Daily living skills in adolescents with and without (developmental) language disorder, measured using the WHEEL OF INDEPENDENCETM framework

Article

Accepted Version

Daily living skills in adolescents with and without (developmental) language disorder, measured using the WHEEL OF INDEPENDENCE™ framework

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Abstract

Introduction: Developing daily living skills (DLS), such as self-care, cooking and managing money, is a key priority for adolescents with special educational needs. Previous studies investigated the emergence of DLS in young people with a range of neurodevelopmental conditions. However, none focused on adolescents with language disorders (LD), including developmental language disorder (DLD).

Method: Two groups of 16-year-olds participated in this study: a typically developing (TD) group (n=88) and a (D)LD group (n=78), which was subdivided into participants with co-occurring motor difficulties (n=56) versus typical motor development (n=22). Data were collected using the WHEEL OF INDEPENDENCE™ framework, a DLS measurement tool. Between-group comparisons assessed whether there were significant differences in DLS between TD and (D)LD participants and between those with and without motor difficulties within the (D)LD group.

Results: Findings revealed that TD participants had significantly better DLS than the (D)LD group. Within the (D)LD group, participants with motor difficulties showed marginally significantly lower DLS than those without.

Conclusion: Adolescents with (D)LD experience challenges developing their DLS, compared to TD peers. This may be compounded if they have co-occurring motor difficulties. Further research could inform understanding of the mechanisms underlying these differences in order to develop tailored and effective interventions.

Introduction

Daily living skills (DLS), such as self-care, house-keeping and money management, are essential for independent living and can contribute to self-esteem and quality of life (Bal et al., 2015; Bishop-Fitzpatrick et al., 2016). Whereas the umbrella term 'life skills' can include higher-level cognitive abilities (e.g., problem solving, critical thinking and interpersonal skills), DLS refers to the practical accomplishment of everyday tasks, which build independence both within and outside the home. For adolescents with Special Educational Needs (SEN) attending specialist school settings, there is a focus on developing basic DLS in order to prepare young people for adulthood (Clarry et al., 2022). This contrasts with life skills provision within mainstream settings, which is typically aimed at developing personal and interpersonal skills to promote positive mental health and well-being (UNICEF, 2012; World Health Organisation, 2003).

Occupational therapists play a key role in supporting young people with SEN to acquire DLS by selecting and delivering interventions based upon their analysis of young people's strengths and limitations, as well as how their environment supports or acts as a barrier to their ability to perform a task (Burridge and Fhlatharta, 2022). The overall goal of occupational therapy (OT) is to 'enable and empower people to be competent and confident in their daily lives' (Duncan 2002, p.6). Traditionally, OT interventions have targeted three key performance areas: self-care, productivity and leisure (Law et al. 1991), though this is increasingly widened to include areas such as preparing individuals to carry out food shopping, saving money, travelling, home management, personal hygiene and accessing community resources (Mannix, 2009; Terrence and Williams, 2012).

Paediatric OTs support young people with a range of physical, sensory and cognitive difficulties, which may affect a young person's ability to develop DLS and independence. In the UK, speech, language and communication (SLCN) needs are the most common type of primary need for pupils receiving SEN support (Department for Education, DoE, 2023). SLCN can include a wide range of speech and language difficulties. However, the population of interest in this study presents with language disorder. A language disorder is a type of neurodivergence which is characterised by challenges with speaking and understanding language that can impact on education, social interactions and mental health. Around 10 per cent of children in the UK have language disorder (Norbury et al., 2016). Within this, 2.3 per cent of children have a known biomedical condition associated with their language disorder, e.g. autism spectrum disorder, cerebral palsy, chromosomal abnormalities, intellectual disability or hearing impairment. The remaining 7.6 per cent of children present with developmental language disorder, a subset of language disorder which is not associated with a known biomedical condition. Within this study, all participants have a language disorder, with the majority meeting the criteria for DLD, so we will use the term (D)LD to reflect this.

While young people with (D)LD experience difficulties with language as a primary barrier to their learning, many of these young people also have co-occurring conditions, which overlap and interact with their (D)LD. These can include literacy difficulties, attention deficit hyperactivity disorder (ADHD) and/or motor difficulties, including developmental coordination disorder (DCD). See Figure 1, which illustrates the overlap between (D)LD and motor difficulties, which forms a focus of this paper:

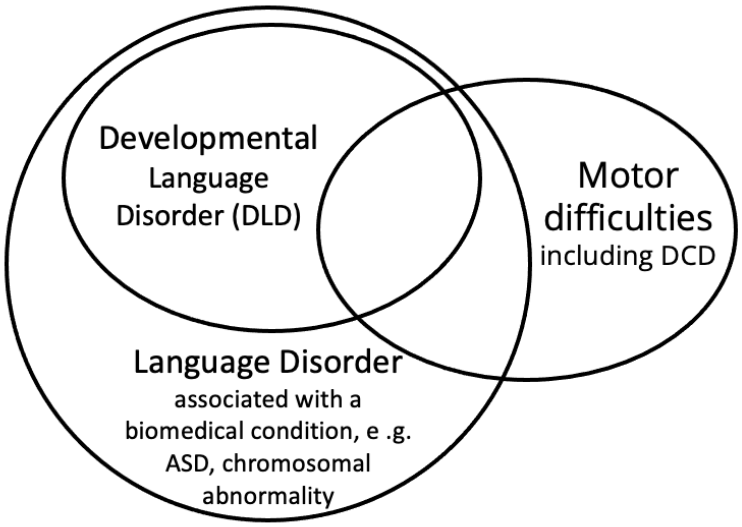

Figure 1: Overlap between (D)LD and motor difficulties, including DCD.

One of the main areas of practice for pediatric OTs is addressing the impact of motor difficulties on functional performance. There is emerging evidence that young people with (D)LD are at high risk of motor impairments, which can affect the learning and coordination of gross and fine muscle movements (Prajapati and Vaidya, 2022). Up to a third of young people with DLD are estimated to have co-occurring developmental coordination disorder (DCD; Flapper and Schoemaker, 2013). This is defined as 'a marked impairment in motor coordination [that] interferes with motor performance at home and in school' (p.756). This association between language and motor difficulties has been attributed to shared cognitive processes (affecting both language and motor processing) known as the procedural deficit hypothesis (Ullman and Pierpont, 2005); neuroanatomical differences (Hill, 2010); or developmental influences, e.g., the emergence of motor skills giving rise to language-learning opportunities through increased engagement with objects and caregivers, which may be lost or delayed if children are not meeting their motor milestones (Iverson, 2010). However, the

relationship between language and motor development is complex and the influence of these two areas on the development of DLS for adolescents with (D)LD has yet to be explored.

Multiple studies have shown that young people with developmental delays have impairments in daily living, which have been linked to cognitive, motor, sensory and language skills, but findings to date have been mixed. For example, Bal et al. (2015) carried out a longitudinal analysis of children referred at age two years for possible autism spectrum disorder (ASD), comparing their DLS outcomes with those of typically-developing (TD) children, as measured on the caregiver-reported Vineland Adaptive Behavior Scales (VABS, Sparrow et al., 1984). Their results indicated that non-verbal ability was the biggest predictor of DLS progress, followed by receptive language (verbal understanding) and social communication skills. Other studies indicate that additional factors to non-verbal IQ may influence the development of DLS. Duncan and Bishop (2015) examined a group of 417 adolescents with ASD and average intelligence (standardized full-scale IQ of 85 or above). Many of their participants had VABS scores up to six years below their chronological age, even in the context of IQ scores within normal limits. The authors that additional factors could include receptive and/or expressive language, which may affect a young person's ability to understand and carry out activities of daily living, motor skills, and skills of executive functioning (EF), a set of abilities related to cognitive development which allow us to filter, plan and remember tasks. EF skills are strongly related to language and communication and may influence young people's use of prediction, inference and social interaction.

Separately, Travers et al. (2022) carried out a correlational study, looking at the relationship between motor and sensory skills and DLS outcomes for autistic children (aged 6-10 years).

They found both motor and sensory difficulties were robustly linked to challenges in developing DLS for this diagnostic group. Severity of motor impairments were associated with ratings of self-care, housekeeping and meal preparation, with children's sensory profiles also contributing to the level of DLS progress they achieved. The authors suggest that both motor and sensory features should be considered when planning intervention for both autistic and non-autistic children. Meanwhile, motor skills have also been established as key predictors of DLS progress in children with cerebral palsy, DCD and attention deficit hyperactivity disorder (Travers et al., 2022). However, up until now, the relationship between motor abilities and DLS has not been explored for adolescents with (D)LD.

Few studies have investigated the DLS skills of children with language disorders. One exception is Liss et al. (2001), who compared correlates and predictors of adaptive functioning, including DLS, across 9-year-old children with autism, DLD and age-matched controls. For the autistic group, IQ was strongly predictive of VABS scores for children with lower non-verbal abilities (in line with Bal et al., 2015), while language and verbal memory were more strongly associated with VABS scores for those with higher IQs (corroborating Duncan & Bishop, 2015). Meanwhile, for children with DLD, receptive language scores (as indexed by the Token Test, DiSimoni, 1978) was the most significant predictor of DLS, providing further evidence for the importance of understanding language in mediating the development of life skills and independence.

There is emerging evidence for the impact of language difficulties on daily living skills in other neurodiverse groups. Thurman et al. (2022) examined the relationship between receptive and expressive language, non-verbal ability and associated features, such as autism symptomology, on DLS for adolescent and young adult males with fragile X

syndrome, using the Waisman Activities of Daily Living Scale. The study found that receptive language was the strongest individual predictor of DLS, whilst supporting previous research identifying a positive relationship between DLS and non-verbal skills and a negative association with autism symptomology. The finding of a key role for receptive language in DLS development aligns with separate research by Park et al. (2012), who found significant associations between receptive communication and early DLS skills for autistic pre-schoolers, but not for non-autistic children with developmental delay or TD controls.

While the literature indicates that language ability plays a role in DLS, there is limited research into the specific links between language and skill areas such as self-care, meal preparation, laundry and leisure. These skills require understanding of complex vocabulary such as 'prescription' or 'return ticket', the ability to follow instructions, such as recipes and washing labels, and to express oneself clearly when making appointments. Thus, we might expect expressive and receptive language to be pivotal to DLS, despite the current lack of empirical research. Unpicking the relative contributions of language and other factors is important in informing our understanding of the mechanisms underlying successful development of DLS. This paper aims to address the current gap in the literature by answering the following research questions (RQs):

1. Do the daily living skills of 16-year-olds with (D)LD differ from typically developing 16-year-olds?
2. Do 16-year-olds with (D)LD and co-occurring motor difficulties differ in daily living skills when compared to 16-year-old with (D)LD who do not have motor difficulties?
3. Are there between-group differences on individual areas of DLS, as measured using the WHEEL OF INDEPENDENCE™ (WOI) Framework?

4. Is there a correlation between severity of language disorder and daily living skills?
5. Is there a correlation between severity of motor difficulties and daily living skills including when controlling for language ability?

Method:

Study design

This study employs a between group design to compare the DLS scores of: typically-developing adolescents, a combined (D)LD group, and the (D)LD group subdivided into those with or without co-occurring motor difficulties. Data were collected at a single time point to investigate the relationships between language, motor difficulties, and DLS scores.

Ethical Consent

This project was approved by Ulster University in August 2021 (REC/21/0050) and by the Moor House Ethics Committee in June 2020 (2020/3/1). All participants and their parents provided informed consent before participating in the project.

Participants

Seventy-eight adolescents with (D)LD and 88 typically-developing adolescents, aged 16 years, were the subjects of this study. Their data were provided by parents or professionals working with the students. The typically developing students were recruited via opportunity sampling by posting online parent questionnaires to local schools and on social media platforms. Inclusion criteria for the typically-developing group were: attending a mainstream school, no

formal diagnosis of a neurodevelopmental condition and no Education, Health and Care Plan (EHCP) in place. An EHCP is a legal document, setting out the additional support needed for young people with SEN, which must be provided by local authorities and services (DoE, 2023).

The students with (D)LD who participated in this study all attended a specialist college for adolescents with language disorders, with the majority meeting criteria for DLD. Figure 2 illustrates the breakdown of students presenting with DLD and wider language disorder, and incidence of co-occurring conditions. Within the (D)LD group, students were classified as having a co-occurring motor difficulty if they had scored below the 16th percentile on the Bruininks-Oserestsky Test of Motor Proficiency (BOT) (Bruininks and Bruinkinks, 2005) on assessment prior to their admission to the setting. These students were on the OT caseload and received one-to-one intervention and regular monitoring of their motor skills. Those who scored within normal limits on the BOT during the pre-admission assessment receive OT provision which is integrated within the school curriculum. They are therefore not assigned an individual OT and their motor skills are not routinely re-assessed, unless other concerns arise regarding motor difficulties.

Fifty-six students with (D)LD met criteria for having a (D)LD plus motor difficulties, while the remaining 22 students with (D)LD formed the (D)LD without motor difficulties group. Standardised language scores for both (D)LD groups, as well as BOT scores for the (D)LD plus motor group are presented in Table 1.

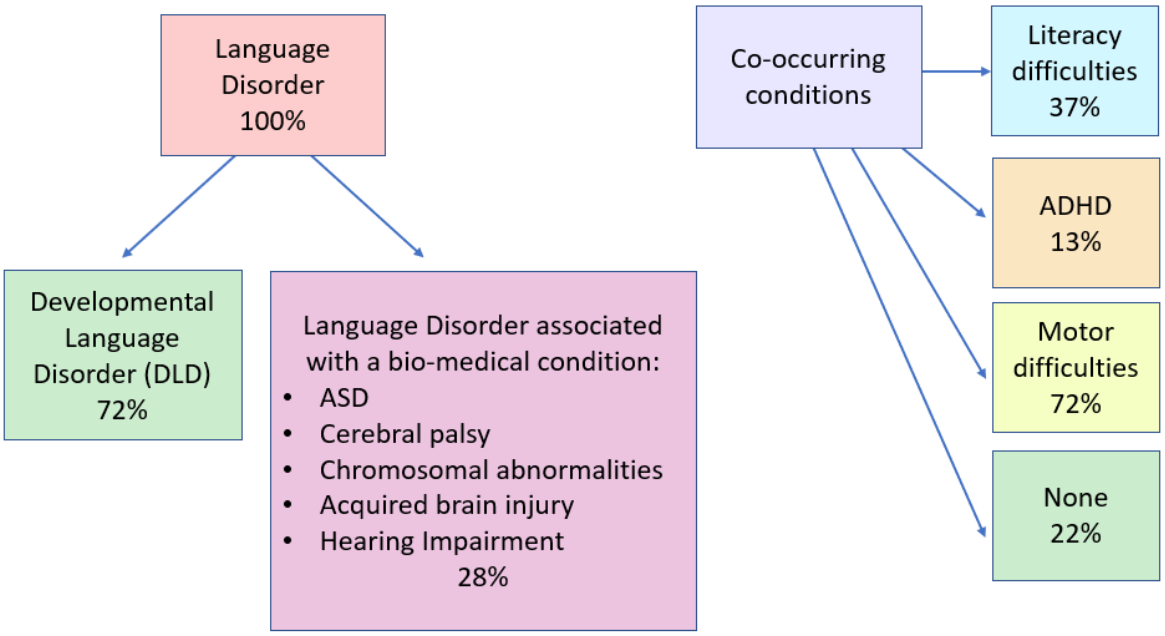

Figure 2: Breakdown of primary and co-occurring diagnoses for the (D)LD group
NB Some students have more than one co-occurring diagnosis.

Group	Measure	Mean	Standard deviation
(D)LD without motor difficulties group (n = 22)	*CELF core language standard score*	65.86	13.96
	CELF percentile	5.73	13.32
(D)LD + motor difficulties group (n = 56)	*CELF core language standard score*	58.61	16.47
	CELF percentile	3.81	7.74
	BOT motor composite standard score	32.39	4.22
	BOT percentile	5.34	3.79

NB BOT-2 standard scores have a mean of 50 and a standard deviation of 10. CELF-5 standard scores have a mean of 100 and a standard deviation of 15.

Table 1: Background characteristics for (D)LD+motor difficulties and (D)LD only groups

Measures:

The primary measure employed for this study was the WHEEL OF INDEPENDENCE™ Framework online tool (WOI) [redacted] 2019). This is a daily living skills curriculum and progress measurement tool that was developed by the first author as part of her work at [redacted] as a highly specialist OT. The WOI is used to track progress and structure OT intervention for 180 skills combined into eight key areas involved in daily living skills: Meal preparation, Time management, Leisure, Self-care, Housekeeping, Laundry, Food shopping and Money skills. Each area includes a hierarchy of skills to work through which are split into five stages. A stage is marked as complete when all skills in that stage are achieved. Thus, each key area has a score ranging from zero to five. Stage five indicates that the student can carry out the most difficult skills independently, such as making and attending appointments on their own or managing their online banking. Stage one covers the most basic skills such as using a kettle or brushing their teeth. Summing across the eight areas and five stages, the total maximum score is therefore 40.

The tool is not yet standardised with proven validity and reliability, but has been used clinically (showing good face validity) over a number of years for students with (D)LD, both at [redacted] and in other specialist settings.

For the (D)LD group, a WHEEL OF INDEPENDENCE^{TM} baseline assessment was completed for each student by college staff when they reached the age of 16. All students completed relevant standardised tests at the same timepoint. These were: the Clinical Evaluation of Language Fundamentals 4th edition (CELF-4) (Semel et al., 2006) or 5th edition (CELF-5) (Wiig et al., 2017), and, where students were on the OT caseload, the BOT (Bruininks & Bruininks, 2005).

For students in the TD group, parents were asked to provide information on their child's daily living skills via an online questionnaire, which contained the same questions and statements as those included in the WOI. The questionnaire (available on request) was shared with respondents from September 2021, using Qualtrics software. Once closed in July 2022, no further responses were recorded. No standardized tests were carried out with the TD group.

Data analysis:

Data were analysed with SPSS Statistics Software Version 29. Shapiro Wilk tests were first carried out to assess normality of the data. Due to a non-normal distribution, Mann Whitney U tests were used to compare WOI scores across TD and (D)LD students and, separately, to compare language and WOI scores between the two (D)LD subgroups: (D)LD only and (D)LD + motor difficulties. Spearman's rank-order correlations were run to investigate: a) the relationship between language and motor skills in the (D)LD + motor group, b) the relationship between students' language and motor scores and their performance on the WOI and c) the relationship between BOT total motor composite standard scores and overall WOI scores. Partial correlations were employed to test whether motor skills have an effect while controlling for language ability. Finally, scores for all three groups were compared on each of the eight individual DLS areas of the WOI using Mann Whitney tests.

For data visualisation, violin plots were created using R software and the ggplot2 package. These depict the distribution of scores within groups. The width of each curve denotes the frequency of scores at each stage. The central box plots indicate the inter-quartile ranges (IQR) for each group, with the horizontal line representing the median. Data points which are marked with circles represent outliers, which lie above the third quartile (Q3), plus 1.5 times the IQR or below the first quartile (Q1), minus 1.5 times the IQR.

Results

RQ1: Do the daily living skills of 16-year-olds with (D)LD differ from typically developing 16-year-olds?

The first aim of this study was to investigate whether the daily living skills of 16-year olds with (D)LD (the combined (D)LD group) differed from those of age-matched TD peers. TD group scores ranged from 9-40, with a mean of 26.64 and a standard deviation (SD) of 8.24. In contrast, scores for the (D)LD group varied between 0 and 24, with a mean of 4.63 and an SD of 4.77.

Shapiro Wilk tests showed a significant departure from normality for both participant groups. TD: $W(88) = 0.969$, $p = 0.032$ and (D)LD: $W(78) = 0.839$ $p = <0.001$. The (D)LD group showed a clear floor effect, whereas the TD group showed a marginal ceiling effect. Therefore, non-parametric statistical tests were used when comparing WOI scores across TD and (D)LD students. Figure 3 shows the distribution of TD versus (D)LD WOI scores. While there is some overlap between the lowest TD and highest (D)LD scores, including some high-performing (D)LD outliers, Mann Whitney U tests indicated that the difference between the two groups was statistically significant (TD *Mdn* = 26.5, DLD *Mdn* = 3, $z = -10.81$, $p = <0.01$).

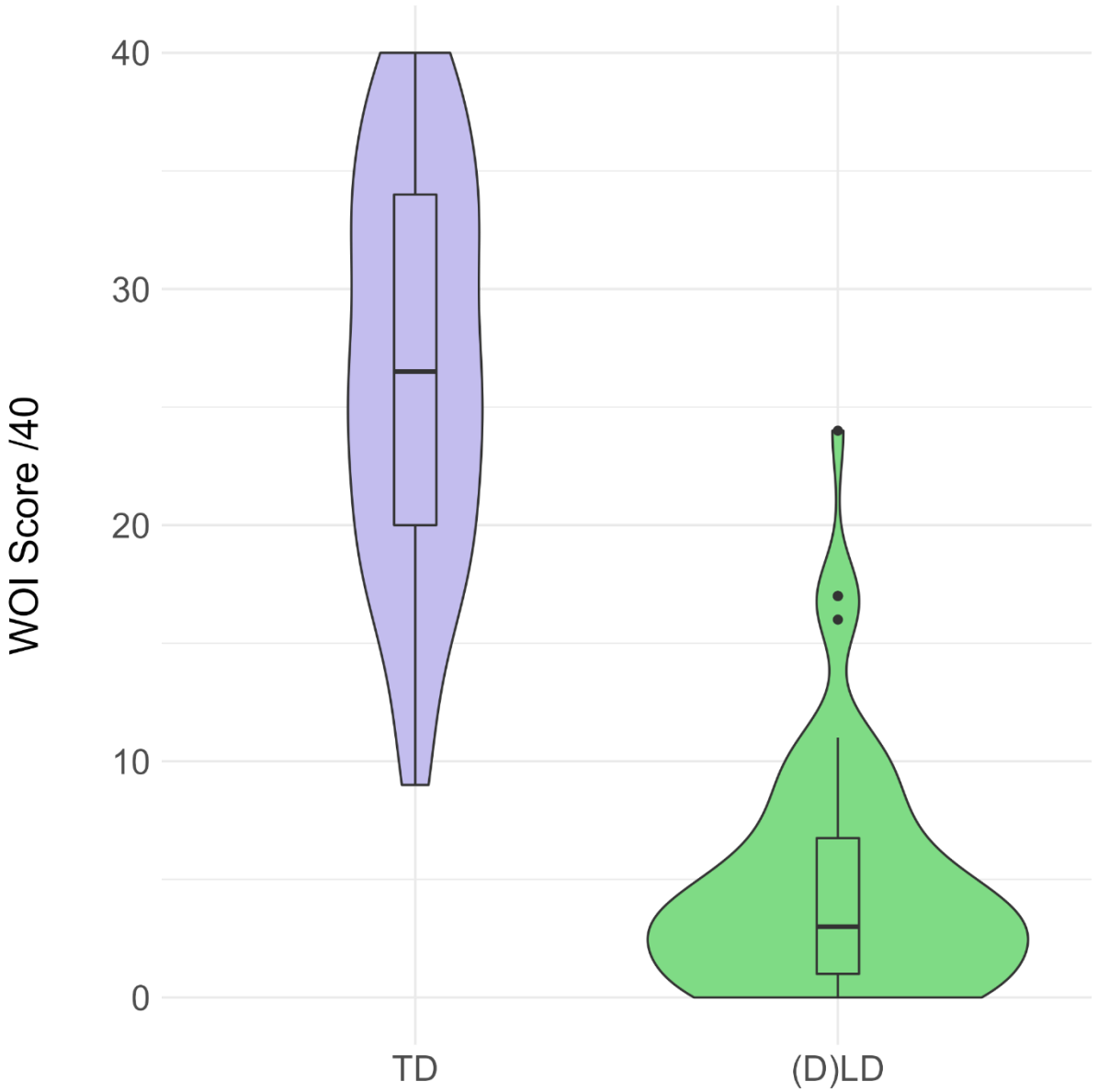

Figure 3: Distribution of TD versus (D)LD WOI scores (box plots show median and inter-quartile range; upper whisker shows Q3 + (1.5 x IQR), lower whisker shows Q1 – (1.5 x IQR); dots represent outliers).

RQ2: Do 16-year-olds with (D)LD and co-occurring motor difficulties differ in daily living skills when compared to 16-year-old with (D)LD who do not have motor difficulties?

The second objective was to investigate whether adolescents with (D)LD who do not have motor difficulties differ in DLS when compared to adolescents with (D)LD and co-occurring motor difficulties. Table 1 summarises background characteristics for both the (D)LD only and (D)LD plus motor difficulties groups.

Figure 4 shows the distribution of WOI results between the (D)LD only and (D)LD plus motor difficulties groups. Both groups appear to show a floor effect, but this is more pronounced in the (D)LD plus motor group. There appears to be a positive tail for the (D)LD only group. Mann Whitney U tests showed that there was a marginally statistically significant difference in the daily living skills of students with and without motor difficulties ((D)LD only Mdn = 5, (D)LD + motor Mdn = 3, $z = -1.987$, $p = 0.047$).

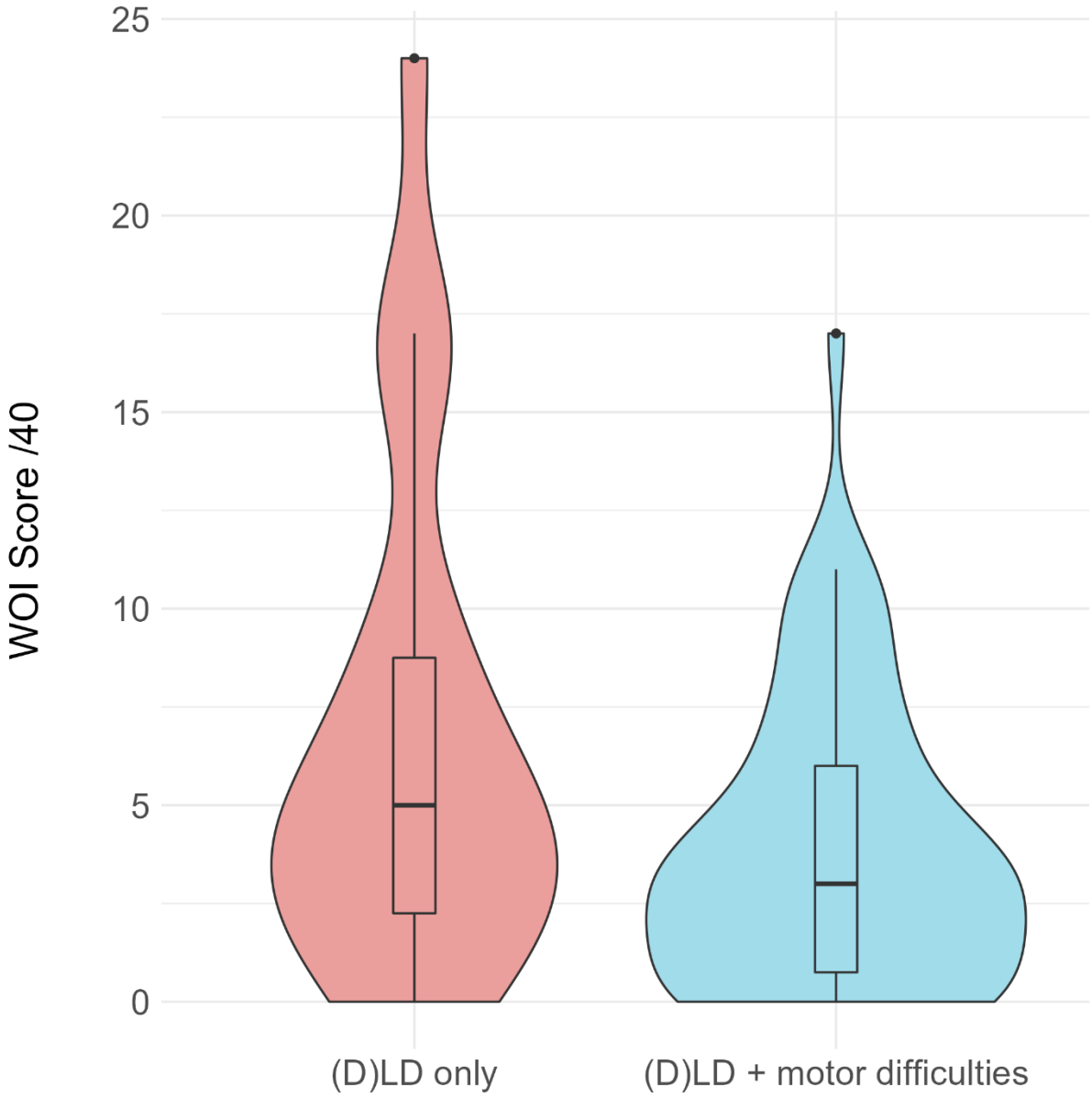

Figure 4: Distribution of (D)LD only versus (D)LD + motor difficulties WOI scores.

RQ3: Are there between-group differences on individual areas of DLS, as measured using the WHEEL OF INDEPENDENCE™ (WOI) Framework?

In order to explore the above results further, we compared scores for all three groups on each of the eight individual skill areas. Visual inspection of the TD data (see Figure 5) showed a ceiling effect for Laundry, Money skills and Time management while Leisure scores were distributed across the higher stages, with most clustering around Stage 4. Food shopping,

Meal preparation and Self-care were more evenly distributed and Housekeeping showed a greater distribution of scores at the lower stages. This contrasts with our (D)LD cohort, for whom Leisure showed the highest distribution of scores at Stage 3 and above while Laundry, Food-shopping and Time management showed a heavy clustering of scores around the lowest stages (0 and 1). For both Self-care and House-keeping, most scores were clustered at the lower end of the scale, but there were outliers who scored higher.

Statistical analysis showed there was a significant difference between the TD group and each of the (D)LD groups on all subtest scores ($p = < .001$). A Bonferroni adjustment was made to correct for multiple comparisons ($N = 24$). Significance was set at 0.002. There was no significant difference between the (D)LD +/- motor difficulty groups across any of the subtests of the WOI ($p > .002$) but the (D)LD+ motor difficulty group scored numerically lower than the DLD only group on all areas, except for food shopping.

It was not considered meaningful to carry out statistical comparisons across the different skill areas because the stages of achievement are not normalized, such that reaching a Stage 1 on Self-care (e.g., brushing your teeth and hair) would not be equivalent to a Stage 1 in Meal preparation (e.g., using a kettle and toaster). This can be seen clearly from our data from typically-developing 16-year-olds in Figure 5, where students are close to ceiling on some areas (e.g., Time management and Laundry) but not on others (e.g., Housekeeping).

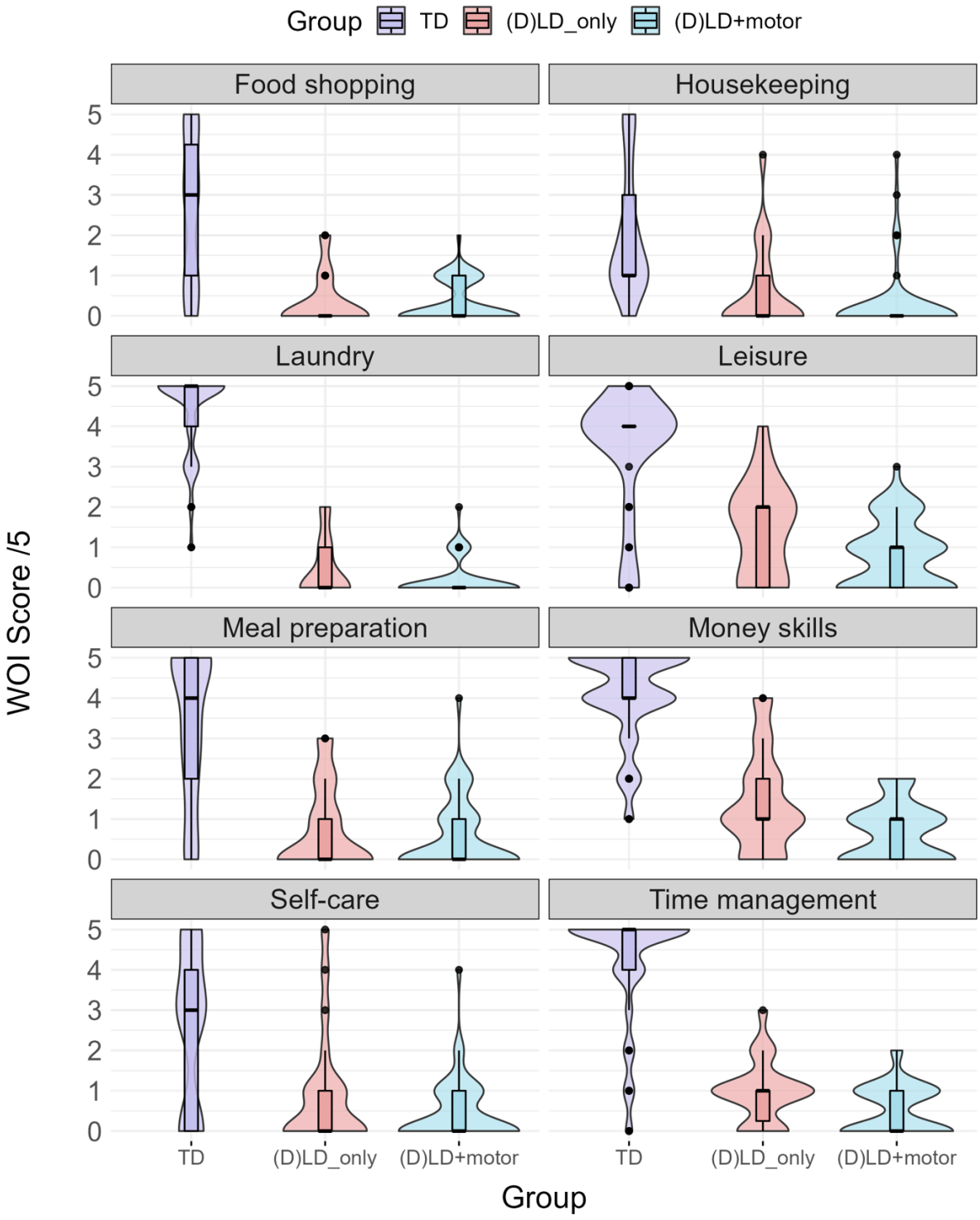

Figure 5: Group comparisons across core WOI life skill areas

RQ4: Is there a correlation between severity of language disorder and daily living skills?

To address our next two research questions (RQ 4 and 5), Spearman's rank order correlations were computed to examine the relationship between students' language and motor scores and their performance on the WOI. Figure 6 presents CELF core language standard scores for all participants with DLD, plotted against their overall WOI scores. This was not statistically significant $r_s(76) = .205$, p = .071.

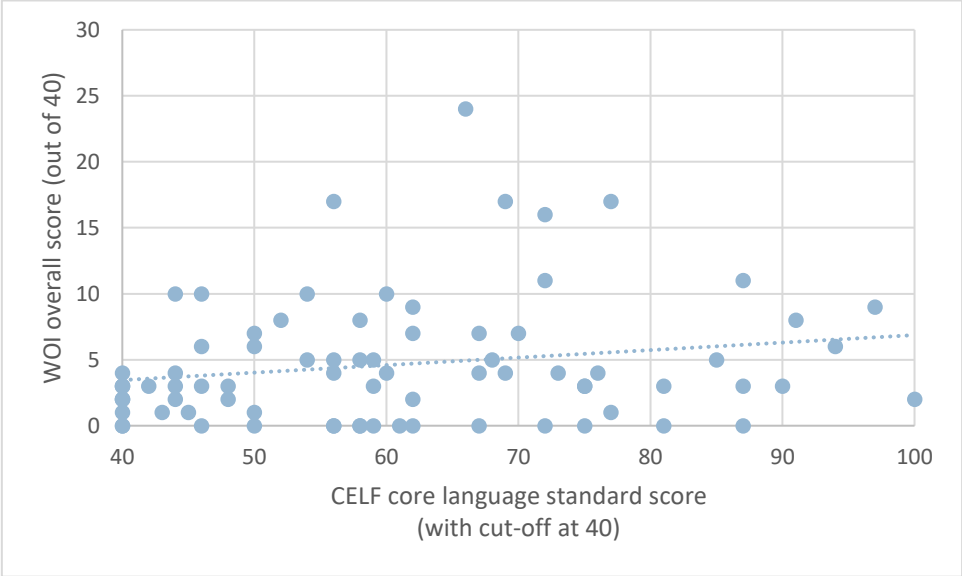

Figure 6: Correlation between severity of language score and WOI score for all participants with (D)LD

RQ5: Is there a correlation between severity of motor difficulties and daily living skills including when controlling for language ability?

We first compared CELF language scores between the (D)LD only and (D)LD + motor groups. Mann Whitney U tests indicated that there was a marginally significant difference in language skills between the two (D)LD groups (DLD only *Mdn* = 64, DLD + motor *Mdn* = 56, *z* = -1.969, p = 0.049). It was not possible to compare motor scores between the two groups, since the

BOT was not carried out with children in the (D)LD only group, for whom coordination was not an area of clinical concern. A Spearman's rank-order correlation was run to determine the relationship between language and motor skills in the DLD + motor group. There was a strong, positive correlation between core language and motor standard scores, which was statistically significant r_s (52) = .307, p = .024.

For the DLD + motor difficulties group, a separate Spearman's correlation was conducted to evaluate the relationship between BOT total motor composite standard scores and overall WOI scores (see Figure 7). The relationship between these variables was not statistically significant r_s(52) = .190, p = .170.

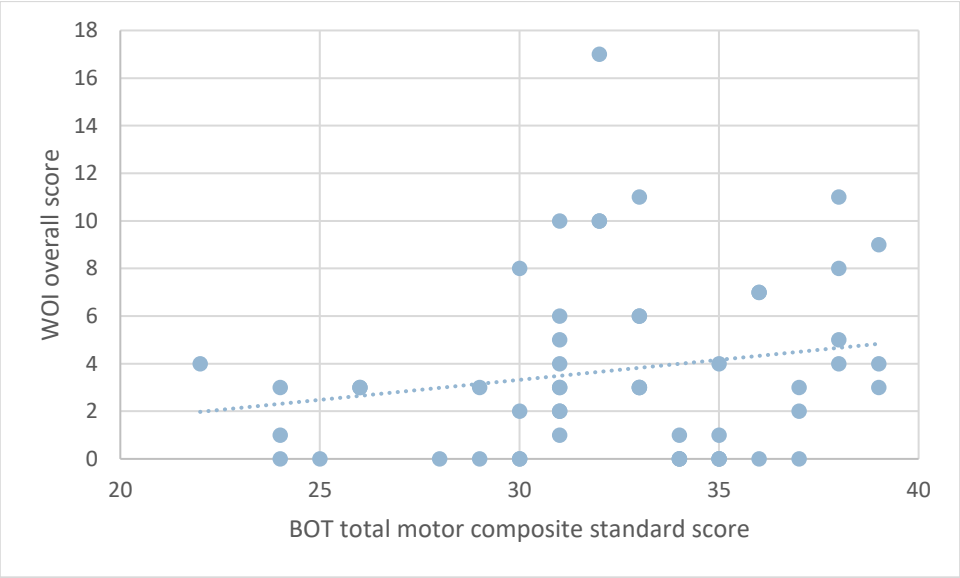

Figure 7: Correlation between severity of BOT motor score and WOI score for DLD + motor group

Non-parametric partial correlations controlling for language ability showed a non-significant relationship between motor scores and WOI scores in the DLD + motor group r_s(52) = .159, p = .257.

Discussion

This study is the first to compare the daily living skills of adolescents with and without (D)LD. We also explored the impact of co-occurring motor difficulties for students within the (D)LD group. Our results demonstrate a clear difference between the daily living skills of typically-developing 16-year-olds, who attend mainstream schools in the UK or Ireland, and those with identified (D)LD, who are accessing a specialist college provision and who have lower skills in all areas of daily living. This aligns with previous research which has identified difficulties with DLS acquisition for students with other developmental disorders e.g. ASD (Bal et al., 2015; Duncan and Bishop, 2015). Additionally, our findings support the theory that language plays a key role in the development of DLS, for example through understanding complex vocabulary, following instructions and communicating with others. However, language is closely associated with a number of other cognitive skills, such as executive functioning, a set of mental processes that allow us to plan, organize, problem solve and maintain focus on tasks. Furthermore, language disorders commonly co-occur with other difficulties, such as with literacy and understanding of numerical concepts. Whilst students' executive functioning, non-verbal skills, maths or writing were not assessed within this project, future research could explore the relative contribution of each of these areas to students' DLS development.

Findings for our second research question – comparing WOI scores for (D)LD students with and without co-occurring motor difficulties – were more equivocal, showing marginal statistical significance. Visual inspection of the plots indicate outliers in both (D)LD groups, which may have influenced the findings. It may be that a clearer effect would have been detected if a larger sample size had been recruited. This would support previous research on

other neurodiverse groups, such as autistic children (Travers et al., 2022), which found robust associations between motor (and sensory) difficulties and DLS.

Whilst the (D)LD + motor group scored numerically lower than the (D)LD only participants across all but one WOI subtest (RQ3), these differences were not statistically significant. This is somewhat surprising, given the overall finding that the (D)LD + motor group scored lower than the (D)LD only group across the combined WOI skill areas. At first sight, lower scores for students with identified coordination problems may be expected in tasks that have high demand on motor skills (e.g., changing washing on a clothes airer, carrying out kitchen tasks, and changing bedding). However, our results suggest that similar levels of difficulty are experienced with areas such as Money management and Time keeping, which draw upon higher-level language and cognitive abilities, rather than physical skills.

Our final research questions (RQ4 and 5) explored the strength and direction of associations between language, motor and WOI scores. There was no significant correlation between severity of language or motor difficulties and overall WOI scores within our population of college students attending a specialist provision for adolescents with severe language and associated needs. This was likely due to floor effects, particularly on the CELF language assessment, which reduced the distribution of scores to allow us to compare meaningfully the relationship between language and DLS skills. Similarly, motor abilities were only assessed for students for whom this was an area of clinical concern (those in the (D)LD + motor group), once again reducing the variability of BOT scores to compare against WOI data.

Our analysis was also complicated by the fact that students in the (D)LD + motor group showed significantly poorer language ability than those in the (D)LD only group (although this finding was marginal). This may be argued to support theoretical accounts indicating an

overlap between language and motor domains and merits further investigation. At present, the causal mechanisms underlying the relationship between language and motor development is unclear, with some researchers arguing that language difficulties place children at higher risk of motor impairments, due to shared cognitive or neuroanatomical pathways (Hill, 2010), while others suggest that delayed motor skills can impact on verbal interaction, e.g. because the child is less physically engaged with the world around them (Iverson, 2010). There could also be a third factor which impacts on both language and motor development, e.g. the procedural deficit hypothesis (Ullman & Pierpont, 2005). This suggests that an underlying cognitive deficit in procedural sequence learning e.g. acquiring the rules of grammar or how to tie shoelaces, may be responsible for difficulties with both language and motor skills. Further longitudinal studies will be required to explore how students' language and motor skills develop across time and which factors support or hinder progress in each of these areas.

Exploratory analysis of between-group differences on individual areas of the WOI showed contrasting patterns of skill development across our TD and (D)LD groups. For example, Laundry showed a ceiling effect for TD students and a floor effect for (D)LD students. Conversely, (D)LD students showed a relatively wider distribution of scores at the mid to high stages within Self-care and Leisure. This may be due to factors such as opportunity and motivation, as well as capability. For example, when students enter [redacted], they receive weekly life skills groups, which cover leisure activities, including travel training, whilst one-to-one OT sessions often focus on self-care, such as washing and styling hair. It is not clear whether differences in DLS teaching across mainstream and specialist educational settings may be contributing to the variation in WOI scores for students within the current

study, though the emphasis on practising aspects of the WOI as part of OT intervention at [redacted] is intended to support students to develop their DLS. The statistically significant difference between the TD and (D)LD groups emphasise the impact that capabilities have on achievement.

Another factor, which was not explored within this project, was the impact of parental expectations on DLS development. It may be that TD adolescents are not routinely being asked to demonstrate and develop house-keeping skills. By the same token, the delayed DLS of participants with (D)LD may be exacerbated by reduced expectations being placed on their abilities in the home. This may be due to the extra time it takes to teach these skills, meaning that the focus may be on achieving safe and functional levels, rather than developing higher-level DLS. Multiple studies have shown that lower parental expectations are linked to lower performance in adolescents with and without SEN (e.g., Carter et al., 2012). It may be that students with (D)LD receive more support and less pressure to carry out home tasks independently in comparison with TD peers. Further studies may be beneficial to gather the views of parents and carers, as well as adolescents, in order to explore this topic further.

Young people with (D)LD experience difficulties with expressive and receptive language, which may create challenges with learning skills that are fundamental to their participation in society and the world of work. The results from this study suggest that students with (D)LD will require adaptation of instructions and resources within DLS curricula to support their understanding and progress in this area. The overlap between language and motor difficulties, which has been highlighted in this study, emphasises the need for OTs and SLTs to consider joint working and sharing of expertise to achieve the best outcomes for students with neurodevelopmental conditions.

Limitations and future directions

A limitation of the current study is that we did not collect data on the language or motor skills of students in the typically-developing group. Face-to-face assessment was not feasible with the TD group, as participants were drawn from across the UK and Ireland. Nor did we assess current motor abilities in the (D)LD only group, since they were not on the OT caseload. Including those with higher and lower level abilities in multiple regression modelling would allow us to analyse robustly which predictors contribute to students' WOI outcomes and any interactions between these.

Another area for future investigation is the role played by other skills, such as literacy, numeracy, non-verbal abilites and executive functioning, in mediating the development of DLS and how these are linked with children's language and motor abilities. Further research is warranted to determine the relationship between these areas in order to help guide and tailor effective DLS interventions for students with language and additional needs. For example, consideration of whether to use bottom-up approaches (e.g., Vascelli et al., 2022), whereby focused practice of motor skills such as pulling, pushing and twisting is seen as a prerequisite for developing DLS, especially those such as dressing and using technology. An alternative to this would be a top-down approach, focusing on functional activities and skill areas, such as those included in the WOI framework.

The statistically significant difference between our TD and (D)LD comparison groups provides early support for the adoption of the WOI as an appropriate measure of a young person's daily living skills. Whilst the WOI is used routinely within our specialist setting, and in other UK schools and colleges, to track individual progress and longitudinal data is available within Moor House, the tool is not yet available internationally. Outcomes data have not yet been

analysed to determine which areas of DLS appear most responsive to intervention and how this relates to students' underlying language and motor profiles. Establishing the WOI as a standardized and validated assessment tool would increase confidence in its clinical usefulness. This would involve trialing the measure with a wider group of TD and (D)LD adolescents, as well as with different clinical populations.

Conclusion

This study focuses on a neurodiverse group, adolescents with (D)LD, who are not typically referred to OT services, unless they present with co-occurring motor or sensory difficulties. The results provide evidence for the impact of language difficulties on adolescents' developing DLS. However, several uncertainties remain. Larger scale studies would allow us to gain a greater understanding of the contribution of motor abilities and other areas to students' DLS development. This, in turn, would help OTs to tailor their interventions to ensure that they are targeting the most important areas and may drive the development of appropriate accommodations to support students with language differences. Doing so may ultimately help maximise the benefits of occupational therapy for students with (D)LD, with the aim of enhancing their quality of life.

Key findings

Adolescents with (developmental) language disorder have significantly lower daily living skills than their typically-developing peers.

Further research with a wider sample is required to determine conclusively whether or not students with (D)LD and co-occurring motor difficulties differ in their life skills from those with (D)LD only.

What the study has added

This study was the first to investigate daily living skills in this clinical population and indicates that language and, potentially, motor abilities can affect adolescents' development of independence.

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