh) and have families who do not speak or sign the languages of the wider community at home (d/Dhh multilingual learners; DML), and may be recent immigrants transitioning to a new country (immigrant DML; IDML). This is a low-incidence, diverse population of learners with minimal research on both language development and on adequate language support during the schooling years. The present study is a scoping review of the research methodologies utilized to conduct 33 original studies. The results help to explain why research is both lacking and sorely needed, and provide a basis for researchers to identify desiderata in research foci and research designs. Recommendations for educational research with DMLs are proposed.

Keywords: DML; immigrant students; multilingual students; research methodology

1 Research with low-incidence, heterogeneous populations

Research with low-incidence, heterogeneous populations of learners in education may present barriers (e.g., Spooner and Browder 2003; Cawthon and Garberoglio 2017) – a fact reflected in the comparative dearth of research and educational materials available. This is especially true in intersectional education and learning
research, which may focus on the intersection of two (or more), often low-incidence, subpopulations. One such group is d/Dhh learners whose families do not speak or sign the languages of the wider community at home, and are often recent immigrants transitioning to a new country, language(s), and cultures. Some have families who utilize multiple languages, including heritage languages, i.e., a language used by the family based on their cultural background but not by the majority of the broader community (e.g., Cherokee or Spanish in the USA, German Sign Language), while others have migrated to a new country and are learning a second language (e.g., English, American Sign Language). In total, such multilingual d/Dhh learners (DML; Cannon et al. 2016) make up an undetermined and yet noticeable proportion of the d/Dhh student population in many countries – in the United States in 2013 approximately 25% of all learners (Gallaudet Research Institute 2013) – and these numbers are increasing in many countries due to changes in migration patterns in recent years.

With changing student populations, school systems need to adapt, and knowledge about migrant students’ language experiences is especially important. However, information on how language acquisition, language development, language use and language education may be unique for DML is sparse (e.g., Cline and Mahon 2010; Crowe and Guiberson 2019; Crowe and McLeod 2014; Howerton-Fox and Falk 2019). One reason is the small number of studies carried out to date and questions regarding their scope and breadth.

Recognizing the complexity of investigating this population of learners, and noting the lack of research explicitly focusing on their language(s) use, development and education, we aimed to examine not what information is available for the population (e.g., results of research in the field), but rather, how this information has been compiled (e.g., research designs and methodologies utilized to answer the research questions). Such a consideration of research methods should help to inform the development of further research foci and research designs when answering questions about the complexities of multilingual acquisition and instruction for learners with varying exposure to accessible languages.

To this end, we carried out a scoping review to analyze the research methodologies of 33 original research papers focusing on DML from primary school until the completion of mandatory formal education. Relevant for the review were papers which investigated language experiences of these learners. The results describe (a) research questions covered, (b) populations studied, (c) languages represented, (d) sources of the information reported, (e) sampling procedures, and (f) design

1 The use of d/D in d/Deaf highlights the identification as a community member to the Deaf community (“Deaf”), the hearing community (“deaf”), or both, and is commonly used as an inclusive way of acknowledging different identities within the communities.
issues (e.g., research paradigms). Finally, we discuss these results and conclude with recommendations for further research with this population of learners.

2 d/Dhh multilingual learners

Schoolchildren make up a notoriously heterogeneous research population, and to better serve the needs of such learners, both research and pedagogical attention has been given to various subgroups. One such group is learners with home spoken or sign languages other than those of the wider culture and education system in which they live, often termed “second/additional language learners” or “multilingual learners” (Cummins 2000; for an interesting discussion of these terms, see García 2009). For each of these groups, a wide body of continuously evolving research is available. However, the intersection of subpopulations, such as “multilingual” and “d/Dhh” (i.e., DML) may be challenging to recruit participants for research; the children are “a small minority of an already small minority” (Grant 1993, p. 135). A further complication involves the subgroup of DMLs who have immigrated to a new country after an age at which formal education would normally have begun (Marx and Urbann 2022).

At least hypothetically, these two groups differ on various dimensions. Culturally, parents of DML will generally be better able to navigate the host country environments, having lived there already by the birth of the child – or even being born there themselves. In host countries with newborn hearing screening programs, the DML child will most likely have received comprehensive audiological testing within a few days of birth and further support, similar to other d/Dhh children in their area (however, see Swanwick et al. 2021 for a discussion about how the family’s cultures might affect their use of available services). In fact, some studies have found minimal differences between these children and children growing up in families speaking or signing the language of the education system if they have received continuous audiological, academic, and language support (Bunta and Douglas 2013; Thomas et al. 2008).

Many of these advantages may not be available to DML who recently immigrated because their families are navigating a new culture and languages themselves. The child may not have had access to previous medical support – or even had their hearing level identified. In the case of cochlear implants, DMLs may have received an implant, but little or no follow-up support (Willoughby 2008). These learners often receive audiological support only upon arrival in the host country or even later (Becker and Juche 2018), since children and families might not have or desire access to support of d/Dhh children in the new country. Further, educators may misinterpret communication difficulties as being behavioural issues, when the underlying
problem is that the DML may have challenges expressing ideas and emotions due to various factors (Prawiro-Atmodjo et al. 2020). DML who have immigrated differ from many d/Dhh learners because they may not have developed an L1 (first language), or may have arrived in the host country with only basic home signs at an age in which L1 acquisition would typically be complete (Swanwick et al. 2021). Thus, their L1 acquisition – whether signed or spoken – may be delayed due to the lack of support in the home country or lack of access to schooling for various reasons (e.g., extended periods without access to formal education; DeCapua et al. 2009). For those DML who are refugees, a number of further unique aspects can affect language development. These may include the experience of trauma, disorientation through not understanding the immigration process, and the concealment of the child’s deafness by family members worried that a disability could impede the family’s chances of being granted residence status by the host country (Akamatsu and Cole 2000; McAuliff 2021; Willoughby 2008).

However, there are similarities between DML who have not immigrated and those who have. They may both experience early language deprivation if a signed or spoken language is not fully accessible to them in the home context and opportunities for early language development are not easily available (Hall et al. 2019; Schönström and Holmström 2019). Different language experiences may also mean family support is not available for the development of school (signed and/or spoken) languages (Alfano et al. 2022). Further, there is often little or no institutional support of spoken or signed heritage languages, so that possibilities for retention of heritage languages in multilingual education are missed (Bagga-Gupta 2002). Parents must also encourage the acquisition of heritage languages to maintain family and cultural ties (Baker 2001). Since parents of DML may have to acquire multiple languages (both spoken and/or signed) to provide accessible language for their child, DMLs are at greater risk than many d/Dhh learners of language deprivation in the home and school settings (Crowe and Guiberson 2022).

Both in research and in pedagogical practice, little is known about the complexities of multilingual language development across modalities for DML populations. To date, no reviews have been carried out considering the research methodologies utilized to study multilingual development, language use, and pedagogy of DML. Other reviews have summarized the outcomes of interventions and other research regarding the education and learning of DML (Cannon and Guardino 2012; Crowe and Guiberson 2019; Guiberson and Crowe 2018). A further review has summarized research regarding different aspects that deaf refugees face, but does not focus specifically on the methodologies utilized in research on language development (McAuliff 2021). All reviews mention the lack of research with these learners (see also Howerton-Fox and Falk 2019). One reason for this may be that researchers need support in finding appropriate research designs to investigate this
heterogeneous, low-incidence population that go beyond those required to examine d/Dhh learners who are not DML. Thus, we conducted a scoping review to consider the previous research methodologies in the literature in order to support and prompt future research in the field.

### 3 Research question

The intent of this scoping review is to investigate research methodologies utilized in the study of low-incidence, heterogeneous populations in applied linguistics research, focusing on DML. Such research is central not just for scientific interests, but also for informing educational practice.

The central question which provided the basis for this methods review was: Which research methodologies are utilized to investigate experiences of language acquisition, language development, language use, and language education in and with DML populations?

### 4 Methodology

#### 4.1 Sampling and inclusion criteria

In order to achieve a comprehensive sample of original research papers on experiences of language acquisition, language development, language use, and language education of DML, we invoked a string of sampling procedures. First, we drew up a list of all studies known to the authors and their working groups. Following this, we enacted a snowballing system based on the authors referenced in these texts. At the same time, we carried out a search of peer-reviewed papers using the keywords “multilingual” (and variants such as “bilingual” and “plurilingual”) and “deaf” (as well as variants such as “DHH”) on the ERIC database and Google Scholar. Finally, we sent a list of papers found through these methods to colleagues conducting research with DML with the request that they add any additional original research papers of which they were aware. This method of sampling resulted in a list of approximately 80 papers across an unrestricted timeframe, which was then reduced according to the criteria set for inclusion. This method has various caveats, the most obvious being that it is entirely possible that we missed relevant studies, especially those published in languages other than English and German, the working languages of the authors.

For final inclusion, papers were judged on the following four inclusion criteria: (a) target population discussed, (b) aspect focused on in the study, (c) type of publication, and (d) publication venue. Any publications that did not meet these criteria
were excluded. First (a), we included only studies examining DMLs. Second, (b) only studies whose main focus was on language(s) acquisition, language development, language use, or language education were considered. Thus, studies focusing on, for example, lived experiences in the community as a deaf immigrant, or describing general educational trajectories of subsamples of DMLs, were excluded from the review. Third (c), only original research papers were included. Finally (d), only studies published in peer-reviewed journals, peer-reviewed, edited books, and those published as Master’s or doctoral theses were included. This aimed to ensure that accepted standards of empirical research were adhered to. We included academic theses because these report original research often broader in scope than single-article papers, and are subjected to a rigorous review by the student’s research committee, but often remain unpublished and thus generally inaccessible. This process resulted in a total number of 33 original research studies for the review.

4.2 Variables included for review

The specific variables of interest for the methods review were developed using a recursive process of content-based and data-based considerations. The final aspects considered were (a) research questions posed, (b) population under consideration, (c) languages and cultures involved, (d) the research participants involved, (e) sampling methods, and (f) research design. We chose, for the purpose of this review, not to discuss study results. Since our goal was to present research methods amongst the population of DML, we look instead only to researchers’ choices when focusing on this group and its multilingual experiences.

5 Results

The results of the scoping review of 33 research studies about DML are included in narrative and table formats.

5.1 Research questions

Studies reviewed examined a variety of research questions, including (a) families’ perspectives, choice and decision-making processes, (b) experience in the education system for both families and learners, (c) accommodations and strategies when working with learners, (d) service provider experiences and perspectives on educating learners, and (e) characteristics of DML (Table 1):
Families’ perspectives, choice and decision-making processes were examined by four studies. Research questions included those about navigating cultures and how this impacts family engagement (Batamula 2016), family language choice and its impact on communication (de Garcia 1993), how parents communicate in the home and community settings (Alfano 2019), and the parental decision-making process for those from culturally and linguistically diverse backgrounds (Steinberg et al. 2003). Only one study examined experiences in the education system for both families and DML with a retrospective view at how they navigated school systems, received accommodations and strategies to support language development, and how these supports impacted the academic outcomes of one DML (Baker and Scott 2016).

The accommodations and strategies examined across research questions in the studies targeted increasing DMLs’ language and/or literacy skills. One study considered understanding of grammar structures in reading comprehension (Cannon et al. 2020). Three studies focused on increasing vocabulary acquisition for DMLs. Cannon et al. (2010) utilized a pre-teaching and chaining intervention that incorporated visual and bilingual strategies to increase targeted, functional, ASL vocabulary, which was replicated by Guardino et al. (2014) with an older population of DML. Granda (2014) also investigated strategies to increase vocabulary (visual, repeated readings, culturally relevant pictures books, ASL-English bilingual strategies) and how often teachers used them. Kwon et al. (2022a) questioned whether a DML with Autism Spectrum Disorder (ASD) in a general education setting would

<table>
<thead>
<tr>
<th>Manifestation</th>
<th>Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Families’ perspectives, choice and decision-making processes</td>
<td>Alfano (2019), Batamula (2016), de García (1993), and Steinberg et al. (2003)</td>
</tr>
<tr>
<td>Experience in the education system for both families and learners</td>
<td>Baker and Scott (2016)</td>
</tr>
<tr>
<td>Accommodations and strategies when working with learners</td>
<td>Cannon et al. (2020), Cannon et al. (2010), Guardino et al. (2014), Granda (2014), Kwon et al. (2022a), Teschendorf et al. (2010), Thomas et al. (2008), and Waltzman et al. (2003)</td>
</tr>
<tr>
<td>Service provider experience and perspectives on educating learners</td>
<td>Becker and Bowen (2018), Begon (2021), Fishbeck (2018), and Olsen (2018)</td>
</tr>
</tbody>
</table>

### Table 1: Research questions posed.
increase their social interactions with classroom peers through social stories that incorporated ASL. Another group of three studies examined DMLs who use cochlear implants and looked at their speech development (Thomas et al. 2008; Waltzman et al. 2003), or tried to determine the languages each DML was exposed to at home and at school (Teschendorf et al. 2010). Four studies contained research questions about the service providers’ experience and perspectives on educating DML (Becker and Bowen 2018; Begon 2021), with two focused on interpreters’ work (Fishbeck 2018; Olsen 2018).

Just over a third of the studies (12 out of 33) examined characteristics of DML – understandable, given that this population has not been heavily researched, and that describing the characteristics of the learners forms a foundation for case studies, the starting point for any research about a relatively unknown population. Becker and Juche (2018) examined the characteristics of learners who are refugees, their strengths and challenges, and the resources required to support them. While Lummer (2011), Shin (2003), and Crowe and Guiberson (2021) examined lived experiences, Guiberson (2014) turned to the L1 and L2 (second language) proficiency, with a focus on the sources of the L2 exposure from parent survey and rating scales. Sivunen (2019) also considered the experiences of DML but focused on asylum seekers, while Youngs (2010) examined refugee camp stakeholder experiences, obstacles, and strategies for support. Only one study included a research question on language proficiency of DML who experienced language delays (Schrötzlmair et al. 2012), while a further four focused on background characteristics of DML. Of these, two investigated demographics and effective strategies to support learners (Lummer 1999; Swanwick et al. 2021), while Willoughby (2008, 2012) considered factors of L1 and L2 acquisition (i.e., becoming bilingual), which included family decisions to use/not use their heritage language, language choice and cultural heritage, family experience within the education system, professionals’ experience supporting DMLs and their families, and changes that are needed for further accessibility.

5.2 Population under consideration

We analyzed which characteristics of DMLs were reported in the studies. The results showed, first, that much of the research was completed with professionals about their experiences; only 19 out of the 33 studies reviewed included DML as research participants. As well, many posed research questions regarding particular sub-populations. These included learners who use cochlear implants, refugees, or learners from specific cultural backgrounds (Table 2):
We first examined the age and educational stage of those participants in studies who were the actual learners themselves. Only nine of the 19 studies reviewed noted the age or educational stage of the learners, while two further studies named the age learners began using a cochlear implant. One of the nine studies focused on learners of preschool age (3–4 years old), four on learners 5–12 years old, two on learners 14–22 years old, and two on adults (talking about their language learning at younger ages).

Next, we examined whether the studies reported the age of the IDMLs at the time their family immigrated to the country in which the study took place. Only six out of the eleven studies that included IDMLs reported the age at immigration.

Nine studies reported the hearing levels of the participants, with two exceptions reporting information about the learners’ cochlear implants (e.g., age received, length of usage), but not specific levels of hearing loss (Thomas et al. 2008; Waltzman et al. 2003). The remaining studies also reported the learner’s access to assistive hearing technology, yet the majority did not report on how long the learner utilized the auditory equipment within their previous and current schooling, or during their home life.

### 5.3 Languages and cultures involved

We examined whether the language(s) of the school, the home, and communities involved were reported. We found that studies examined learners, families, and
professionals who utilized 35 spoken languages and 9 sign languages (Table 3; see Table 3a, Supplementary Material, for a full listing of languages involved):

Table 3: Languages & cultures involved across studies.

<table>
<thead>
<tr>
<th>Spoken languages</th>
<th>Sign languages or variations</th>
<th>Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Various spoken languages in different populations</td>
<td>ASL</td>
<td>Cannon et al. (2020), Guardino et al. (2014)</td>
</tr>
<tr>
<td></td>
<td>N/A</td>
<td>Guiberson (2014)</td>
</tr>
<tr>
<td></td>
<td>International sign, VGT (Flemish SL, British SL, DTS (Danish SL)</td>
<td>Kusters et al. (2021)</td>
</tr>
<tr>
<td></td>
<td>ASL and ‘native sign language’ (unspecified)</td>
<td>Becker and Bowen (2018)</td>
</tr>
<tr>
<td></td>
<td>DGS (German sign language)</td>
<td>Teschendorf et al. (2010), Thomas et al. (2008), Waltzman et al. (2003), and Willoughby (2012)</td>
</tr>
<tr>
<td>Spanish and English</td>
<td>ASL</td>
<td>Cannon et al. (2010), de Garcia (1993), and Lummer (2011)</td>
</tr>
<tr>
<td></td>
<td>N/A</td>
<td>Bunta and Douglas (2013)</td>
</tr>
<tr>
<td>Spanish, Tulani and French</td>
<td>Gestures, home signs, lipreading</td>
<td>Granda (2014)</td>
</tr>
<tr>
<td>Arabic and English</td>
<td>ASL</td>
<td>Kwon et al. (2022b)</td>
</tr>
<tr>
<td>Korean and English</td>
<td>ASL</td>
<td>Kwon et al. (2022a, 2023), and Shin (2003)</td>
</tr>
<tr>
<td>German</td>
<td>N/A</td>
<td>Begon (2021)</td>
</tr>
<tr>
<td>Russian, Cantonese, Korean, Malay</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Arabic</td>
<td>DGS (German SL)</td>
<td>Olsen (2018)</td>
</tr>
<tr>
<td>Swahili</td>
<td>Kenyan sign language</td>
<td>Youngs (2010)</td>
</tr>
</tbody>
</table>

Across the variety of spoken languages, following English, learners who were exposed to Spanish were studied most often (11 studies). Learners also used Arabic (six studies), French (four studies), Korean and German (three studies each), and Cantonese, Mandarin, and Russian (two studies each). The most common sign language used by participants was ASL (12 studies), followed by Australian Sign Language (two studies), and then German, Kenyan, Peruvian, Flemish, British, Danish, and International Sign Language (one study each). Two studies mentioned home signs and one mentioned an unspecified “native” sign language.

Just over half (17) of the studies considered participants with different language backgrounds, involving at least three spoken and/or sign languages. Examples include the following across multiple participants: five sign languages (Kusters et al. 2021), 13 (Cannon et al. 2020), eight (Guiberson 2014) and seven (Teschendorf et al. 2010;
Waltzman et al. 2003). However, few studies went beyond mere lists by reporting more in-depth and nuanced data (e.g., English and Spanish language support at home and at school across their study participants; Bunta and Douglas 2013). As well, because the majority of studies (25 out of 33) were from English-dominant countries, English spoken language and ASL and Auslan were overrepresented in the sample. Twelve studies did not report the languages utilized by the DML population of interest at all.

Even fewer studies reported the country of origin of their participants; those that did often included participants from a large number of different regions (e.g., Alfano 2019, with learners from a number of Central American countries). The country where the studies took place, in contrast, was consistently reported and/or evident from the background of the researchers and publication venue (Table 4):

### Table 4: Country where studies took place.

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Manifestation</th>
<th>Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>4</td>
<td>Cannon et al. (2020), and Kwon et al. (2022a, 2022b, 2023)</td>
</tr>
<tr>
<td>Germany</td>
<td>4</td>
<td>Becker and Juche (2018), Begon (2021), Schrötzlmair et al. (2012), and Teschendorf et al. (2010)</td>
</tr>
<tr>
<td>Australia</td>
<td>3</td>
<td>Crowe and Guiberson (2021) and Willoughby (2008, 2012)</td>
</tr>
<tr>
<td>England</td>
<td>1</td>
<td>Swanwick et al. (2021)</td>
</tr>
<tr>
<td>Finland</td>
<td>1</td>
<td>Sivunen (2019)</td>
</tr>
<tr>
<td>Kenya</td>
<td>1</td>
<td>Youngs (2010)</td>
</tr>
<tr>
<td>Norway</td>
<td>1</td>
<td>Olsen (2018)</td>
</tr>
<tr>
<td>Scotland</td>
<td>1</td>
<td>Kusters et al. (2021)</td>
</tr>
<tr>
<td>Spain</td>
<td>1</td>
<td>Guiberson (2014)</td>
</tr>
</tbody>
</table>

The majority of studies (16) took place in the United States, while four each were conducted in Canada and Germany. Three stemmed from Australia, while the remaining studies were the only ones in the current review in their respective countries: England, Finland, Kenya, Norway, Scotland, and Spain.

### 5.4 Research participants involved

Since the population of interest was not always the same as the research participants providing information (Table 5), these categories are considered separately.
### Table 5: Research participants.

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Manifestation</th>
<th>Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of participants</td>
<td>1</td>
<td>Baker and Scott (2016), Granda (2014), and Kwon et al. (2023)</td>
</tr>
<tr>
<td></td>
<td>2–5</td>
<td>Cannon et al. (2010), Fishbeck (2018), de Garcia (1993), Guardino et al. (2014), Kwon et al. (2022b), Kusters et al. (2021), Shin (2003), and Swanwick et al. (2021)a</td>
</tr>
<tr>
<td></td>
<td>21–30</td>
<td>Cannon et al. (2020) and Steinberg et al. (2003)</td>
</tr>
<tr>
<td></td>
<td>31–40</td>
<td>Bunta and Douglas (2013) and Lummer (1999)</td>
</tr>
<tr>
<td></td>
<td>41–50</td>
<td>Becker and Juche (2018)</td>
</tr>
<tr>
<td></td>
<td>51–60</td>
<td>Guiberson (2014) and Teschendorf et al. (2010)</td>
</tr>
<tr>
<td></td>
<td>61–70</td>
<td>Youngs (2010)</td>
</tr>
<tr>
<td></td>
<td>DMLs and parents/families</td>
<td>Alfano (2019), de Garcia (1993), Guardino et al. (2014), and Shin (2003)</td>
</tr>
<tr>
<td></td>
<td>DMLs and teachers</td>
<td>Baker and Scott (2016)</td>
</tr>
<tr>
<td></td>
<td>DMLs and peers</td>
<td>Kwon et al. (2022b)</td>
</tr>
<tr>
<td></td>
<td>DMLs and two further groups</td>
<td>Sivunen (2019), Swanwick et al. (2021), Willoughby (2008), and Youngs (2010)</td>
</tr>
<tr>
<td></td>
<td>Parents/family only</td>
<td>Batamula (2016), Guiberson (2014), Kusters et al. (2021), Steinberg et al. (2003), and Willoughby (2012)</td>
</tr>
<tr>
<td></td>
<td>Parents and teacher or principal</td>
<td>Kwon et al. (2022a, 2023)</td>
</tr>
<tr>
<td></td>
<td>Teachers or principals only</td>
<td>Becker and Juche (2018), Begon (2021), and Lummer (1999)</td>
</tr>
<tr>
<td></td>
<td>Service providers and interpreters</td>
<td>Becker and Bowen (2018), Crowe and Guiberson (2021), Fishbeck (2018), and Olsen (2018)</td>
</tr>
<tr>
<td>Comparison population of non-DML</td>
<td>Yes</td>
<td>Bunta and Douglas (2013), Schrötzlmair et al. (2012), Guiberson (2014), Teschendorf et al. (2010), and Waltzman et al. (2003)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>(All other studies)</td>
</tr>
</tbody>
</table>

*aSwanwick et al. (2021) also report basic descriptive data on a survey they sent to schools for d/Dhh learners. Since this only reports numbers of students with a Roma background, we do not include this information here.*
The sample size of participants was quite varied, ranging from one (three studies) to 65, (average = 16.1; median = 9; SD = 17.3). Since studies in medical clinics tended to have larger sample sizes, ranging from 12 to 56 participants (average = 25.3; median = 16.5; SD = 20.6), a more representative portrayal of participant numbers would exclude clinical studies. For the purpose of this review, we do not include numbers of monolingual d/Dhh participants in comparison groups. In the 29 non-clinical studies in this review (average = 14.8; median = 7; SD = 16.9), a full 18 studies (i.e., over half) involved ten or fewer participants, meaning that all research was informed by a total of 432 participants. Further, if only data gathered from DML themselves is considered, the number sinks to 118 participants in non-clinical and 101 in clinical studies.

Regarding research participants, many researchers consider data gathered from the learners themselves (19 studies), whether this be through testing, observation, interviews, a review of school documents, or a combination thereof. Some studies also involved parents or the whole immediate family of the d/Dhh learners, teachers, principals, interpreters, further service providers, or peers. Of the 33 studies involved, 21 examined only one group of research participants; however, eight studies gathered data from two different populations, while two studies each looked at three or four different participant groups.

5.5 Sampling procedures

Closely tied to research participants is the question of data sampling, i.e., how the participants were chosen for the study (Acharya et al. 2013). This important information was not addressed directly in all studies. In total, 28 articles explained sampling procedures. Five studies gave no information about sampling procedures. All studies reported involved non-random sampling (i.e., data was gathered based on the researcher's sample construction possibilities), with participants often self-selecting. For the purpose of this scoping review, we categorized studies into one of four sampling approaches: (a) convenience sampling (i.e., researcher has access to the participants), (b) purposive sampling (i.e., an a priori decision on necessary traits that participants must have, and recruitment of those who fit the category), (c) snowball sampling (i.e., participants are asked to recruit further participants), and (d) quota sampling (i.e., participants are chosen to represent specific sub-groups of the population) (Table 6):
Fifteen of the 28 studies used convenience and six studies used purposive sampling, while sampling procedures were combined in six studies. Pre-existing contacts with schools, DML’s teachers or families were drawn upon; in many cases, these were private contacts in family or friendship circles, and in one case, the researchers themselves were part of the group under study (Kusters et al. 2021). For studies combining sampling methods, a two-step procedure of gathering a group of participants was common. This usually involved a general invitation to participate (e.g., parent-teacher evenings, notice boards, mailing lists, teacher conferences, social media), combined with convenience and/or purposive sampling. One study carried out quota sampling as a primary sampling method (Begon 2021). Only two studies specifically mentioned snowball sampling, which was combined with purposive (Shin 2003) or purposive and convenience sampling (Batamula 2016).

### 5.6 Research design

To describe the research design, we considered various aspects, although the first two were not always stated clearly in the project. We looked at (a) the theoretical paradigm underlying the study motivation and research design; (b) research paradigm as being deductive-nomological (i.e., hypothesis-testing) or explorative-interpretative (i.e., hypothesis developing); (c) whether the study involved an experimental design; (d) type of data collected (i.e., qualitative or quantitative); (e) method of data collection; and (f) instruments involved (Table 7; for a full listing, see Table 7a in Supplementary Material):
Because the four studies carried out in medical clinics seemed to form a category of their own, they are not included in the following results. These studies were all nomological, non-intervention studies that elicited quantitative data based on a battery of standardized and normed tests to consider different aspects of DML’s hearing and language levels in the language of the wider community. All but one (Waltzman et al. 2003) considered a comparison group of d/Dhh learners who were not multilinguals as per the definition in this review. The studies are included in the Tables in the Supplementary Material.

First, it was challenging to determine the theoretical approach that researchers took when designing their studies. A few studies placed themselves in ethnographic research, some mentioned a phenomenological approach or a design based on grounded theory, others an intersectional methodological approach; however, in almost all cases, we could only determine the approach by inferring the researchers’ standpoints. Thus, we decided to dispose of this category for the analyses of research paradigms as being too unclear to delineate satisfactorily.

Second, the research paradigm invoked was tied to the field of linguistics involved and the research questions posed. Most evident, for example, was that clinical studies were solely quantitative in nature and involved batteries of tests. We classified studies according to whether they – explicitly or implicitly – were primarily hypothesis-testing ( deductive) or had the goal of hypothesis development (explorative). A full 26 of the non-clinical studies were classified by the researchers or

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Manifestation</th>
<th>Studies</th>
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<tbody>
<tr>
<td></td>
<td>Explorative-interpretative</td>
<td>(All other studies)</td>
</tr>
<tr>
<td>Experimental</td>
<td>Yes</td>
<td>Cannon et al. (2010), Granda (2014), Guardino et al. (2014), and Kwon et al. (2022b)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>(All other studies)</td>
</tr>
<tr>
<td>Type of data</td>
<td>Quantitative</td>
<td>Bunta and Douglas (2013), Cannon et al. (2010), Cannon et al. (2020), Guardino et al. (2014), Guiberson 2014, Kwon et al. (2022b), Schrötzlmair et al. (2012), Teschendorf et al. (2010), Thomas et al. (2008), and Waltzman et al. (2003)</td>
</tr>
<tr>
<td></td>
<td>Mixed methods</td>
<td>Baker and Scott (2016), Kwon et al. (2022b), Shin (2003), and Swanwick et al. (2021)</td>
</tr>
<tr>
<td></td>
<td>Qualitative</td>
<td>(All other studies)</td>
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</table>
through an analysis of the research design as explorative, while only three took a nomological perspective. Many of the projects analyzing quantitative data also invoked explorative research paradigms, although projects focusing only on quantitative results tended to pose hypotheses in some form. All projects considering only qualitative data were explorative.

Third, only four studies conducted intervention research, of which three were single case design studies carried out by the same research teams. These involved small numbers of participants with between one and five learners, as to be expected in such heterogeneous populations. Finally, the primary data gathered and analyzed through the study was generally qualitative, with 21 studies gathering only qualitative data and a further four studies both qualitative and quantitative data. The remaining five (non-clinical) studies focused on quantitative data and tended to have slightly larger participant numbers. In almost all cases of quantitative data analysis, the researchers chose to present only descriptive data (i.e., generally raw data and averages), but eschew inferential statistical testing – unsurprising considering the small number of participants involved and thus the difficulty in achieving sufficient power to yield statistically significant results.

To describe the data collection chosen for the studies, we described studies along two basic categories: (a) data gathering technique (observational, survey, educational records, or testing), and (b) type of instrument used (i.e., videography, field notes, interview, questionnaire, school records; Table 8):

Table 8: Data collection techniques.

<table>
<thead>
<tr>
<th>Manifestation</th>
<th>Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observation – field notes</td>
<td>Guiberson (2014), Kusters et al. (2021), and Kwon et al. (2022b, 2023)</td>
</tr>
<tr>
<td>Survey – questionnaire</td>
<td>Becker and Juche (2018), Crowe and Guiberson (2021), and Steinberg et al. (2003)</td>
</tr>
<tr>
<td>Survey, testing, school records</td>
<td>Baker and Scott (2016), and Kwon et al. (2023)</td>
</tr>
<tr>
<td>Survey, testing, school records, observation</td>
<td>Granda (2014)</td>
</tr>
</tbody>
</table>
Twelve projects used only survey data, three only observation data, and eight assessment data (including four clinical studies), whilst ten projects combined survey data with one or more other methods of data collection. Of these, one project combined interviews with videography, four with field observations, two with the examination of school records, and one single-case study that used data from questionnaires, interviews, school records, videography, and assessment (Granda 2014).

Of the survey methods used, five projects invoked questionnaires as collection instruments, whilst 21 projects used (mostly semi-structured) interview techniques, and four projects combined interviews with questionnaires. For the observational data, only two projects included videography as a method of data collection (de Garcia 1993; Granda 2014), and nine used participant observation with field notes. Three studies included school records, often retrospectively, and eleven studies in total involved testing of one or more of the languages used by the learners.

Central to the data collection method and instruments is the type of information to be gleaned from the data. For projects using surveys, for example, at least one of three aspects was at the forefront. Studies using interviews with teachers and other service providers as one of the chosen instruments were generally interested in educational perspectives and educational needs of DML. Projects where the learners themselves or their parents were interviewed often had a focus on DMLs’ communication and language use. Finally, data collected through interviews with parents or service providers focused on family decisions about language use, medical interventions, and/or educational choices, such as which schools the children should attend. Observational data, in contrast, was collected solely to explore learners’ communication skills and language use in context within the home, school, and community settings.

Some studies utilized standardized instruments keyed to specific languages to examine various aspects of language comprehension and production and, in one case, auditory measures, or ad hoc instruments developed by the researchers to examine one aspect of language, such as grammar, reading comprehension, or vocabulary. Only five out of 33 studies assessed the language proficiency of the participants in the study with standardized data collection assessments (Table 9 in Supplementary Material). Nine other studies examined an aspect of language (e.g., vocabulary knowledge, receptive auditory skills) but did not provide assessment results indicating overall language proficiency. And five out of those nine studies reported language proficiency via parent report or interview, but did not assess the learners themselves. Four studies reported on the language proficiency of DMLs in their second language, with one reporting information from parent interviews about both the second (Korean) and third (ASL) languages utilized by the learners (Shin 2003).
As with the previous categories of interest, data collection methods were dependent upon both the number of participants involved (the fewer the number, the more instruments), and the primary question of interest in the study. A combination of instruments for in-depth qualitative data, but with a focus on interview data, seemed to be preferred, while methods such as videography or examination of school records were much less common.

6 Discussion

This scoping review aimed to answer the question: What kind of research is being carried out on/with the population of DML regarding experiences of language acquisition, development, use and education? The specific variables for this methods review included what was primarily of interest for all researchers – which DML were considered and how much information was provided about them, who was involved in the study and how data was collected and analyzed. Aspects were considered separately for the purpose of the review, yet are associated with each other. For example, studies focusing on pre-school DML tended to conduct qualitative interviews with adult research participants (usually parents and teachers of these young children or further service providers). However, because of the heterogeneous nature of the studies considered and the small number of studies available, it was not possible to cluster the categories into larger entities. Thus, we summarize observations within categories and base recommendations on overreaching aspects identified through these summaries.

6.1 Research questions

The research questions posed across a third of the studies reviewed ask for more information about the DML and their families. This aligns with recommended methodology when investigating a new phenomenon or population. Understanding the characteristics of DML can assist professionals in providing linguistic supports that might increase language and literacy skills, as well as social-emotional development. The majority of studies asked research questions about the family’s, educational professional’s, and learner’s perspectives about the educational system and their decision-making processes. These research questions can assist professionals in ensuring they are using family-centered practices that engage them in the DML’s language acquisition and schooling.

Understanding the backgrounds of DML and the perspectives of professionals provides the field with a foundation for culturally and linguistically diverse
strategies and practices. Yet, only eight studies contained research questions about language and literacy interventions with DML. This highlights the minimal research on linguistically and culturally responsive teaching practices with DML.

6.2 Population under consideration

In the investigation of low-incidence, heterogeneous learner groups, accurate descriptions of the population of interest are important. We reviewed the population under consideration and found that only half of the studies actually focused on learners, while the remainder considered the family and educators working with these learners. For example, only just over half of those studies reported the age at which the learner and/or their family immigrated to their current country, even though this is a vital piece of information to understand the cultural and linguistic background of the DML and their family. Results showed that many studies did not collect enough data to offer a holistic picture of DML, including more detailed information about their length of time and exposure to schooling and language.

A holistic perspective of DMLs’ backgrounds can then provide perspective on how the multiple languages of participants may impact the methodology of the research and allow researchers to consider how they use methodology to mitigate these variables and strengthen their research design. Understanding the language and the culture of the population being considered can help researchers realize how they may impact the way people respond to surveys, interviews, interventions, etc.

A gap within the studies reviewed includes asking questions and reporting on whether or not DML had a disability. Researchers must consider that 40–50% of d/Dhh learners have disabilities (Gallaudet Research Institute 2013), which may have an impact on language acquisition, as well as the variations in services and supports across countries. This again highlights the importance of providing as much information as possible about all DML research participants.

6.3 Languages and cultures involved

The large disparity between the number of spoken languages and sign languages may indicate that heritage sign language is not accessible in some countries (i.e., no formalized sign language and/or courses for instruction), professionals are not encouraging use of them by families, and/or families have chosen listening and spoken language for their child’s mode of communication and do not expose them to their native sign language.
Of interest is that all studies reported the use of at least one spoken language, but only 18 studies also reported DML participants using a sign language; and of these, 14 report only the sign language of the host country community. The languages considered were almost solely English or ASL, the two dominant languages in the United States and Canada, where the majority of the work was published. Considering that across all 33 studies, a total of 44 different spoken and sign languages were utilized by the participants, we seem to know very little about the linguistic profiles of DML involved.

### 6.4 Research participants involved

We considered research participants regarding both number and type. In general, the number of participants was quite small, ranging from single-case studies to a maximum of 65 individuals. However, over half of the studies involved under ten participants. Since many participants were not DML themselves, our knowledge of the entire population is informed by direct data from only 219 DML participants – 101 of whom were involved in clinical studies – in 19 studies. Logically, the number of participants was commensurate with the methodological design of the study (e.g., three single-case design studies with under five participants; case studies with one participant).

Regarding participant groups, most studies looked to only one population, whether DMLs, parents, teachers, or other service providers, although twelve studies did turn to two or more groups – often, but not always, involving a combination of learners and their parents and/or families. Very few studies gathered data from more populations, such as learners, parents, and teachers, and only five studies compared DML with a comparison group of d/Dhh learners whose families did not speak a heritage language at home. The choice of research participants was also related to the research design, with testing involving only the learners, interviews being the mainstay for data from parents or educators and further service providers such as school principals or speech-language pathologists, and observations for data from families.

The small numbers of research participants – especially of DML themselves – and the tendency to focus on only one population reflect the difficulties involved in studying low-incidence populations. However, this narrow focus raises questions about the validity of the information available to date. This becomes especially relevant when considering issues of sampling.
6.5 Sampling methods

The studies considered here relied completely on non-random sampling and, specifically, most often self-selection of participants in convenience sampling procedures. This is unsurprising considering the nature of the diverse, low-incidence population of interest and the choice of qualitative research designs in the majority of projects. As well, it reflects the tendency of most educational research on specific target groups. While no sampling procedure is “better” or “worse” than the others, but rather depends on the accessibility and diversity of the population being studied and the research questions of interest, it is important that a research field is informed by data gathered through a variety of sampling procedures in order to ensure that a wide variety of situations are considered. This is not the case with the group of studies on DML. Thus, results as a whole must be interpreted with caution.

6.6 Research design

With the exception of the clinical studies, which carried out group comparisons on quantitative data, almost all studies were explorative and non-experimental (with the exception of three single case design studies) which elicited qualitative data. The decision to conduct exploratory, qualitative research is most certainly tied to the dearth of information in general on DML. However, it does point to some obvious research gaps, which it would be advisable to address in future research.

Notably, there is a major reliance on introspective data, which is useful for gathering information on attitudes and motivation, but less valid when considering aspects such as linguistic behavior or proficiency levels, where methods such as observation and assessment are preferable. The lack of observational data is most likely due to its strain on both personell and financial resources, requiring a large number of researcher hours and, in the case of video data, expensive technical support. Such issues are not as relevant when using assessment instruments, but these come with their own caveats. Most prominent is the fact that there is a general lack of research instruments available for the DML population. This resulted in the use or adaptation of instruments – both survey and assessment – developed for other populations and lacking norms for DML. Confounding this difficulty is that most instruments were used without consideration for difficulties arising through the fact that test-takers were learners of the test language, meaning that difficulties in the tests may actually be due to difficulties understanding test items and instructions. Of particular concern is that, although all studies were concerned with language experiences of DML, very few even noted their language abilities or reported any
language assessment data, and of these, sign language assessments were extremely rare.

Finally, even survey data is not without its problems. In a population as heterogeneous as DML, survey data may not be able to portray accurately the complexity of learners’ situations, since respondents are typically answering questions in their second or third language and may not provide all information if they do not trust/know the researchers. This should also be considered when evaluating information stemming from such studies.

7 Recommendations and limitations

Our goal in conducting this scoping review was to understand the types of research methodologies and information utilized with DML to gain a broader perspective on where researchers should go next in the field. The research community as a whole would benefit from expanding questions/hypotheses posed in studies with DML. Studies are needed which go beyond considering the experiences of learners, families, and educators, and ask what practices work best to support language development for this population.

A major recommendation arising from the review is that demographic information about the linguistic and cultural background of the family and the DMLs’ intersectionality (Crenshaw 1989) should be gathered within a study. Attention to comprehensive demographic information allows researchers to gain a valid picture of the whole child and is vital to understanding the linguistic influences of the learner in previous and current environments. Lack of information about the language exposure of learners who experience multiple languages, cultures, and regions across their home, community, and school setting is of great concern; the emphasis on learning current societal languages, and not on a child’s the full linguistic repertoire child, neglects the influence of the family’s background on multilingual acquisition. A first step to gathering such data would be for the research community to develop a tool offering a summary of important questions for learners, their families and teachers regarding language and education of the learner.²

Recommendations regarding research methodologies include the fact that survey data, which is introspective in nature, cannot stand alone when researching educational experiences and language proficiency. Survey data is especially useful when considering participants’ opinions, attitudes, or desires, or when gathering

² For a continuously evolving list of recommended items for questionnaires and interviews regarding these learners, see the OSF project on Research with d/Deaf and Hard-of-Hearing Multilingual Learners: https://osf.io/ghz89/?view_only=8ab2a81c5f3045028be9195072b99861.
information not accessible through other means (e.g., because school records in a previous country are not available). However, it is markedly less valid when considering aspects such as current language exposure and use, classroom practice, or language proficiency. For data on language exposure and use and classroom practice, observational fieldwork – preferably using videography as a supportive tool – is preferable, since human subjects tend to self-report unreliably. In the studies reviewed here, only two research teams turned to videographic methods to gather observational data in the family or the classroom. This is a major desideratum in research on DML and their language and educational experiences and should be considered in future research. As with survey data, it would be helpful to develop methodological tools for a wide variety of languages and countries, including observational matrices for language communication within families or peer groups, as well as for classroom practice situations.

Although vital to understanding the population being examined, assessing for overall language proficiency across multiple languages is a challenge, and assessments of language proficiency were sparse in the studies. Self-report measures are especially unreliable, so that information about language proficiency is best gained through holistic assessment using a combination of instruments, secondary data such as work samples or school records, and observation. These data can then be compared to interviews and parent/teacher reports of language proficiency. In this way, longitudinal research can also track language progress over time and increase external validity.

Regarding instruments, assessors and assessments across multiple languages may be necessary to provide the most accurate data with learners with complex linguistic and cultural backgrounds. Although valid data regarding a learner’s language proficiency across all languages (spoken and signed) is important, gathering such data may be difficult if fluent users or assessments for specific languages are not available (Pizzo and Ford 2022). This is a further reason why data from a variety of sources is advisable. One possibility utilized in some studies is to consider observational matrices that can be applied across languages. Such instruments, however, do come with their own caveats (including the difficulty of not being culturally sensitive) and should thus be used with the appropriate degree of caution. When using instruments, researchers should consider whether they have assessed all the languages the learner is exposed to, and how results should be evaluated if students are not proficient in one or more of the languages. Additionally, studies should report the language abilities and the training of the examiners/researchers who administer language assessments to their participants, as proficiency of the examiner impacts results. Finally, despite the need for comprehensive information about learners’ languages and cultures, researchers should carefully consider the amount of time it takes to complete a battery of assessments and balance this with the information
provided by the results (e.g., missing up to 6 h of instructional time; Taub and Valentine 2014). Many DML have missed a significant amount of schooling, and any time spent on assessments during school hours is time spent away from instruction.

Tied in with this is the recommendation that researchers reflect on their personal cultural competence, including knowledge, skills, and understanding to facilitate interactions across different cultures (McCain and Farnsworth 2018) in order to better understand the complexities of populations that may involve multiple languages and cultures. This could affect how, why, and when languages are utilized in studies and assessments – and in what roles – as well as highlight the connections between the multiple linguistic and cultural identities in DMLs’ lives. However, utilizing culturally and linguistically diverse practices to elicit detailed, and often personal, family information that is accurate involves building trust and rapport with families and the community. Building these foundations for research takes time, energy, and commitment and is best accomplished through communication in the families’ home language and culture (Musyoka and Adeoye 2021). This is one of the reasons why sampling procedures are strongly based on convenience measures.

Who is being asked to participate in the research is a central concern. Similar to data triangulation for language use and proficiency, we recommend participant triangulation (Hammersley 2008). Studies should aim to involve different groups associated with a particular DML population of interest, such as educators, support staff and students, families, peers and students. This is particularly important for DML due to their complex language, family, and experiential background (Cannon et al. 2022). Further, how these participants are being found should be reflected upon. A research field fully dependent on convenience samples will lack external validity, since only persons readily accessible to researchers and willing to take part in their projects will be reflected in the data – and the research with DML almost completely relies on such samples. While a completely satisfactory solution is probably not possible, one recommendation would be to attempt to include different (non-random) sampling methods within a study, including quota sampling (Acharya et al. 2013). As well, a transparent presentation of sampling procedures would do much to warn of potential validity issues with the results found.

Finally, considering that supporting the education of these learners is a primary concern, pedagogical interventions should be tested in different contexts to determine their effectiveness. Here, single case design studies can be of especial value, since they are subject to stringent standards, are replicable, and can be carried out with very small groups, but at the same time, can be compared to each other (Kazdin and Tuma 1982; Wendel et al. 2015). As well, they allow for individualization to meet the complex needs of the learners, whilst adhering to empirical standards. Here, again, it is advisable to collaborate across contexts. Developing study designs that can be (and are) easily replicated and carried out in different situations, with different
learners, and focusing on different languages, is a promising route for learning more about how educational systems can best support DML.

Limitations of the current scoping review include the small number of research studies available for examination, and the fact that only those published in German and English were reviewed. Further research across the field published in other languages may provide additional insight into relevant research designs and methods to answer a variety of questions about DML and their languages. As a scoping review, the recommendations reported here should be viewed with the knowledge that more research is necessary to answer research questions across a range of methodologies.

The breadth and scope of studies reviewed point to specific gaps in the literature, which should be reflected upon and addressed in order to better support the unique and complex language and academic development of DML. Therefore a summary of the recommendations from this scoping review include: (a) gathering appropriate background information on participants; (b) going beyond survey data to include videography, observational matrices across languages, holistic assessment, and longitudinal data; (c) reflecting on researchers’ cultural competence and the intersectionality of the participants; (d) incorporating participant triangulation and quota sampling into research designs to increase validity and reliability; and (e) utilizing single case design research methodology to investigate culturally and linguistically responsive teaching techniques across research teams. In summary, the field of research involving DML is continuously evolving and shows great promise in its potential to aid in the understanding of these learners’ language development, language use, and language education if researchers work collaboratively and incorporate these recommendations.

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