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RESEARCH REPORT

Staff perceptions and experiences of using Key Word Signing with children with Down syndrome and their peers in the first year of mainstream primary education

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ABSTRACT

Background: Key Word Signing (KWS) is one system that can be used to support the communication needs of children with Down syndrome (DS) who attend mainstream school. The success of KWS in schools is mediated by staff experiences and perceptions of KWS. The current study is one of the first to explore KWS use in mainstream schools.

Aims: To explore the perceptions and experiences of teachers and special needs assistants (SNAs) with reported varying levels of experience, using KWS with children with DS and their peers in the first year of mainstream primary school. Secondly, we aimed to explore how those perceptions and experiences evolved throughout the year.

Methods & Procedures: Five mainstream schools were recruited where children with DS attended. A speech and language therapy (SLT) researcher taught 25 key word signs to the relevant class in each school at four time points across the year. Five teachers and eight SNAs from participating schools engaged in a series of semi-structured interviews to explore their perceptions/experiences of using KWS (*Lámh*) over the course of the year. Longitudinal data were analysed using inductive qualitative content analysis.

Outcomes & Results: Four categories were generated from the data: Challenges, Facilitators, Benefits, and Incorporation into the whole school environment. Findings suggest that the supported introduction of KWS in school by an SLT researcher can assist inclusive educational practices; facilitate children's comprehension and expression; reduce frustration in children with DS; and facilitate interaction with peers. Results also indicate an increasingly positive attitude among teachers and SNAs towards KWS as the year progressed. Teachers reported the absence of a pedagogical framework as an obstacle to the integra-

tion of KWS into the curriculum, while SNAs highlighted inconsistent access to funded entry-level training.

Conclusions & Implications: Overall, using KWS was a positive experience that supported communication in children with DS in mainstream school. However, future training should embed knowledge on key facilitators and consider how challenges can be addressed to maximize the potential of all children with communication needs attending mainstream primary school.

KEYWORDS

Down syndrome, inclusive education, Key Word Signing, Lámh, mainstream school, special needs assistants, teachers

WHAT THIS PAPER ADDS

What is already known on the subject

- It is well established that the use of KWS is beneficial in supporting the language and communication needs of children with DS. It is also accepted that if KWS is to be effective as a system of communication, the system needs to be understood and used by the communicative partners of those who rely on it. However, many staff in mainstream schools (with children with DS in attendance) have had limited exposure to KWS, little to no experience of using KWS and limited support available to help them create a signing environment.

What this paper adds to the existing knowledge

- This study provides a current account of the perceptions and experiences of teachers and SNAs to the use of KWS in mainstream primary schools in Ireland. Through qualitative approaches it identifies a number of benefits, facilitators and challenges to the use of KWS in schools, as well as the need for KWS to be incorporated into a whole-school approach to communication. Lastly, the study indicates that with ongoing support over the course of the school year, staff attitudes towards KWS changed and became increasingly positive.

What are the potential or actual clinical implications of this work?

- To facilitate the successful implementation of KWS in schools there is a need to develop a whole school-tiered intervention approach to KWS in mainstream schools. This study also highlights the need for ongoing support for school staff to use KWS to ensure successful implementation.

INTRODUCTION

Inclusion is a fundamental ideal based on democratic principles within the human rights framework; it refers to a multifaceted process that targets both the right to take full part in school life and the right to achieve the individual's full potential. In 2006, the United Nations Convention on the Rights of People with Disabilities guaranteed the right of people with disabilities to full participation in mainstream society, requiring that states recognize the right to education and ensure an inclusive education system at all levels (United Nations, 2006). Accordingly, all students, regardless of their intellectual ability, should be welcome at their local educational setting and provided

with appropriate supports to fully participate in all aspects of learning (Faragher et al., 2020; UNESCO Office Bangkok and Regional Bureau for Education in Asia and the Pacific, 2009).

In the Irish context, the Education for Persons with Special Educational Needs (EPSEN) Act 2004 (Government of Ireland, 2004) provides a statutory basis for educational provision for children and young people with special educational needs. The legislation has contributed to an increase in the number of children with special educational needs attending mainstream schools in Ireland.

Despite what appears to be increased integration, McCarthy and Light (2022) argue the concept of inclusion is complex and encompasses much more than classroom attendance. Whereas integration refers to a process of placing students together in the same setting, inclusion involves ensuring that the processes and routines within the setting are designed to maximize participation (Lynch et al., 2023). Children with disabilities are not always socially accepted by their typically developing peers and often encounter negative attitudes, bullying, social exclusion and isolation (Babik & Gardner, 2021). In addition, typically developing children who experience meaningful interactions tend to have more positive attitudes towards individuals with a disability (Babik & Gardner, 2021). In this context, school staff would benefit from training in inclusionary practices and ongoing support to implement those practices consistently and effectively (McCarty & Light, 2022).

Key Word Signing (KWS)

One such inclusionary practice used with children with intellectual disability (specifically Down syndrome (DS) in this context), is KWS, a manual signing system used to support language and communication. However, many staff in mainstream schools (with children with DS in attendance) have had limited exposure to KWS, little to no experience of using KWS and limited support available to help them create a signing environment.

KWS systems are used internationally, with some systems devised specifically for people with intellectual disability, for example, *Lámh* in Ireland (meaning *hand* in Irish), and Makaton in the UK (Walker, 1978). *Lámh* entry-level training is available directly from the employer, who may apply for funding (e.g., from the National Council for Special Education—NCSE) to source a limited number of places. Alternatively, individuals or groups can self-fund privately. Data regarding the number of children that use KWS in mainstream schools in Ireland are not available, which may reflect the lack of a structured approach from policy and government. In addition, a school-specific KWS course has not yet been established in Ireland. This is significant as teachers require an understanding of how to apply pedagogical principles to integrate sign into the curriculum; how to focus on the specific vocabulary and activities undertaken in mainstream schools; and how to encourage other staff members and children to use KWS.

KWS in mainstream schools

The introduction of KWS into mainstream schools can be considered a complex behavioural change intervention (Law, 2019). The extent to which interventions are effectively implemented in a real word setting (implementation science) is central to their success (Hutchins & Schmitt, 2024). In line with implementation science models, such as the integrative Theoretical Domains Framework (Atkins et al., 2017; Michie et al., 2011), it is vital to establish current staff attitudes and evaluate change in perceptions regarding new practices over time. Identifying facilitators and barriers to change will also inform the development and efficacy of future inclusionary practice trainings. The current study aims to understand staff perceptions and experiences of using KWS in a mainstream setting and to examine how these perceptions might change over time if given some support over the course of the school year.

Current research supports the inclusion of students with disabilities in mainstream education classes (O'Regan Kleinert et al., 2023). One of the core ideas behind inclusive education is that students with and without disabilities experience social benefits in attending school together (Buckley et al., 2006). However, academic benefits for children with disabilities have also been reported, including enhanced literacy development and an improvement in expressive language abilities (Couzens et al., 2012). A recent systematic review of specific interventions focused on Alternative and Augmentative Communication (AAC) also indicated an improvement in communication ability and social interactions with peers (O'Regan Kleinert et al., 2023).

Why KWS is important for children with DS

Children with DS are a group that are increasingly been educated in mainstream schools in Ireland (Shevlin et al., 2008). As a group they are particularly challenging in the context of having language difficulties that are disproportionate to their overall cognitive abilities (Frizelle, 2019). As outlined by Abbeduto et al. (2007), a child's expressive language skills are fundamental in enabling them to participate and advocate for themselves, and hence

facilitate inclusion. The speech and language difficulties evident in children with DS are therefore likely to challenge their agency and participation. For example, a low level of speech intelligibility can undermine a child's ability to clearly communicate their intentions and desires and to play with their peers; difficulties with receptive language can make it challenging to influence class discussions; and expressive language difficulties can make participating in class group work problematic—all vital areas for successful inclusion. Indeed, expressive language skills, in particular, have been reported to be the strongest predicator of teacher ratings of classroom inclusion of children with DS (Engevik et al., 2018). Despite these difficulties children with DS have relative strengths in their visual processing, imitative skills (Vanvuchelen et al., 2011) and in their use of gesture (Zampini & D'Odorico, 2009). Therefore, KWS is a tool that can capitalize on these core strengths and is used extensively with children with DS to facilitate communication (Wright et al., 2013). KWS involves using manual signs while simultaneously speaking to highlight the most salient/content words in a sentence (Rombouts et al., 2017). The KWS system used in Ireland, *Lámh*, has a total vocabulary of 588 signs, while Makaton in the UK consists of both a signing and symbol vocabulary (Walker, 1978). Other countries have not devised a specific system but borrow from the sign language within the country it is being used for example, American Sign Language (ASL) in the United States and Auslan in Australia. Using KWS has several advantages for young children with DS, including the fact that it has been shown to promote the development of spoken language (Launonen, 2019). It also facilitates comprehension by allowing more time to process information (Emmorey, 2002); reducing the complexity of the message (focusing on the key words in the sentence); making word boundaries more distinguishable (Rombouts et al., 2017); and reducing demands on verbal working memory. Lastly, it compensates for oromotor difficulties experienced by people with DS in that it involves using the hands (with simplified hand positions) and body (Woll & Grove, 2019).

Staff perceptions of KWS

Although, research has been carried out examining parents' experiences of KWS (Glacken et al., 2019), and the attitudes of peers towards KWS in schools (Bowles & Frizelle, 2016), research focusing on staff perceptions exploring the use of KWS with children with DS in mainstream schools is limited. Furthermore, there is no prior research specifically focusing on school staff perceptions' of KWS and how they may evolve over time.

School-based studies have tended to explore AAC in segregated settings (Iacono et al., 2022; Tönsing & Dada, 2016); focus on the use of more high-tech speech generating devices (Barbosa et al., 2018); and evaluate aided interventions (Leonet et al., 2022). Current practice indicates a shift over the last 30 years in how KWS is viewed, from a method of communication reserved for children deemed unsuitable for mainstream education to a good example of inclusive practice internationally (Rombouts et al., 2019). However, research reflecting that shift is sparse. One significant study by Sheehy and Duffy (2009) in which school staff attitudes to KWS were examined in the UK compared findings from two studies carried out in special schools in 1986 ($n = 30$) relative to 2005 ($n = 59$) through the medium of individual interviews in the school setting. In contrast to the original study, learning support assistants and classroom assistants were included in the follow-up 2005 study to reflect their increasingly significant role in the classroom. Overall, they reported that attitudes towards the use of KWS had become more positive, it was seen as something that supported and facilitated language development, and the previous stigma associated with signing had reduced. They also highlighted the variability of attitudes that existed within the same school, and the significant impact that teacher attitude had on the educational experiences and opportunities for children with intellectual disabilities. While positive staff attitudes towards KWS led to an increase in sign use, negative teacher attitudes and beliefs about KWS meant that they were unlikely to succeed implementing KWS in the classroom. Another relevant study carried out by Sheehy and Budiyanto (2014) provided insights into the attitudes of teachers towards the potential use of KWS in Indonesian primary schools. Based on semi-structured interviews ($n = 20$) and questionnaire responses ($n = 69$), there was a consensus among participants that signing is relatively easy to learn and can encourage the use of speech in children with a learning disability. While the majority of attitudes were positive, there was also agreement among participants that signing can stigmatize children due to parental disapproval of KWS for their children and limited exposure to signing in the media, specifically on television. While the authors acknowledged the findings may not be representative of teachers across the country due to Indonesia's diversity, the findings show the relevance of culture and existing practices.

Rombouts et al. (2017) explored the attitudes of secondary school teachers working in special schools and adult support staff towards KWS through the medium of individual semi-structured interviews ($n = 10$). A commonality between all participants related to the consistency of use of KWS which was shaped by three behavioural components, namely, effectiveness, self-

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monitoring and environmental facilitators/barriers. In particular, perceptions of insufficient time and skills needed to maintain KWS, led to an increased likelihood that use of KWS would fade following initial implementation. An additional study by Norburn et al. (2016), which explored the use of AAC more broadly with children with complex needs (again in a special school), also highlighted inconsistent use as an issue across the school. Although KWS (Makaton) was reported to be the most frequently used mode of AAC, limited access to training, and subsequent lack of understanding and confidence were considered by participants to be key barriers to implementation. Norburn et al. (2016) advocate for further research into implementation and training for communication partners to enhance their understanding of why they are using a particular AAC strategy, which will in turn motivate consistent use. Therefore, for KWS to be successful in school it is important that we have a comprehensive understanding of teachers' and other staff members' perceptions and experiences of KWS.

The current study

Given the ongoing increase in the number of children using KWS in mainstream primary schools due to inclusive education policies; training opportunities emerging for school staff; the use of KWS in the media; and the aforementioned research gap, it is important that staff attitudes are explored to inform the development of future training and KWS implementation in schools.

Previous research exploring teachers' and other staff members' perceptions and experiences of KWS have tended to use cross-sectional data collection methods exclusively. The current study takes a more longitudinal approach, to explore individuals' experiences over time and aims to enhance what is known through multiple data collection points (Lyons et al., 2022). In addition, given the relatively recent policy shift in Ireland regarding the dual role of special needs assistants (SNAs) in personal care and in supporting pedagogical activity under the direction of the class teacher, the elicitation of SNA perceptions is a necessary consideration (National Council for Special Education, 2018; Zhao et al., 2021). In different countries, those who play a similar role to SNAs, are given different titles such as special education needs teaching assistants (SEN TAs) in the UK, paraeducators in the United States, and educational assistants—special needs in Australia.

To the best of our knowledge, no study has explored how teachers' and SNAs' perspectives of KWS evolve over the course of a school year, while receiving some degree of ongoing SLT support. In the current study, we investigated the following research questions:

- What are the perceptions and experiences of teachers and SNAs using KWS (*Lámh*) in the first year of mainstream primary school?
- How do their perceptions/experiences evolve over the course of the school year?

METHOD

This study was part of a larger project which aimed to develop a core KWS vocabulary to facilitate communication with children with DS in the first year of mainstream primary school in Ireland (Frizelle & Lyons, 2022). We have used the Consolidated Criteria for Reporting Qualitative studies (COREQ): 32-Item Checklist as a reporting guide (Tong et al., 2007).

Research team and reflexivity

The interviewer (second author) was a qualified SLT with a BSc (Hons) degree and Quality and Qualifications Ireland (QQI) level 5 training in *Using Lámh in a Total Communication Approach*. The SLT researcher and the school staff had no prior knowledge of each other before the interviews began. The first and third authors, who conducted the primary and secondary data analyses, respectively, have backgrounds in SLT as well as experience in qualitative data analysis. Data were anonymised prior to analysis.

Study design

The study uses a qualitative longitudinal design where participants were interviewed on multiple occasions over the course of the school year. This method is appropriate when exploring change over time (Read, 2018). Carrying out a series of interviews allows the researcher to build trust and to explore different aspects of participants' experiences. This methodology also helps to overcome biases that can be associated with one-off interviews, such as a tendency toward safe and less complex answers and can help to provide insights into what change (if any) has happened, why change has occurred as well as the consequences of that change (Lyons et al., 2022).

Participant selection

Participants were five teachers and eight SNAs (all female) from five different primary schools and were identified on the basis that they had children with DS in their

Junior Infant class (the first year of mainstream primary school). As such, a purposive sampling approach was taken to ensure that participants had relevant experiences and could provide a rich insight in the topic of KWS in school (Patton, 2002). Once parents had consented to their child with DS taking part in the larger study, the researcher contacted the principal of each child's school. In line with best practice guidelines, the principal acted as a gatekeeper to potential participants and was asked to share the study information and consent forms with the child's class teacher and SNA(s). Teachers and SNAs were invited to contact the researcher to discuss the project in more detail and confirm that they were willing to take part. Initially, this resulted in a total of five teachers and five SNAs (all invited participants). However, as the year progressed some participants had a number of different SNAs, so this resulted in eight SNAs participating in the study. Degrees of staff training in the use of KWS are shown in Table 1. Beyond their training we do not have further information on their degree of experience using KWS. However, given teachers completed the formal KWS training in preparation for the school year and based on the interview responses (expressing apprehension during initial implementation), we can infer that overall experience was limited.

Data collection

Data collection was carried out through interviews at four time points in the school year: the beginning of Term 1 (September/October 2019), midpoint of Term 1 (November 2019), the beginning of Term 2 (January 2020), and the beginning of Term 3 (April/May 2020). The study was designed such that each interview phase involved five school visits, one to each of the schools involved. The aim was to interview each of the teachers four times; however, one teacher was on maternity leave for the final interview and was therefore unavailable. This resulted in a total of 19 teacher interviews. Eight SNAs participated in the study, but only one SNA from each school was interviewed at each of the four time points. In three of the five schools, the same SNA was consistently interviewed throughout the study ($n = 12$), while in the other two schools, rotating SNAs were interviewed (n = 8). Therefore overall, there were a total of 20 SNA interviews conducted.

The intention was to conduct all interviews on a one-to-one basis in a quiet room in each school. However, for the final phase of interviews all primary schools in Ireland were closed due to the COVID-19 pandemic, therefore interviews were conducted remotely through the Zoom® platform. The interviews with teachers and SNAs were structured so that all teachers and SNAs were asked the

TABLE 1 Level of Key Word Signing (KWS) (*Lámh*) training completed by each of the school staff involved in the study.

School	Staff	Gender	Entry-level KWS (*Lámh*) training completed
School 1—Rural	Teacher 1	Female	Module 1
	SNA 1	Female	Module 1 and Module 1 Add On
School 2—Rural	Teacher 2	Female	Module 1
	SNA 2.1	Female	Module 1
	SNA 2.2	Female	–
School 3—Rural	Teacher 3	Female	Module 1
	SNA 3.1	Female	–
	SNA 3.2	Female	Module 1
	SNA 3.3	Female	–
School 4—Rural	Teacher 4	Female	Module 1
	SNA 4	Female	–
School 5—Urban	Teacher 5	Female	Module 1
	SNA 5	Female	–

same set of questions. However, there was also scope for topics that were not specifically probed to be discussed, and the teachers and SNAs had the freedom to raise issues which may not have been anticipated. Interviews covered a range of topics relating to KWS in school, including what KWS vocabulary items would be most useful in school, learning and using signs, and barriers and facilitators to using KWS (*Lámh*) in a school environment. For the purpose of this study, only those questions that specifically addressed staff perceptions and experiences were analysed and reported. The original interviews were between 30 and 45 min long. The final virtual interviews lasted up to 90 min. The specific questions designed to probe staff perceptions and experiences at each interview phase are available in Supplementary Material in the Supporting Information section.

To provide the wider context, 1–2 weeks after each interview phase, the researcher carried out a school visit where she demonstrated 25 signs for the class (a total of 100 signs over the course of the school year). Given that there was no other SLT support to the school, we considered it unethical to carry out research on staff perceptions/experiences of using KWS (*Lámh*) in school without providing participants with some level of training in the *Lámh* signs they deemed necessary to facilitate optimal communication over the course of the year.

Data analysis

Data were analysed cross-sectionally and longitudinally using a sequential approach. We chose to use inductive content analysis as it facilitated a deeper qualitative analysis of the data while at the same time conducting a quantitative analysis using frequency counts of responses (McAllister et al., 2022). The data were analysed following the three phases of preparation, organizing and reporting (Elo & Kyngäs, 2008).

Preparation phase: Analysis began with multiple readings of the transcripts by the first author. Participants' answers to each interview question at each respective phase were organized to facilitate cross sectional analysis at each phase. The dataset was unstructured to allow codes and categories to be generated from the analysis.

Organizing phase: The lead author organized the data using open coding creating categories and abstraction as per six-step process outlined in Hilari et al. (2024) (see the Supplementary Material in the Supporting Information section). Categories and subcategories were identified from the data. In this open coding stage, the researcher identified units of content in a comment column on an Excel spreadsheet. Following review and consultation with the last author, the data were then coded, and frequency counts were taken. Categories were generated and grouped to produce higher order categories by merging similar categories. Once categories and subcategories were established, a matrix was then used to organize, track data and retain temporal structure of the longitudinal data. The matrix provides a visual representation to systematically examine how individuals compare to different time points (see the Supplementary Material online).

Reporting phase: The findings are described with illustrative quotes from the data. Longitudinal data were organized in a matrix with time points across the *x*-axis and subcategories along the *y*-axis. Excerpts and the numbers of participants whose responses were group into a subcategory at each respective phase of the study populated the content boxes between the *x*- and *y*-axes (Lyons et al., 2022). Although data were analysed separately, categories and subcategories have been colour-coded to indicate whether they are applicable to both teachers and SNAs or to one profession only (Figure 1). Participant quotations were coded according to profession and study phase (1–4). For example, SNA quotations were coded as SNA1, Ph1; SNA2, Ph2; while teacher quotes were coded as T1, Ph1; T2, Ph2. Therefore, SNA codes were assigned to reflect the rotational nature of the role. For example, SNA2.1, Ph1; SNA3.1, Ph1. Participants with DS who were referred to by teachers and SNAs in the results are coded by participant number and school. For example, participant 1 who attends school 1 is PPT1.

Rigour

Study rigour was enhanced using a number of strategies. Confirmability was demonstrated by obtaining data from more than one mainstream school and by exploring perspectives of both teachers and SNAs. Transferability of the study findings was considered by providing a comprehensive description of the context and participants. In addition, credibility of the findings was enhanced by providing detailed quotes to illustrate each of the content analysis categories and subcategories. Although Bernard et al. (2017) suggest that 10 interviews are needed to generate the majority of themes, our methodology involved a series of interviews culminating in a total of 19 teacher and 20 SNA interviews, therefore satisfying this criterion. Dependability of the findings was sought through independent and joint coding of the data which led to consensus. We adhered to a six-step process as outlined by Hilari et al. (2024). Given the structured coding framework and procedures followed among team members, we ensured a consistent analytical approach. However, we recognize

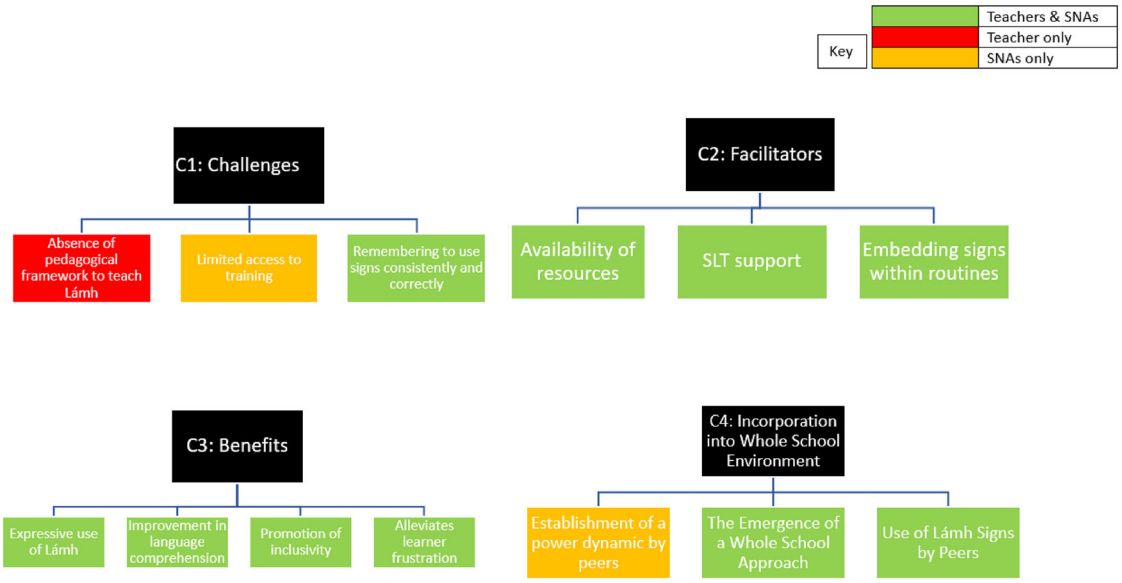

FIGURE 1 Categories and subcategories generated based on interviews with teachers and special needs assistants (SNAs).

that interrater reliability could be beneficial for future studies where counts are used. When performing a qualitative analysis there is always the risk of unconscious bias, such as the researchers' professional background and positive disposition towards KWS, impacting analysis. Therefore, to facilitate a critical analysis, reflective journals were used to facilitate reflection into how our subconscious biases may have influenced interpretation of the codes (Finlay & Gough, 2003). Furthermore, the use of reflective journaling proved valuable in facilitating the research team to gain a more nuanced understanding of the longitudinal data. For instance, it enabled the research team to gain insights into the process of mainstream schools moving from an integrated approach to KWS to a more inclusive approach over the course of the study.

RESULTS AND DISCUSSION

Perceptions/experiences of teachers and SNAs

In our first research question we asked, 'What are the perceptions and experiences of teachers and SNAs of using KWS (*Lámh*) with children with DS and their peers in the first year of mainstream primary school?' Findings were summarized in four categories namely, Challenges, Facilitators, Benefits, and Incorporation into the whole school environment. Each category had three subcategories with the exception of Benefits under which there were four (Figure 1).

CHALLENGES

Absence of a pedagogical framework to teach KWS (teachers only)

The need for training to support teachers' understanding and engagement with KWS emerged as a subcategory of Challenges. All teachers shared the perspective that the entry level KWS course does not provide sufficient preparation for 'us to go into a classroom and teach it' (T2, Ph4) and consequently they were unsure of how to approach the embedding of KWS into the curriculum and classroom environment. As expressed by T3, Ph4 'we were so, like, unsure what we were doing at the start' and T5, Ph4 who stated that they 'kind of felt like I was thrown into the deep end'. All teachers commented that they were 'really limited' (T1, Ph4) by the absence of some signs pertinent to the school setting, such as 'tidy up, sit and stand' (T3, Ph1) in the training programme. As T5, Ph1 recounts 'a lot of it [KWS] wasn't specific enough for the classroom'. In the context of expressing challenges, T3, Ph4 suggested providing teachers with 'not just a *Lámh* [module 1] course but a course on how to teach it as opposed to giving you the manual and letting you off with it'. This finding is consistent with research by Frizelle and Lyons (2022) and Norburn et al. (2016) who highlighted that many schools are not provided with specific guidelines or instructions in relation to the most effective way to implement KWS/AAC systems. As outlined by McDowell and Bornman (2022), teacher training is critical for the successful use of KWS at school. The findings of the current study indicate that teachers require training that goes beyond learning the

signs themselves, and the need for access to a pedagogical framework which would equip them to teach KWS to children implicitly and explicitly and to embed it in the curriculum.

Limited access to training (SNA only)

Responses from SNAs suggested that creating a KWS environment was challenging. In our study the majority of SNAs (five out of eight) had not completed foundational KWS training. SNAs described a lack of training as a barrier to using KWS, such as SNA4, Ph1 who explained while they welcome ideas on how to promote KWS 'it is hard if not everybody has training in it'.

Limited access to training resulted in SNAs feeling apprehensive about the accuracy of their signing. SNA3.2, Ph2 commented 'I'm not a hundred percent sure even the signs I'm doing are correct' and SNA5, Ph4 expressed a level of confusion about similar signs. SNAs also expressed reservations about relying on the children with DS to provide an accurate model in order for them to learn the signs correctly. SNA4, Ph4 states 'sometimes they have a completely different way of doing it'. SNA3.3, Ph3 shared they would rather avoid signing than take the risk of providing an inaccurate sign. SNA2.1, Ph1 described being reliant on a limited number of core signs stating she was 'using the same signs over and over', while SNA4, Ph2 reported being unsure of KWS vocabulary available 'I'm not sure if there is or isn't a sign for something'. SNA4, Ph1 accredited their knowledge of KWS to working with a Special Education Teacher 'it was through the SET teacher that I learned *Lámh* [. . .] I hadn't done any of the courses'. Although continuing professional development for SNAs is recognized as essential for delivering high-quality support for pupils who have special educational needs, unlike teachers, SNAs cannot apply for direct funding (NCSE, 2018). Issues with respect to training and the lack of a pedagogical framework are also coherent with the international literature, which suggests that limited availability of school-specific training and resources, makes it difficult for the relevant and consistent use of signs in the school environment to become a reality (Norburn et al., 2016).

Remembering to use signs consistently and correctly (teachers and SNAs)

Throughout the timeframe of the study, a ubiquitous challenge outlined by all participants was remembering to use KWS on a consistent basis. As T2, Ph1 outlines the 'challenge would be to think to use them'. This point is strengthened by T5, Ph2 who detailed the demands of consistently incorporating KWS into the curriculum daily, 'you're giving so many instructions, all the time and frequently throughout the day'. This challenge is also captured by SNAs. SNA5, Ph4 reported the difficulty in integrating KWS into an already busy curriculum, 'as a direction to the whole class [referring to the teacher], you could see the difficulty in always remembering to use the sign'.

Motor dexterity was highlighted as an issue. Teachers foregrounded this specifically with regard to children's use of *Lámh* signs as outlined by T4, Ph2 'actually they find just manipulating their fingers quite hard'. Specific handshapes, locations, movements, and orientation are the building blocks of sign parameters and require a complex integration of fine motor skills (Grove, 2019; Meuris et al., 2014). Given the motor difficulties of children with DS (Roizen, 2007) and the fact that fine motor skills are still developing in typically developing children at age 5–6 years, it is unsurprising that teachers in the current study perceived manual dexterity as a challenge (Bowles & Frizelle, 2016).

Facilitators

External SLT support (teachers and SNAs)

All teachers described the scheduled visits and modelling of signs by the visiting SLT researcher as an important support to their use of KWS over the course of the school year. The specific support referred to included getting the opportunity to 'see you [visiting SLT researcher] teaching *Lámh*' (T4, Ph1) and collaborative selection of relevant school-based signs. The external support was also deemed useful for goal setting and accountability. As SNA5, Ph3 pointed out 'when you know someone [visiting SLT] is coming then you want to give a good outlook'. External support also helped to maintain motivation to sign and provided clarification regarding sign accuracy 'I was signing lunch wrong all along' (SNA5, Ph2). Our results are in keeping with Tönsing and Dada (2016), who reported that teachers perceived additional training as beneficial when implementing aided AAC in special schools. They are also supported by Byrne et al. (2019) who reported the value of ongoing training in KWS in centres for adults with intellectual disability. Our results strengthen the need for ongoing KWS support and modelling of appropriate practices in schools and indicate how this support offers potential to increase self-efficacy.

Availability of resources (teachers and SNAs)

Teachers also pointed out that resources used by the visiting SLT researcher to model/teach signs were helpful and routinely used to give KWS a 'positive vibe' (T2, Ph4). In particular, *Lámh*-a-song DVDs (a collection of songs with signs appropriate for preschool and early school aged children) were reported as 'very engaging for the children' (T2, Ph4) and facilitated teachers' learning.

SNAs also stated the *Lámh* DVD was 'helpful' (SNA2.2, Ph3) due to the repetition of signs and demonstration on how to 'string sentences together in the songs' (SNA5, Ph4), thus providing a model on how to combine signs. SNAs also described other useful resources to create a KWS environment such as a 'Lámh sign book' (SNA4, Ph4); 'signs up around the room' (SNA2, Ph4); 'sign of the week' initiative (SNA1, Ph4); and access to the *Lámh* website (SNA5, Ph4). Our findings suggest the optimum manner to integrate KWS into a mainstream school environment is through a multimodal approach, which is in keeping with the key principles of signing (Dark et al., 2019).

Embedding signs into routines (teachers and SNAs)

Teachers reported that the integration of KWS into school routines, such as lunch, and Irish language lessons, was key to learning signs. A number of teachers (e.g., T1, Ph4, T3, Ph4) highlighted the convenience of using KWS in Irish language lessons as an alternative to translating into English when teaching Irish (*Gaeilge*) vocabulary. As explained by T3, Ph4 'using the sign for 'go *raibh maith agat*', I don't have to say 'go *raibh maith agat*' means 'thank you' or give them that explanation'. This is somewhat similar to how Makaton has been used as a pedagogical tool to teach English to children as an additional language (Mistry & Barnes, 2013). SNAs also highlighted how the assimilation of KWS into daily routines, such as personal hygiene and social greetings, facilitated more consistent signing. As captured by SNA1, Ph4 'you have to make it part and parcel of your day' SNAs recognized how routines provide a platform for regular use of KWS which enabled them to 'get into the habit of it' (SNA2.1, Ph4) and become 'more comfortable' (SNA1, Ph4). Our findings contrast with Parkhouse and Smith (2019) and Rombouts et al. (2018) who report that in schools where KWS is actively used, it is likely to be used in a restricted way, with emphasis on correcting breakdowns, maintaining focus, or labelling. By the end of the academic year, participants in the current study were modelling signs during classroom activities as an instructional strategy for both sign users and their peers and as an adjunct to effective communication. The difference in findings is likely to be driven by the fact that in the current study the SLT researcher was visiting the school over the course of the year with a specific focus on promoting KWS. As outlined in Kent-Walsh and McNaughton (2005), maintenance and generalization of targeted strategies are best facilitated by instructors who periodically monitor communication partners' use of acquired skills over an extended period of time.

BENEFITS

Promotion of inclusivity (teachers and SNAs)

Prior to the introduction of KWS (i.e., Ph1 interview), all staff participants expected that KWS would facilitate inclusion of children with DS due to the signing environment potentially enhancing their participation in school activities. T5, Ph1 outlines 'it would be much more inclusive, and she would feel much more part of things and involved'. Similarly, SNA2.1, Ph1 was optimistic KWS would be a 'gamechanger' for the child she supported. By Ph4 teachers and SNAs commented on how they had now observed an increase in the inclusion of children with DS in the school. As stated by T2, Ph4 'it made her part of the class, and it made them part of her world as well'.

Staff also noted how the use of KWS influenced their relationship with the children with DS. For example, SNA5, Ph4, viewed KWS as fundamental to building rapport with the child with DS she supported and believed that the absence of KWS would adversely impact the formation of their working relationship at school 'I just think we wouldn't have had the same relationship'. Our findings indicate that the use of KWS appeared to facilitate social inclusion of children with DS with their peers as well as with staff. This is consistent with the work of Cologan and Mevawalla (2018), who highlight that the universal implementation of KWS in early childhood settings can help address common barriers to social and educational inclusion. Positive interactions between children in inclusive environments promotes acceptance and social inclusion of individuals with disabilities within a classroom and in society in general (Babik & Gardner, 2021).

Alleviates learner frustration (teachers and SNAs)

Teachers noted the sense of frustration shown by children with DS experiencing difficulty communicating with peers and staff members. As indicated by Chadwick and Jolliffe (2009), people who are unfamiliar with manual signs,

untrained in KWS, or unsupportive of it, may be unable to interpret the communicative attempt of a KWS user. The introduction of KWS within the school was reported by teachers to reduce this frustration, as children with DS were using KWS in the knowledge that they were more likely to be understood by their peers, SNA, and teacher in the classroom. T1, Ph4 shared 'we knew how to communicate more effectively, then she wasn't getting frustrated as much either'. SNA3.1, Ph4 also commented on the instrumental role KWS plays in reducing frustration stating, 'it's huge for PPT5, it was very important to have for communication, then it kind of removes some of the frustration'. These findings are consistent with Bornman and Tönsing (2017) who found KWS helped to reduce the frustration of people with intellectual disability and associated challenging behaviour. It appears that in keeping with Hofmann and Muller (2022), more successful communication between communication partners resulted in less challenging behaviours in the children with DS, as their needs were better expressed and better understood by their communication partners.

Improvement in language comprehension (teachers and SNAs)

Interestingly, only two teachers stated that KWS leads to improvement in language comprehension. T3, Ph1 shared that KWS helps 'with that processing element, like I even find using *Lámh* makes me slow down' and T2, Ph2 ('she does understand the signs when we're using *Lámh* signs'). In contrast, all SNAs suggested that KWS plays an important role in assisting language comprehension. SNA2.2, Ph3 states 'she seems to understand more about what you're saying when you use the sign'. In addition, some SNAs expressed the view that using KWS slows down delivery rate of speech and provides a visual representation of the intended message, thus enhancing concentration. As captured by SNA3.3, Ph3 '*Lámh* for PPT4 is making it very simple and breaking it down and […] she focuses I think better'. SNA4, Ph4 states 'if I signed to her, it was like she really listened and took it on'. The premise that KWS supports language comprehension is well established in the literature and is likely due to the fact that signing the key words within a sentence reduces the complexity of the message imparted by the signing partner. Signing provides a visual representation of the word which capitalizes on the visual memory strengths of people with DS. Furthermore, more time is afforded to process messages, as signs are produced 1.5 times more slowly than speech, and word boundaries are more distinguishable (Emmorey, 2002) which all combine to increase children's attention (Frizelle et al., 2023). The finding that improved comprehension was noted more by Special Needs Assistants (SNAs) than by teachers may reflect the fact that SNAs typically work with children on a one-to-one basis and are, therefore, more attuned to instances when a breakdown in comprehension occurs, as suggested by McCarthy and Light (2022). The role of the SNA in ensuring that children with disabilities can meaningfully participate in the school environment has been previously highlighted by Zhao et al. (2021).

Development of expressive use of KWS by children with DS (teachers and SNAs)

Both teachers and SNAs acknowledged that it will take time and repeated exposure before children with DS begin to use KWS expressively. T3, Ph2 states 'I don't think it has [*Lámh*] had an effect just yet' and 'I think it may possibly need a little more time' (T5, Ph2). Teachers observed how children began imitating the signs at first for example, T2, Ph3, 'she is copying and making an effort', a necessary prerequisite before children start using KWS spontaneously. As reported by SNA1, Ph4 'I was doing matching with her in her workbook, and she was able to say same and different […] she was the one who initiated that'. In this way, KWS can be used to scaffold expressive language in children with DS (Launonen, 2019; Vandereet et al., 2011).

INCORPORATION INTO A WHOLE SCHOOL ENVIRONMENT

The emergence of a whole school approach (teachers and SNAs)

Some teachers reported benefits of using KWS in the classroom irrespective of the presence of a child with DS. This is captured by T5, Ph4 who stated KWS is 'something that should be used with all children in the class and not just for one specific child. I can see the benefits for all children at infant level'. Our findings are in keeping with Sheehy and Duffy (2009) who highlight that KWS can potentially be used by all pupils and staff as a medium of supporting inclusion.

T1, Ph4 reported on the use of KWS extending beyond the child with DS stating, 'we were using as a whole class'. This was reinforced by T2, Ph4 and T5, Ph4 who indicated that their respective schools had begun the process of introducing KWS to the entire school and that integration into a whole school environment supported a 'fully inclusive sort of atmosphere in your school towards *Lámh*' (T5, Ph4).

Similarly, SNAs outlined how the use of KWS extended beyond individual classrooms. SNA2.1, Ph4 noted how

other teachers had taken an interest as shown in the following quote—'the other classroom teachers have taken some of the simpler signs and shown them to their classes'. Other initiatives were also used to disseminate to the wider school environment, such as the display of printed *Lámh* signs on school noticeboards and the sign of the week initiative (SNA2, Ph4). Our findings suggest that other teachers in these schools were motivated to use *Lámh* due to enhanced knowledge and skills of KWS and opportunities to use KWS in the school environment.

SNA5, Ph4 shared how the whole school were on board with KWS as the school community wanted to 'be able to play with her, able to communicate with her, to stop and have little chats'. This included sixth class pupils (11–12-year-olds in the final year of primary school) who used KWS in an instructional capacity to assist with lining up pupils after breaktime. Our findings reflect literature highlighting that the introduction of signing is best supported by a whole school initiative, rather than an individual compensatory strategy (Budiyanto et al., 2018; Rombouts et al., 2019). Our findings are further corroborated by Dolly and Noble (2021) who found that a whole school intervention approach resulted in positive increases in sign use by communication partners.

Use of KWS by peers (teachers and SNAs)

There was some variation regarding participant perceptions of peer attitudes to the use of KWS in the mainstream classroom. Some teachers maintained that children viewed the KWS system as part of the school curriculum and did not realize its function. T4, Ph3 states 'the majority of children wouldn't realise what it's [*Lámh*] specific to or what's it for' and 'I don't think they [peers] saw it as something particular to one child' (T5, Ph4). It appears some children were using signs irrespective of the presence of children with DS 'they will use it if they're telling me they're finished, or they want a drink' (T1, Ph3). These findings suggest that some children do not consider KWS as something specific to people with communication difficulties, rather they see it as something everyone can use. Our results are also in contrast with Bowles and Frizelle (2016) who found that children in their study clearly differentiated between the KWS (*Lámh*) user and other children in the class (with respect to the need for *Lámh*). In keeping with Bowles and Frizelle (2016), other teachers believed that the peers of the children with DS had an awareness of communication differences, and some made a concerted effort to use *Lámh* for the purposes of initiating social interaction. T1, Ph4 stated 'if they wanted to play with PPT1 they would sign with her, so they definitely had an awareness she needs this' and 'I think some of the children like interacting with her and they appreciate having signs' (T2, Ph3).

SNAs also commented on children's generalization of KWS. For example, SNA3.3, P3 stated 'a lot of them are using sign all time, even without Ph3 being present, they enjoy doing it'. Some SNAs highlighted that although some members of the class used KWS to initiate social interaction, they were in the minority. SNA1, Ph3 reported 'A handful of boys and girls use them really when they're talking to her now […] there's only certain people I feel comfortable enough' and 'look it's not everybody, but the girls who were on board with it in September are using signs' (SNA 5, Ph2). Although teachers and SNAs observed different attitudes among peers and varying degrees of KWS use, all reported observing some KWS use among peers and noted many positive effects of this for the children with DS. This is in keeping with a systematic review by O'Regan-Kleinert et al. (2023) who reported emerging evidence for the effective use of peer mediated strategies when teaching AAC in inclusive educational settings. The use of targeted peer mediated strategies is salient given relationships can be difficult to form organically in the inclusive education setting for students with complex communication needs (McCarty & Light, 2022). The variation of attitudes and varying degrees of KWS use among peers demonstrated in the current study are influenced by perceptions of disability which, from a bioecological view of development, can be conceptualized as an interplay between society, family, the school environment and the individual (Babik & Gardner, 2021; Bronfenbrenner, 1976). In terms of the individual developmental level, between the ages of 3 and 6 years, children's social awareness shifts from being an individual to being members of a wider social group. Thus, children's social development in the form of social attributions and in-group biases depends on their knowledge of different disabilities, understanding of disability, as well as general cognitive development. We refer the reader to Babik and Gardner (2021) for a conceptual framework which describes children's development of disability perception.

Establishment of power dynamic by peers (SNAs only)

Although the majority of peer use of KWS was reportedly positive, three SNAs stated that peers were using KWS in an instructional capacity and raised concerns about the impact this might have on how the child was viewed by their peers. As SNA1, Ph4 shares 'it seemed more like they were giving her instructions' and 'initially it started with stop or no PPT2'. SNA5, Ph3 was critical of this behaviour because some 'kids wouldn't give up on the whole follow-

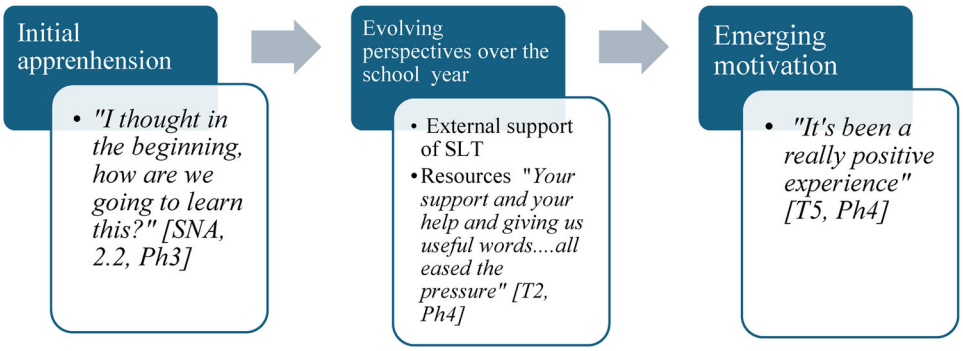

FIGURE 2 Progression of perceptions/experiences with KWS (*Lámh*) over the school year.

ing her around doing signs for sit' and commented that 'it's not their job' to give instructions to their peer in that manner. Brereton (2008) detail a year-long case study in which sign language was used within a mainstream early childhood setting and found when KWS is implemented inclusively, the use of sign does not lead to adverse experiences. Furthermore, Bowles and Frizelle (2016) reported all peers in their study revealed an understanding of the value of signing and an equally positive outlook on the use of KWS. In contrast, the current study suggests that some peers may not be using KWS for its intended purpose of promoting equal opportunities for communication and social inclusion. Factors affecting perceptions of disability aforementioned in 'Use of KWS by peers (Teachers and SNAs)' are equally relevant for this subcategory. Our results indicate that some children may have negative attitudinal perspectives which may benefit from input to enhance their understanding and knowledge of disability. As McCarthy and Light (2022) suggest, teachers or SNAs may assign peers the role of helper or model, a role which can subsequently evolve into that of an instructor, potentially influencing how these children perceive and interact with their peers with disabilities.

Change over time

In our second research question we asked, 'How do the perceptions/experiences of teachers and SNAs evolve over the course of the school year?'. The study design involved an exploration of perceptions at four different time points, so that any change in perceptions over the course of the academic year 2019/20, could be detected (Figure 2).

Prior to the introduction of KWS into each classroom or school some teachers reported feelings of apprehension and a sense of uncertainty because of gap in professional experience of working with children with DS. T5, Ph3 reported 'I felt a bit apprehensive at the beginning the start of the year, knowing that *Lámh* had been a communication tool for PPT6 that she's used it quite a lot and I don't know it. I was worried that she would be upset or bothered about something, and I wouldn't be able to help her'. Feelings of apprehension were also reflected in the SNA interviews. As stated by SNA2.2, Ph3 'I thought in the beginning, how are we going to learn this?'. The apprehension experienced by staff may be linked to insufficient intensity of KWS training provided prior to the commencement of this study. Staff are more inclined to consistently apply a communication strategy if they received sufficient training (Rombouts et al., 2016).

However, as the year progressed it was evident that these feelings began to dissipate. By phase 4, SNA 4 shared 'it was not as daunting as I thought it was going to be. It was a really fun and positive way of communicating'. In addition, teachers initially reported a level of uncertainty regarding whether the introduction of KWS was specifically for children with DS or 'should it be for everybody?' (T5, Ph2). This uncertainty was further expressed by T3, Ph3 who stated, 'should it just be PPT3 on her own time doing it until she gets more of a handle on it?', 'should it be the whole class?', 'should it be the whole school even?'.

All teachers reported that at the initial stages of introducing KWS, it was 'a lot of extra work' (T2, Ph2) due to the pre-planning required to incorporate effectively into lesson plans and the time needed to teach signs to themselves. However, over time, the perceived value of KWS appeared to outweigh concerns about the extra work involved. As exemplified in the quote by T2 Ph4 'how useful *Lámh* is in the classroom environment and how useful it is for PPT2, you just see the value of it and the benefit of putting time into it, it's a work in progress and that's the important lesson'.

As the year progressed teachers felt reassured in the knowledge that the visiting SLT researcher was available as a 'reference point' (T5, Ph3) and that there was a 'sense of encouragement coming from the outside in' (T2, Ph4). This is in keeping with previous literature indicating that the sustainability of KWS depends on ongoing reinforcement

of signing skills, if a signing environment is to be maintained (McDowell & Bornman, 2022; Meuris et al., 2014). In addition, despite the work and time investment required to facilitate inclusion of KWS in the classroom, by phase 4, teachers valued how 'useful it is in the classroom environment and how useful it is for PPT2' (T2, Ph4). There was a sense of emerging self-efficacy and perceived control in how to maximize the inclusion of children with DS.

A notable change with the respect to the SNAs, was in relation to whether the students still needed KWS to scaffold their understanding of language. By phase 3, three SNAs stated they intentionally reduced use ('drop a bit'; SNA5, Ph4) due to an overestimation of the receptive language ability of the children with DS. However, by phase 4, SNA4 and SNA5 reported they began using KWS again. As SNA4, Ph4 stated 'I realised she still does need *Lámh* very much [. . .] for her understanding'. In addition, SNA 5, Ph4 noted how the reduction in KWS (*Lámh*) use was associated with a 'little bit of more challenging behaviour'. The reduction in use would seem to reflect a lack of sufficient expertise in KWS, potentially as a result of limited access to training, as communication partners are more likely to reduce use of KWS because it requires considerable effort and recall to produce the manual signs. Previous literature indicates the people's perceptions of effectiveness of KWS, can either impede or facilitate implementation (Rombouts et al., 2017). It is therefore essential that all communication partners understand the role KWS plays to support language learning in children with DS, and how it can facilitate positive interactions with those with complex communication needs.

It was also evident at the latter stages of the study that some SNAs had developed intrinsic motivation and at phase 3, SNA2 stated 'what keeps me motivated is that it works for PPT1, that's her way of communication [. . .] this is the way she communicates' and SNA5, Ph4 'I felt because I enjoyed it and I could see how important it was for PPT6, it never seemed like a chore or difficult'. As delineated by Michie et al. (2011), motivation is one of the key precursors to behavioural change, along with capacity and opportunity.

Overall, responses indicated that KWS evolved from something that was considered daunting to more habitual over the course of the study. Participants reported that 'eventually it does get more natural' (T3, Ph4), they had become 'more fluent' (T1, Ph3) and 'first day it was to get PPT1 involved but as time went by [. . .] well, this was just another way of communicating' (SNA1, Ph4). Therefore, in keeping with Cologon and Mevawalla (2018), KWS seemed to serve as a catalyst for developing greater confidence and openness to engaging in inclusive practices more broadly.

Aligned with Bornman and Donohue (2014), findings from the current study suggest that teacher and SNA perceptions changed over time as a function of the development of both their experience and expertise, through the supported introduction of KWS into mainstream schools. The collection of data from the same cohort of participants over the academic year about their experiences of introducing KWS provided cumulative datasets which in turn enabled insights to be further elucidated (Lyons et al., 2022). The impact was perceived to be positive, with respect to participation and inclusivity of children with DS, therein supporting inclusive educational practices (Brereton, 2008; Sheehy & Budiyanto, 2014). Moreover, consistent with previous literature (McDowell & Bornman, 2022; Sheehy & Budiyanto, 2014), teachers and SNAs perceived KWS to play a positive role in education due to enhancing language comprehension, as well as increasing concentration levels, classroom participation and interaction with peers.

RECOMMENDATIONS

KWS implementation training course for teachers and SNAs with ongoing support from SLT

Our results indicate the need for a school-specific KWS training course in which an evidenced-based pedagogical framework and post-training follow up, at various times over the course of a school year, are embedded. Our results also underscore the need for ongoing SLT support in schools when implementing an AAC system such as KWS. In the current study, SLT support was beneficial at the outset for modelling and collaborative vocabulary selection. In line with implementation science models, the SLT offered post-training follow-up to provide reassurance, clarification regarding signing accuracy and encouragement with the ultimate aim of increasing self-efficacy for all stakeholders. In contrast, traditional in-service trainings fail to provide expertise needed to support the development and long-term implementation of targeted communication skills (Kent-Walsh & McNaughton, 2005).

Tiered intervention approach to KWS

We suggest that a tiered intervention approach to KWS may be beneficial. As KWS use extends beyond individual classrooms, a universal approach would be training staff, including ancillary staff, as to why the use of KWS is important beyond those who have a child who uses KWS. The universal approach may comprise of workshops and the teaching of school-specific vocabulary. The target component of our proposed tiered intervention approach to

KWS would be the provision of a pedagogical KWS course for teachers and SNAs. Another component of the tiered intervention approach may be the establishment of a 'train the trainer role', where a teacher can take responsibility, beyond specific class pedagogical training, to teach and advocate for the use of KWS within the wider school environment (i.e., a KWS Champion). In keeping with Meuris et al. (2015), a peer-led approach designed to enhance engagement and retention of KWS knowledge among staff may be more effective than top-down training. In line with this proposed model, the SLT may have more of a specialist consultative role (e.g., promoting remote support) and advise on specific sign-based goals for the individual who uses KWS to support their communication. Further research is needed to evaluate the feasibility and sustainability of a whole-school-tiered intervention for KWS, particularly in mainstream settings where the presence of students with disabilities may vary each year, impacting its long-term implementation. A more sustained structural approach to introduction of KWS may lead to positive attitudinal changes towards children with disabilities, such as DS.

Furthermore, inclusive educational systems are more cost effective to implement and maintain than special educational models (OECD, 2023). Therefore, the cost of developing future training could be offset by the reduced cost of implementing this type of education model.

Development of additional school-specific resources

There is a need for more resources that specifically support the use of sign in routine class activities. Our results suggest that integration of signs is best facilitated by assimilation into daily routines such as lunch, social greetings and play routines (e.g., *Lámh*-a-song DVD). In addition, teachers reported additional work in pre-planning how to effectively incorporate KWS into lesson plans, Therefore the provision of targeted resources may reduce this extra workload.

CONCLUSIONS

The current study explored the perceptions and experiences of teachers and SNAs of using KWS in the first year of mainstream primary schools in Ireland and how these perceptions and experiences evolved over the course of the school year. Our findings suggest that the supported introduction of KWS (*Lámh*) in the mainstream classroom can assist inclusive educational practices; facilitate children's comprehension and expression; reduce frustration in children with DS; and facilitate interaction with peers. Our results also indicate an increasingly positive attitude amongst teachers and SNAs towards KWS over the course of the school year.

However, teachers and SNAs also reported experiencing challenges in learning and using signs. Teachers reported that the absence of a pedagogical framework to guide implementation was an obstacle to the integration of KWS into the mainstream curriculum, while SNAs highlighted inconsistency in accessing funded entry-level training. Facilitators to the use of KWS included the external support provided by the SLT researcher, availability of KWS-specific resources and the use of routine tasks as a way of embedding signs into daily activities. Our results suggest that future training developments would benefit from taking a tiered approach to the introduction of KWS into mainstream schools considering these key facilitators of KWS use as well as how the above challenges can be addressed so that we can maximize the potential of all children with communication needs in mainstream primary school.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

Datasets for this research are included in the Open Science Framework; https://osf.io/75nbv/?view_only=15254e19a851408dbcdb4dab2b3316bc.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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