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ORIGINAL PAPER

“I Am Dyspraxic”: Self-Concept and Wellbeing in Adults with Developmental Coordination Disorder

Clare Josephine Rathbone[1] · **Kate Wilmut**[1]

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Abstract

Objectives Self-concept is underresearched in adults with developmental coordination disorder (DCD), as is the role of diagnosis. Self-concept is linked to wellbeing, which has been shown in previous research to be reduced in DCD. This research aimed to examine the relationships between diagnosis, self-concept, and wellbeing and to explore for the first time the autobiographical memories that underpin self-concept in DCD.
Methods Across two novel studies, we examined how adults with DCD define their identities and how this relates to their wellbeing, their memories, and the presence of a diagnosis. Both diagnosed (dDCD) and self-identified (sDCD) adults with DCD and without DCD were recruited (Study 1: dDCD $N = 97$, sDCD $N = 48$, non-DCD $N = 49$; Study 2: dDCD $N = 104$, sDCD $N = 32$). An online questionnaire asked participants to describe and rate their identity using ‘I am’ statements and (in Study 2) associated memories. Participants also completed scales of wellbeing and, for Study 2, a scale of motor ability.
Results We found no significant differences between dDCD and sDCD groups—both had lower wellbeing scores than the non-DCD group and rated their DCD-related self-concepts and memories as negatively valenced (compared to non-DCD-related aspects of their identity). In both studies, self-concept valence was a significant predictor of well-being scores.
Conclusions These finding suggests that self-concept in DCD is a priority area for future research and may be an important target for intervention. Furthermore, these data suggest that an early diagnosis of DCD may not be a protective factor.

Keywords DCD · Dyspraxia · Self · Identity · Autobiographical memory · Wellbeing

The core characteristics of developmental coordination disorder (DCD), a condition affecting around 5% of the population (Blank et al., 2019), include difficulties with fine and/or gross motor skills relative to their peers, which has a negative impact on activities of daily living, scholastic achievement, and vocational choices (APA, 2013). Difficulties manifest across all activities of daily living which includes, but is not limited to dressing, eating with utensils, learning to drive, preparing food, and shaving/putting on makeup (Blank et al., 2019). These difficulties occur during early stages of development and in the absence of neurological conditions such as cerebral palsy (APA, 2013), the difficulties have also been shown to persist into late childhood and throughout adulthood (Blank et al., 2019). Although DCD is a distinct neurodevelopmental condition, it does commonly occur alongside attention deficit hyperactivity disorder (ADHD) and autism spectrum disorder (ASD) (Blank et al., 2019). If we look beyond the primary consequences of DCD, we also see a number of secondary consequences associated with DCD which include deficits in executive function (Bernardi et al., 2018), lower levels of cardiovascular fitness (Rivilis et al., 2011), and an increase in mental health difficulties (Omer et al., 2019). It is this last secondary consequence, in adults with DCD, which is the focus of the current paper.

As alluded to above, there has been a growing body of research which demonstrates higher levels of emotional problems (anxiety and depression) in children with DCD compared to their peers (Tamplain & Miller, 2021). In fact, a review has identified that up to 34% of children with DCD experience symptoms of anxiety and up to 15% symptoms of depression (Draghi et al., 2020) which are significantly higher than those seen in neurotypical groups with up to 23%

✉ Kate Wilmut
k.wilmut@brookes.ac.uk

[1] Centre for Psychological Research, School of Psychology, Social Work and Public Health, Oxford Brookes University, Oxford OX3 0BP, UK

experiencing anxiety and up to 5% depression (Draghi et al., 2020). More broadly, another meta-analysis considered internalising symptoms in children and adults with DCD (Omer et al., 2019). The combination of 22 studies yielded a medium effect size with higher levels of internalising symptoms found in groups of DCD compared with controls or, in some papers, groups of those described as probable DCD compared with controls. Research has suggested that this increase in internalising symptoms may be mediated by personal and interpersonal factors as described in the 'Environmental Stress Hypothesis' (ESH; Cairney et al., 2013). The ESH provides a model which describes the pathways that might exist between motor skills and internalising problems. It is hypothesised that DCD exposes an individual to a range of psychosocial stressors (e.g., peer exclusion, lack of social support, poor academic achievement, low self-esteem, etc.). It is constant exposure to these stressors that may then result in the onset of internalising problems which are further maintained by the mediation of those stressors (Cairney et al., 2013; Mancini et al., 2016). Despite these findings, only a handful of studies have focused on these factors in an adult population. Studies on young adults with DCD have reported a lower level of life satisfaction and quality of life compared to their peers (Hill et al., 2011; Tal Saban et al., 2014). Which could potentially be linked to the higher levels of both state and trait anxiety which have also been seen in this population (Hill & Brown, 2013) along with a high incidence of self-reported anxiety and depression levels falling above the 'normal' range (Kirby et al., 2013).

Despite its prevalence, DCD is underrecognised by healthcare professionals (Meachon et al., 2024; Wilson et al., 2013), teachers (Bidwell, 2022), employers (Doyle, 2020), and wider society (Steenbergen et al., 2024). For example an online study, conducted in 2024, comprising 346 clinicians (from Germany) demonstrated that only 58% of clinicians had knowledge of the condition and only 35% could correctly diagnose DCD when given a case vignette (Meachon et al., 2024). Alongside this lack of awareness, there is growing acknowledgment of the complexity and heterogeneity of DCD which can make the identification and support more challenging (for a review see Meachon, 2023). One aspect of this complexity is the apparent mis-match between the primary consequences of DCD (a difficulty with motor control) and the everyday experiences of adults who would cite difficulties with executive functioning as their primary concern (Purcell et al., 2015). Both the lack of awareness and the complexity of DCD can lead to underdiagnosis during childhood leaving adults with DCD either unaware of the reasons for the difficulties they face or seeking diagnosis during adulthood which can be costly. Furthermore, the lack of awareness and knowledge surrounding DCD may mean that, even with a diagnosis, individuals are not sufficiently supported (Steenbergen et al., 2024) and so a diagnosis may not reduce emotional problems. This is reflected in a qualitative study interviewing four female adults seeking a diagnosis of DCD (Williams et al., 2015). Participants reported a sense of relief coming from the diagnosis, which in turn meant they treated themselves less harshly and were more able to accept their difficulties. However, participants also reported negative emotions such as feeling overwhelmed by the diagnosis or continuing to feel let down in terms of the support received (Williams et al., 2015).

Many of these feelings post-diagnosis are also described by individuals with other neurodevelopmental conditions. A meta-synthesis considered studies looking at the diagnostic process and outcome for individuals with autism. When focusing on the emotion connected to diagnosis this review demonstrated that diagnosis of autism was accompanied by a range of emotional responses. Most of the studies in the review reported a range of emotions including sadness towards a late diagnosis but also relief and validation (Wilson et al., 2023). Furthermore, adult participants often thought back to past challenges and felt an earlier diagnosis would have been more beneficial for their sense of self and emotional wellbeing. However, younger participants sometimes reported feelings of anger or avoidance with regard to their diagnosis. In a study on the impact of autism diagnosis on wellbeing, self-esteem, and identity, Corden et al. (2021) found that dissatisfaction with being autistic decreased with more time since diagnosis. Research focusing on adults with ADHD has also reported the important 'explanation' provided by a diagnosis but they also reported feelings that it restricted possibilities (Hansson Halleröd et al., 2015). These studies, and many more not cited here, demonstrate the mixed emotions which can accompany diagnosis in both adulthood and childhood.

If we want to consider the role diagnosis might have in wellbeing (e.g., Corden et al., 2021; Wilson et al., 2023), we must understand its impact on self-concept. The term 'self-concept' is defined as qualities that constitute individuals' perceptions of long-term and enduring aspects of their identity and is closely linked to mood and wellbeing (Marsh & Shavelson, 1985; Rathbone et al., 2015). Research focusing on psychiatric diagnoses (which included ADHD) has examined the impact of diagnosis on self-concept. In their review, O'Connor et al. (2018) analysed 38 studies covering qualitative data on diagnosis with a range of conditions including ADHD, ASD, anorexia, anxiety, and schizophrenia. They found that, whilst diagnosis can reduce self-worth and create a threat to self-concept, it can also help promote a more positive self-concept via enhanced self-understanding. Naturally the impact of diagnosis varies across condition, for example psychotic disorders are associated with more societal stigma than mood disorders (Angermeyer & Dietrich, 2006). Studies which have considered self-concept in DCD have focused on self-concept with regard to physical aptitude and skill and, in all but one study, have only considered child populations (Cocks et al., 2009; Hands et al., 2020). These studies suggest that some aspects of self-concept are viewed more negatively by children with DCD. For example, Cocks et al. (2009) found that boys with DCD had more negative views of aspects of their self-concept associated with physical and social domains, compared to normative mean values, and (Yu et al., 2016) found that children with DCD viewed themselves as less competent in terms of physical coordination, sporting ability, and physical health, compared to peers without DCD.

Only a single study has considered self-concept in adults with DCD and this was explored alongside anxiety, self-efficacy, and resilience (Harris et al., 2021). General and movement-specific anxiety, self-efficacy, and general resilience were all poorer in adults with DCD (both diagnosed and self-identified) compared to adults without DCD, while no differences were seen between those with and without a DCD diagnosis. However, this study did not consider how participants viewed those aspects of their self-concept (whether they were positive or negative) nor how central or important they were to their identity. Understanding the importance and valence of self-concepts is valuable, as previous research in the general population has shown that having a positive self-concept/self-image is linked to higher levels of wellbeing (Rathbone et al., 2015). Thus, in addition to seeking to replicate Harris et al., (2021), the present research is the first to focus specifically on the characteristics of DCD-related identities and how they relate to wellbeing.

Study One

The first study had a number of pre-registered[1] research questions and hypotheses:

> **RQ1:** How does general self-concept differ between a population with and without DCD and is this influenced by diagnosis status? (Here, when we talk about self-concept, we are referring to the valence and importance of identities in the form of 'I am' statements). *Given the limited findings from previous studies, which focus on children and use different methods (*Cocks et al., 2009; Yu et al., 2016*), it is difficult to make a clear directed prediction; however, we would expect the overall valence of statements to be more negative within the DCD population.*
>
> **RQ2:** Within a DCD population are identities relating to their DCD seen as positive or negative and what importance do individuals place on these? Does this differ regarding diagnosis status and does it link to age of diagnosis? *Although previous studies have examined general self-concept in DCD (*Harris et al., 2021*), this is the first study to ask for identities relating to DCD so it is difficult to know whether these will be positive or negative.*
>
> **RQ3:** How do anxiety, depression, life satisfaction, and wellbeing differ between a population with and without DCD and is this influenced by diagnosis status? *In line with previous research, we would expect to see a higher level of anxiety and depression and a lower level of life satisfaction and wellbeing in our group with DCD compared to the group without. However, how this is influenced by diagnosis or age of diagnosis remains to be seen.*
>
> **RQ4:** Is there a relationship between elements of self-concept (e.g., importance and valence), anxiety, depression, life satisfaction, and wellbeing? How does this relationship differ, for the DCD group, when considering identities in relation to their DCD? How does it relate to diagnosis status? *We would expect to see positive relationships between self-concept valence and life satisfaction and wellbeing (more positive identities related to higher well-being) and negative relationships between identity valence and depression and anxiety (more positive identities related with lower depression and anxiety). The relationship between identity importance and wellbeing will also be explored. As this is the first study to specifically ask for identities relating to DCD, it is difficult to know how this will change the relationship.*

Method

Participants

105 adults diagnosed with DCD (dDCD), 52 adults with self-identified DCD (sDCD) and 53 adults without DCD (non-DCD) submitted their data. However, exclusions were made under the following criteria: 1. providing nonsense identity statements (dDCD = 1); 2. not providing full details for general identity statements (dDCD = 3, sDCD = 1); and 3. not providing chronological age (dDCD = 4, sDCD = 3, non-DCD = 4). Details of the remaining participants can be found in Table 1 which also contains details of participants for study 2. A further five participants (3 dDCD, 2 sDCD) did not provide full details for the DCD-specific identity statements. These participants were retained in the overall cohort but excluded for analyses using those variables. This was an online study and participants were recruited in a number of

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[1] Both studies one and two were pre-registered on the OSF website, those pre-registrations along with the questionnaires and data can all be found under this project: https://osf.io/b4k2z/. For clarification, where additional analyses were conducted which were not specified on the OSF pre-registration this has been made clear.

Table 1 Group characteristics for study one and study two

		Study one			Study two	
		dDCD	sDCD	Non-DCD	dDCD	sDCD
N		97	48	49	100	31
Age (in years)*	Mean	38.9 (12.7)	46.4 (13.6)	46.2 (14.7)	31.8 (9.3)	39.2 (13.6)
	Range	18–69	18–79	20–74	18–60	18–76
Gender (%)	Man	20.6	10.4	12.2	23.8	13.3
	Woman	72.2	83.3	81.6	68.3	70.0
	Non-binary	4.1	4.2	2	4.0	13.3
	Self-describe	2.1	2.1	4.1	3.0	3.3
	Prefer not to say	1.0	0	0	0	0
Co-occurrences (%) grouped in line with neurodevelopmental disorder categories in the DSM-5	None	47%	65%	88%	40%	55%
	ASD	16%	13%	4%	12%	29%
	ADHD	5%	17%	4%	13%	19%
	SpLD	43%	21%	6%	47%	16%
	Intellectual disorder	0%	4%	0%	1%	0%
	Communication disorder	10%	17%	0%	19%	6%
Adult DCD/Dyspraxia Checklist (ADC)[a]	Section 1	-	-	-	24.2 (4.80)	22.5 (5.41)
	Overall total				81.7 (19.15)	79.3 (16.16)

[a] For study 2: in the dDCD group, 8% of participants scored under 17 on section A of the ADC suggesting those participants may not have had movement difficulties in childhood, this was 12% for the sDCD group, no significant difference was seen between these groups, $\chi^2(1)0=0.684$, $p=0.408$. For section B, 12% of the dDCD group and 9.7% of the sDCD group scored below 56 suggesting that they may not meet the criterion for DCD, again no difference in grouping was seen between the groups $\chi^2(2)=0.975$, $p=0.614$. Despite the fact that some participants in the DCD groups may not meet the criteria laid out by the ADC, all participants were included as no differences were seen between the groups and because the ADC does not address all of the diagnostic criteria for DCD. Please note the ADC was not administered in study 1

*Significant group difference $p<0.001$ for both studies. However, ANOVA was used given that older adults are less likely to have received a diagnosis of DCD and it is rarely appropriate to use ANCOVA to remove the effect of a variable which may be inherent to group membership (Miller & Chapman, 2001)

ways namely, through the author's database of participants willing to take part in research, through social media (i.e., Twitter, now re-named X), via the Dyspraxia Foundation and via other personal contacts of the authors. Ethical approval for this study was granted by Oxford Brookes University Research Ethics Committee (Ref No: 191352).

Procedures

Participants were presented with the sections of the questionnaire as they are described above. In addition, participants indicated whether they were diagnosed with DCD, had self-identified DCD, or did not either have diagnosed or self-identified DCD, allocation to groups was done on the basis of their answer to this question.

Measures

The online questionnaire consisted of five distinct sections as described below, a full copy of the questionnaire can be found under the OSF project page as cited above.

Self-Concept Participants were asked to provide up to 10 'I am' statements and then also rate each one in terms of its importance (from 1, not at all important to 10 very important), its valence (−5, very negative to + 5, very positive) and also the age at which it emerged (i.e., the age the participant was when that self-concept became a defining part of their identity). These statements were freely-generated (not selected from a list) and thus enabled participants to describe their identity in their own words. They included reference to a range of identities including social (e.g., 'I am a sister'), physical (e.g., 'I am tatooed'), and psychological (e.g., 'I am caring') self-concepts. Participants who had indicated they were either diagnosed with DCD or self-identified they had DCD were also asked to generate up to three DCD related 'I am…' statements also providing importance, valence and age of emergence for each. Mean values of importance and valence were taken for both types of identity statement (general and DCD-related). These are not standardised scales but are based on the widely used Twenty-Statements Test (Kuhn & McPartland, 1954) and IAM Task (Rathbone et al., 2008).

Wellbeing Scales: Generalised Anxiety and Depression These were measured using the Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983). This consists of 14 questions, each rated on a 4-point scale (from 0 to 3), which ask participants to choose the statement which most closely relates to how they have been feeling over the past few weeks. An overall anxiety and an overall depression subscale score were determined by summing relevant questions. For both subscales, a score of $\geqslant 8$ is used to indicate possible cases and $\geqslant 11$ to indicate valid cases (Zigmond & Snaith, 1983).

Life Satisfaction This was measured with the standardised Satisfaction with Life Scale (SWLS; Diener et al., 1985) which requires participants to respond to 5 questions using a 7-point scale (7 strongly agree to 1 strongly disagree). Responses were summed to provide an overall score. The scale has high internal consistency and high temporal reliability (Diener et al., 1985), with higher scores indicating a higher satisfaction with life.

General Wellbeing General wellbeing was measured using the standardised 18-item Psychological Well-being (PWB) scale (Ryff & Keyes, 1995). This scale asks participants to rate 18 items on a 7-point scale (1, strongly agree to 7 strongly disagree). Appropriate questions were reverse coded and then the responses summed. Higher scores indicate higher psychological wellbeing.

Demographics Participants were asked to provide their age in years, their gender, any formal or self-identified diagnoses of DCD/Dyspraxia (where appropriate we asked for age at diagnosis) along with any other developmental difficulties they have experienced (and age at diagnosis/self-identified diagnosis).

Statistical Analysis

One- and two-way ANOVAs were used to investigate differences between groups and identity types while Spearman correlations were used to look for relationships. Where multiple correlations were conducted, a Bonferroni adjustment for the number of comparisons was made. A regression analysis was used to investigate factors predicting wellbeing. Bayes factor is reported throughout and was investigated via the JASP package using default priors. A model average was given for *F* tests (ANCOVAs and regression) and is represented as bayes inclusion (BF_{inc}), for correlations a BF_{10} value is provided. Values above 3 were taken as evidence of a significant effect with cut-off point for different degrees of strength (in line with the standard classifications > 100 is taken as “extreme evidence,” 30–100 is taken as “very strong evidence,” 10–30 is taken as “strong evidence,” and 3–10 is taken as “moderate evidence”). Values between 0.33 and 3 are taken as no evidence of either a significant or a non-significant effect. Values below 0.33 is taken as evidence for a non-significant effect (0.10–0.33 is moderate evidence, 0.033–0.33 is strong evidence, 0.01–0.033 is very strong evidence, and values below 0.01 extreme evidence). These values are in line with those suggested by previous research studies (Lee & Wagenmakers, 2013). *Q-Q* plots were checked prior to all statistical analyses (where appropriate).

Results

RQ1: How Does General Self-Concept (Valence and Importance) Differ Between a Population with and Without DCD and is this Influenced by Diagnosis Status?

Data concerning the valence and importance of the general ‘I am’ statements can be found in Fig. 1. One-way ANOVA found a significant group effect of valence ($F(2,191) = 4.58$, $p = 0.009$, partial $\eta^2 = 0.05$, $BF_{inc} = 3.56$). Post-hoc tests with Tukey correction found that this was due to lower valence (more negative) from the individuals with diagnosed ($p = 0.012$, $BF_u = 0.130$) and self-identified DCD ($p = 0.025$, $BF_U = 0.175$) compared to the non-DCD individuals, no difference was found between the two DCD groups ($p = 0.98$, $BF_u = 5.238$). No effect was found for importance (group: $p = 0.092$, $BF_{inc} = 0.456$).

RQ2: Within a DCD Population are Identities Identified by the Participant as Relating to DCD Seen as Positive or Negative and how Important are these? Does this Differ Regarding Diagnosis Status and Does it Link to Age of Diagnosis?[2]

The relationship between importance and valence of DCD statements was initially explored in each group by running correlations between these variables (and between age of diagnosis for the dDCD group only). For the dDCD group, a significant positive correlation was found between the valence of the DCD specific statements and the importance of those statements, the more positive an identity the more importance it carried ($N = 97$, $\rho = 0.345$, $p < 0.001$, $BF_{inc} = 196.738$). The same correlation was not significant for the sDCD group ($p > 0.05$, $BF_{inc} = 0.309$). In addition, no significant correlations were seen between age of diagnosis and DCD specific valence ($p > 0.05$, $BF_{inc} = 0.130$) or DCD

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[2] Please note, as a deviation from the OSF pre-registration we choose to answer this question using a two-way ANOVA which allowed us to compare the DCD and the non-DCD-related identities. This was an additional consideration on top of what we had already proposed.

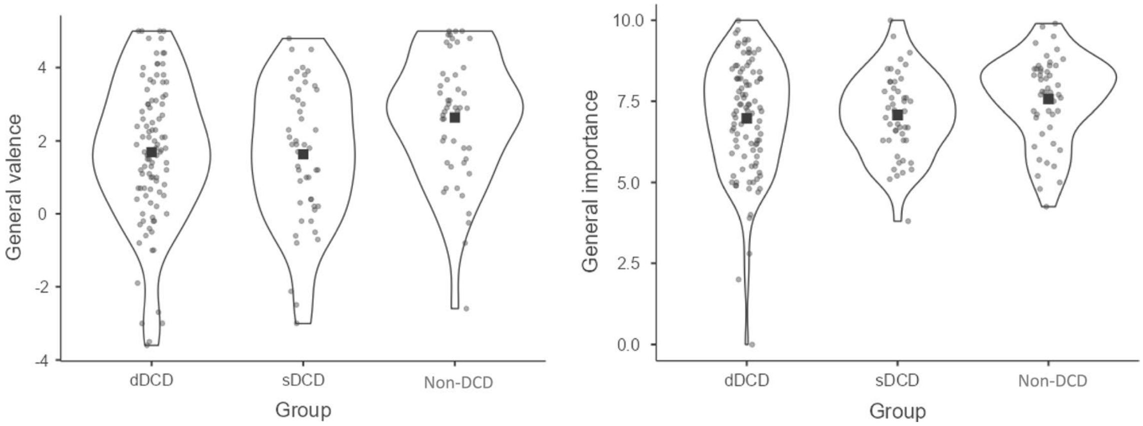

Fig. 1 Violin plots for the general valence and importance data shown across group. The mean value is represented by a black square

specific importance ($p > 0.05$, $\mathrm{BF}_{\mathrm{inc}} = 0.172$) in the dDCD group.

As the participants with DCD completed two different types of self-concept statement, a comparison of these as well as group was considered for both valence and importance using two-way ANOVA comparing group (dDCD vs. sDCD) and type of I am statement (DCD-specific vs general statements). Data can be found in Fig. 2. For valence, extremely strong evidence was found for a significant difference across statement type ($F(1,142) = 169.87$, $p < 0.001$, partial $\eta^2 = 0.545$, $\mathrm{BF}_{\mathrm{inc}} = \infty$) which was due to more negative DCD-related statements compared to the general statements. A significant interaction between group and statement type was also found ($F(1,142) = 4.89$, $p = 0.029$, partial $\eta^2 = 0.03$, $\mathrm{BF}_{\mathrm{inc}} = 2.43$). The interaction is explained by the non-significant difference for the dDCD compared to the sDCD group for general statements (see above) but that the sDCD group attributed a significantly more negative valence to DCD-specific 'I am' statements compared to the dDCD group ($F(1,142) = 5.10$, $p = 0.025$, partial $\eta^2 = 0.04$, $\mathrm{BF}_{\mathrm{inc}} = 1.88$). However, do note that Bayesian analysis suggests insufficient evidence to conclude either a significant or a non-significant effect.

For importance, a main effect of importance type was significant ($F(1,142) = 47.52$, $p < 0.001$, partial $\eta^2 = 0.25$, $\mathrm{BF}_{\mathrm{inc}} = 3.10 \times 10^6$), with general statements rated as more important than DCD-specific ones. The main effect of group was not significant for either valence or importance (valence, group $p = 0.106$, $\mathrm{BF}_{\mathrm{inc}} = 1.08$, importance, group $p = 0.149$, $\mathrm{BF}_{\mathrm{inc}} = 2.50$). There was also strong evidence of a significant interaction between group and statement type ($F(1,142) = 8.33$, $p = 0.005$, partial $\eta^2 = 0.06$, $\mathrm{BF}_{\mathrm{inc}} = 8.70$). The interaction is explained by lack of a significant difference for the dDCD compared to the sDCD group for general statements (see above) but that the sDCD group attributed less importance to DCD-specific statements compared to the

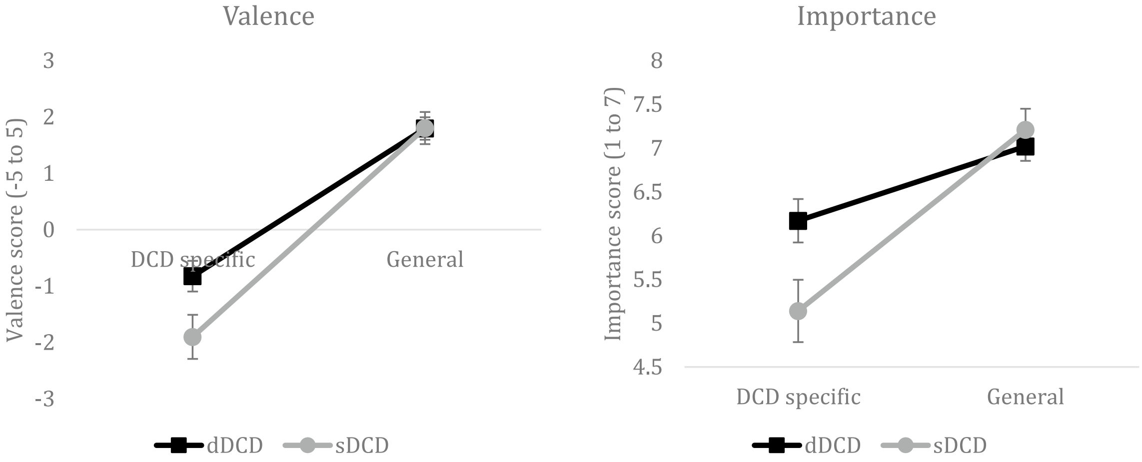

Fig. 2 Graphs depicting the interaction between the type of statement given (general or DCD specific) and group (dDCD or sDCD). Self-concept valence data are provided on the left and importance on the right. The error bars represent standard error

Table 2 Scores from the SWLS, HADS anxiety, HADS depression, and PWB questionnaires, given for each group. Standard deviation is given in brackets

	dDCD	sDCD	Non-DCD	Group effect
SWLS	20.2 (6.85)	19.4 (7.90)	22.7 (8.10)	$BF_{inc}=0.507$
HADS anxiety	11.9 (4.20)	12.3 (4.16)	9.86 (3.96)	$BF_{inc}=4.91$*
HADS depression	6.15 (3.87)	5.56 (3.79)	4.59 (3.32)	$BF_{inc}=0.375$
PWB total	81.4 (15.6)	81.9 (17.7)	90.8 (13.6)	$BF_{inc}=13.5$*

*$p<0.001$

dDCD group ($F(1,142)=5.63$, $p=0.019$, partial $\eta^2=0.04$, $BF_{inc}=2.38$). These data are depicted in Fig. 2.

RQ3: How do Anxiety, Depression, Life Satisfaction, and Wellbeing Differ Between a Population with and Without DCD and is this Influenced by Diagnosis Status?

Data from the well-being measures can be seen in Table 2. One-way ANOVAs (group) were used to investigate the presence or absence of group effects. A significant group effect was found for HADS anxiety ($F(2,191)=5.26$, $p=0.006$, partial $\eta^2=0.052$, $BF_{inc}=4.91$) and PWB total ($F(2,191)=6.40$, $p=0.002$, partial $\eta^2=0.063$, $BF_{inc}=13.5$). Indicating strong evidence for group differences for these factors. For HADS anxiety, the difference lay between the DCD groups and the non-DCD group (dDCD > non-DCD, $BF_u=6.21$, sDCD > non-DCD, $BF_u=10.446$, sDCD = dDCD, $BF_u=0.224$). The same pattern of results was found for the PWB total (dDCD < non-DCD, $BF_u=33.665$, sDCD < non-DCD, $BF_u=3.597$, sDCD = dDCD, $BF_u=0.191$). No group effects were seen for HADS depression ($p=0.058$, $BF_{inc}=0.701$) or SWLS ($p=0.077$, $BF_{inc}=0.517$), although in both cases Bayesian analysis suggests insufficient evidence to conclude either a significant or a non-significant effect.

RQ4: Is there a Relationship Between Elements of Self-Concept (e.g., Importance and Valence), Anxiety, Depression, Life Satisfaction, and Wellbeing? How does this Relationship Differ, for the DCD Group, when Considering Identities in Relation to Their DCD and Diagnosis Status?[3]

Relationships between self-concept (valence and importance for both general and DCD specific statements) and measures of wellbeing (these were only done for the HADS anxiety and PWB scores as it was these which demonstrated a group difference) were explored using Spearman correlations for each group separately (for the dDCD group age of diagnosis was included). The outcome of these correlations is in Table 3.

Finally, in order to consider the predictors of wellbeing in DCD, we conducted regression analysis on the DCD groups only. To do this, we used the PWB measure as it yielded stronger relationships between it and the valence of identities compared to anxiety. Variables which were added to the regression included valence and importance measures (both general and DCD-specific), group, and chronological age. Prior to analysis assumptions, checks were conducted. Durbin-Watson test was non-significant ($p=0.274$) indicating auto-correlation of errors, tolerance values were all above 0.813, thus not approaching zero, the *Q-Q* plot indicated close clustering of residuals to the line, demonstrating normal distribution of residuals and the residual plots suggested random distribution. All of these checks suggest assumptions were met and so the outcome of the regression analysis is reliable (Tabachnick & Fidell, 2007).

A significant regression model was found $F(6,137)=7.02$, $p<0.001$, Adjusted $R^2=0.202$. Both measures of valence (for general and DCD-specific self-concepts) were significant predictors. Group (dDCD or sDCD), age, and the two measures of importance were not significant predictors. Coefficients can be found in Table 4.

Discussion from Study One

This first study had four specific research questions which focused on the nature of general self-concepts in those with DCD compared to those without, the nature of DCD specific self-concepts in those with DCD, differences in wellbeing measures across those with and without DCD, and finally, the relationships between self-concepts and wellbeing. In terms of general self-concepts, these were shown to be more negative in those with diagnosed DCD compared to their peers without DCD. There was evidence, albeit weak, that the general self-concepts of those who self-identify as DCD were also more negative compared to their peers. This finding is in line with previous work which has shown that children with DCD report a greater degree of negative self-concept compared to their peers (Cocks et al., 2009; Yu et al., 2016). This is the first study which has considered the emotional valence of identity in adults with DCD. The finding that those self-concepts were no less important in the DCD population, despite their increased negativity, may explain the poor outcomes in terms of wellbeing which characterise this population. However, despite the non-significant *p* value Bayesian analysis suggests a lack of evidence to support a conclusion that there were no differences between the importance of those general identities (Lee & Wagenmakers, 2013).

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[3] Please note that this is a combination of RQ4 and RQ5 as stated on the OSF website. In the pre-registration, we only stated that correlations would be conducted. The regression analyses conducted here were an addition and are exploratory.

Table 3 Spearman correlation coefficients, *p* values, and BF_{10} values for relationships between the identity measures (valence and importance) and the measures of wellbeing (PWB and HADS anxiety)

		dDCD			sDCD			Non-DCD		
		ρ	P	BF_{10}	ρ	P	BF_{10}	ρ	P	BF_{10}
Valence general	PWB	.437	<.001	1455	.441	.002	14.52	.414	.003	31.15
	HADs anxiety	-.218	.032	.872	-.249	.087	1.56	-.429	.002	6.61
	Age of diagnosis	-.014	.889	1.509	-	-	-	-	-	-
Valence DCD specific	PWB	.346	<.001	56.81	.375	.009*	3.547	-	-	-
	HADs anxiety	-.420	<.001	211.9	-.194	.190	.696	-	-	-
	Age of diagnosis	-.014	.894	.130	-	-	-	-	-	-
Importance general	PWB	.189	.064	1.599	.067	.650	.209	.292	.042	1.44
	HADs anxiety	-.072	.481	.314	-.054	.718	.180	-.393	.005	2.97
	Age of diagnosis	.558	.060	.152	-	-	-	-	-	-
Importance DCD specific	PWB	.064	.533	.163	.005	.975	.182	-	-	-
	HADs anxiety	.069	.502	.150	-.090	.548	.214	-	-	-
	Age of diagnosis	.081	.428	.172	-	-	-	-	-	-

*When a Bonferroni correction was applied, these correlations were no longer significant

Table 4 Regression coefficients when considering factors which predict wellbeing in the DCD groups only

	B	SE	Standardised *β*	*T*	*p*	BF_{inc}
Group (reference level 'dDCD')	0.854	2.78	0.052	0.308	0.759	0.440
Age	0.105	0.094	0.087	1.12	0.266	0.774
Valence general	2.89	0.84	0.342	3.45	< 0.001	629.71*
Valence DCD-specific	1.51	0.542	0.250	2.77	0.006	14.190*
Importance general	– 0.14	1.04	– 0.014	– 0.13	0.894	0.421
Importance DCD-specific	– 0.60	0.604	– 0.09	– 1.00	0.320	0.735

Please note, despite inter-correlations as shown above, the VIF values were all below 3 indicating no concerns regarding multi-collinearity (Kock & Lynn, 2012)

*A significant effect

When we compare within the DCD groups across the general and the DCD specific identities, we see strong evidence that the DCD-specific identities are seen more negatively and as less important compared to the general identities. There was also evidence that the DCD-specific statements were more negative, but carried less importance in the sDCD group compared to the dDCD group. This finding fits with both the self-enhancement literature (i.e., if something is bad then it is not that central to who I am, e.g., Alicke & Sedikides, 2009) and also previous work on children with DCD which has demonstrated that negative self-concepts tend to carry less importance (Hands et al., 2020). However, it is important to note that when asked for what we have referred to as 'general' statements the participants were not explicitly told not to think about or refer to their DCD and some of the participants did refer to their DCD in these 'general identities' suggesting that these 'general' identities may be diluted by those related to DCD.

When considering wellbeing levels, we have demonstrated significantly higher anxiety levels and poorer levels of wellbeing in adults with DCD compared to their peers. Both of these factors have been found previously (Harris et al., 2021; Hill & Brown, 2013; Hill et al., 2011; Tal Saban et al., 2014) but this is the first study to provide strong evidence that there are no differences in any of the wellbeing measures across the diagnosed DCD group and the self-identified DCD group. Furthermore, we have provided strong evidence that the valence of the self-concepts (both general and DCD specific) are not related to the age of diagnosis. This seemingly goes against previous research which indicates that a diagnosis of ADHD and of autism can support self-concept and thus wellbeing (O'Connor et al., 2018; Wilson et al., 2023) and that an earlier diagnosis of DCD and of autism would support self-concept and wellbeing (Cleaton et al., 2021; Wilson et al., 2023). It is worth bearing in mind that DCD is underrecognised by healthcare professionals (Meachon et al., 2024), teachers (Bidwell, 2022), employers (Doyle, 2020), and wider society (Steenbergen et al., 2024). Therefore, even with a diagnosis, the support received during childhood and adulthood may simply not be sufficient to benefit those with a diagnosis over those without (Steenbergen et al., 2024). However, one limitation of our study is that we did not collect data considering the motor skills of our dDCD and sDCD groups so we cannot be sure that these groups are equivalent in terms of their experiences of DCD symptomology.

In comparing the valence of general and DCD-specific statements to wellbeing measures, we have demonstrated strong evidence that the valence of both general and DCD-specific statements are related to psychological wellbeing. In delving into this a little further, when considering factors which might predict wellbeing, we have seen strong evidence that both general and DCD-specific valence of identities predicts wellbeing, whereas diagnostic status does not. Once again, this may suggest that it is not as simple as a diagnosis supporting wellbeing, but rather, in line with previous work, that diagnosis can result in a range of emotions (Williams et al., 2015). This is also supported by a systematic review which found evidence showing an association between positive autistic identity and improved mental health and wellbeing (Davies et al., 2024). Therefore, suggesting that the links between identity and wellbeing which we have found here are not isolated to this population. Finally, Bayesian analysis suggests no evidence of a non-significant effect in terms of the importance of the DCD-specific statements and their relation to wellbeing.

Above, we have highlighted the mixture of strong and inconclusive evidence and also some limitations to study one, namely, the dilution of 'general' identity statements with mention of DCD and no information regarding the comparability of the dDCD and sDCD group in terms of symptomology. Therefore, we conducted a second study which only considered individuals with DCD and included a screening questionnaire for motor skills. We chose to focus only on participants with DCD in study 2 as we wanted to explore in detail the memories that might underpin DCD-related self-concepts. The primary objectives of this second study were to replicate the findings above, to collect data on identities while specifically asking for those that do or do not relate to DCD and to examine the autobiographical memories associated with the self-concept participants define themselves with.

Study Two

The second study had a number of pre-registered (refer to footnote 1 for the link to this) research questions and associated hypotheses:

The first research question of the second study was, therefore, do findings in this second study replicate those we have found previously? *We have no specific hypothesis here as there are no studies which have attempted to directly replicate findings in adults with DCD. However, we would expect to replicate the findings where we demonstrated strong evidence.*

The second, third, fourth, and fifth research questions all centre around the links between the self-concepts and the autobiographical memories (i.e., memories for personally experienced life events) which support them. This approach is based on an extensive literature demonstrating the important relationship between identity and autobiographical memory (e.g., Conway, 2005; Rathbone et al., 2008) and the idea that memories are used to support the self-concept (Rathbone et al., 2019). As Study 1 indicated that self-concepts may be closely related to wellbeing in DCD, we sought to examine the basis for these self-concepts using the IAM Task (Rathbone et al., 2008), in which participants generate autobiographical memories cued by 'I am' statements. These memories can be analysed in terms of their emotional valence and importance (much like self-concepts), but this method also enables examination of the temporal relationship between self-concepts and the memories associated with them. Multiple studies (e.g., Rathbone et al., 2008, 2015, 2019) have demonstrated that self-concepts are supported by temporal clusters of memories, typically dated from the period in life when a given self-concept emerges (e.g., reflecting on one's self-concept as a mother, medic, worrier or tennis player tends to cue sets of memories dated from times in life when each self-concept emerged/began). These ‘self-supporting memories’ elucidate the way in which self-concepts might develop and be maintained, which is particularly important when self-concepts are negative and related to reduced well-being. The IAM Task has been used to examine the relationship between autobiographical memory and the self in a range of populations including Alzheimer’s disease (Rathbone et al., 2019), schizophrenia (Bennouna-Greene et al., 2012), and dysphoria (Grace et al., 2021). This is the first study to directly examine the relationship between self and memory in DCD.

Therefore, the remaining questions are as follows:

RQ2. Are there differences in the valence and importance of memories when they are DCD related compared to non-DCD-related and does this differ across group (DCD diagnosed vs. DCD self-identified)? *In line with our previous findings which focused on identity, we expect DCD-related memories to be more negative and less important than non-DCD-related memories in both groups. We will also explore the differences between the groups and the memory types*

RQ3. Do valence and importance rating of identities relate to those given for the associated memories? *We would expect to see positive relationships between identities and associated memories in terms of valence and importance and for each group.*

RQ4. How does wellbeing relate to importance and valence ratings of memories relating to DCD-specific identities and general identities? Do these findings differ across groups (DCD diagnosed versus DCD self-identified)? *We would expect to see positive relationships between memory valence and wellbeing (more positive memories correlated with higher well-being). However, exactly how identity valence/importance and memory identity/importance along with diagnosis status relate to wellbeing is exploratory.*

RQ5. What, if any, is the temporal relationship between memories and identities? And do these findings differ across groups (DCD diagnosed versus DCD self-identified)? And for the DCD diagnosed group, how is this related to age of diagnosis? *No current research exists on this with regard to a population with DCD; therefore, we have no specific hypothesis and this is exploratory.*

Method

Participants

104 adults diagnosed with DCD (dDCD) and 32 adults with self-identified DCD (sDCD) submitted their data. However, some of these were excluded under the following criteria: 1. providing no information for the ‘I am’ statements (dDCD = 1); 2. failing the attention check questions (dDCD = 3, sDCD = 1). Details of the remaining participants can be found in Table 1. Once again, this was an online study and the methods of recruitment were as for study 1, without the use of the Dyspraxia Foundation and instead including the use of Reddit. It is possible that this second study included participants from the first study; however, there is not a direct overlap between these groups as evidenced by the differing age ranges and pattern of co-occurrences. Once again, a significant difference in age was found across the two groups; however, it was decided not to remove the effects given the strong evidence found in study one that this was not a factor in the pattern of results. Ethical approval for this study was granted by Oxford Brookes University Research Ethics Committee (Ref No: 191352).

Procedure

Participants completed the scales in the same order as listed above. In addition, participants were asked whether they had a diagnosis of DCD or if they self-identified as having DCD. Allocation to groups was done on the basis of the answer to this question.

Measures

The questionnaire consisted of five distinct sections as described below, a full copy of the questionnaire can be found on the OSF website using the links provided previously.

Self-Concept Participants were asked to provide up to 3 ‘I am….’ statements which were related to their DCD/Dyspraxia and then to rate each one in terms of its importance (on a scale from 1, not at all important to 10, very important), its valence (on a scale of − 5, very negative to + 5, very positive) and also the age at which this identity emerged. Participants were also asked to provide up to 3 ‘I am….’ statements which were not related to their DCD/Dyspraxia and then to also rate the valence and importance of these and provide an age at which the identity emerged. These are not standardised measures but are based on the IAM Task (Rathbone & Moulin, 2024; Rathbone et al., 2008).

Memories For both, the self-concepts related to DCD and those not related DCD participants were asked to select the one self-concept which was most important to them. For both of these self-concepts, they were asked to describe up to three autobiographical memories which they associate which that identity. Participants were then asked to rate the valence and importance of those memories on the same scales described above (i.e., higher scores = more positive and more important) and provide an age at which the memory took place. These are not standardised measures but they have previously been used to examine the phenomenological properties of autobiographical memories associated with self-concepts (Rathbone et al., 2015).

General Wellbeing General wellbeing was measured using the 18-item Psychological Well-being (PWB) scale (Ryff & Keyes, 1995). For scale details, see Study 1. This was the only measure of wellbeing included in this second questionnaire as the first study indicated it was the most appropriate and this reduced the burden on participants.

DCD Symptomology In order to determine severity DCD-based symptoms the Adult Developmental Disorder Checklist (ADC) (Kirby et al., 2010) was used. This has two sections, the first asking about DCD-related symptoms during childhood the second asking about adulthood. Normally, each question is rated on a four-point scale from Never to Often. We added an additional option of 'not applicable' to every question because in some instances participants may not be able to answer some of the questions, for example one asks about parking a car and participants without experience of this could choose not applicable. In the cases where participants selected not applicable scores were pro-rated (as described in Harris, 2024). Higher scores indicate a higher prevalence of DCD-related symptoms. This was not used as an exclusion tool, but as described in footnote 2, not all participants met the ADC criteria for 'probable DCD.' The ADC allowed us to examine whether there were any quantitative differences between the diagnosed and self-identified groups.

Demographics Participants were asked to provide their age in years, their gender, and any other developmental difficulties they have experienced.

Statistical Analysis

The approach to statistical analysis was as described in study one in terms of the use of ANOVA, correlations, and regression and in terms of the statistical packages used and the parameters for Bayes factor.

Results

RQ1: Do Findings in This Second Study Replicate Those We Have Found Previously?

For conciseness, the analyses relating to the replication of Study 1 can be found in the Supplementary material. These are summarised and inferences drawn in "General Discussion."

RQ2: Are there Differences in the Valence and Importance of Memories when they Are DCD-Related Compared to Non-DCD-Related and Does this Differ Across Group (DCD Diagnosed Versus DCD Self-Identified)?

Two-way ANOVA comparing memory type (DCD-related vs. non-DCD related) and group (dDCD vs. sDCD) were conducted on the valence and importance of the memories. Data can be found in Fig. 3. For both valence and importance, a significant effect of memory type was found (valence: $F(1,125) = 114.79$, $p < 0.001$, partial $\eta^2 = 0.479$, $\mathrm{BF}_{\mathrm{inc}} = \infty$, importance: $F(1,126) = 4.617$, $p = 0.034$, partial $\eta^2 = 0.035$, $\mathrm{BF}_{\mathrm{inc}} = 5.037$), with memories linked to non-DCD identities being classed as more positive and more important. Group was not significant for either variable (valence: $F(1,125) = 0.08$, $p = 0.775$, partial $\eta^2 = 0.0001$, $\mathrm{BF}_{\mathrm{inc}} = 0.285$; importance: $F(1,126) = 0.349$, $p = 0.556$, partial $\eta^2 = 0.003$, $\mathrm{BF}_{\mathrm{inc}} = 0.206$] nor was the interaction between group and statement type [valence: $F(1,125) = 1.26$, $p = 0.264$, partial $\eta^2 = 0.010$, $\mathrm{BF}_{\mathrm{inc}} = 0.230$, importance: $F(1,126) = 0.150$, $p = 0.699$, partial $\eta^2 = 0.001$, $\mathrm{BF}_{\mathrm{inc}} = 0.189$).

RQ3: Do Valence and Importance Ratings of Identities Relate to those Given for the Associated Memories?

Given the lack of significant difference across group up to this point (and the small sample in the sDCD group) the decision was taken to analyse this in the entire cohort rather than separately for each group. Spearman correlations found extremely strong evidence for significant positive relationships between each pair of variables: the valence of DCD identities and associated memories ($N = 129$, $\rho = 0.551$, $p < 0.001$, $\mathrm{BF}_{10} = 6.63 \times 10^{10}$], the valence of non-DCD identities and associated memories ($N = 127$, $\rho = 0.436$, $p < 0.001$, $\mathrm{BF}_{10} = 285{,}984$], the importance of DCD identities and associated memories ($N = 128$, $\rho = 0.505$, $p < 0.001$, $\mathrm{BF}_{10} = 9.18 \times 10^{10}$], and the importance of non-DCD identities and associated memories ($N = 128$, $\rho = 0.415$, $p < 0.001$, $\mathrm{BF}_{10} = 1745$).

RQ4: How does Wellbeing Relate to Importance and Valence Ratings of Memories Relating to DCD-Specific Identities and General Identities? And do these Findings Differ Across Groups (DCD Diagnosed Versus DCD Self-Identified[4])

A linear regression was conducted, in part this replicated that from study 1 and so model one included valence of DCD and non-DCD identities and the importance of those DCD and non-DCD identities to investigate whether these could predict wellbeing. Neither group nor age were added into this model given their non-significance in study 1 and the small level of input of these variables thus far. A second model was then added which included the valence and importance of associated DCD and non-DCD memories.

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[4] Rather than using correlations to choose which variables to input into the regression we decided to replicate the regression analysis from Study 1, this differs from the method stated in the pre-registration.

Both regression models were significant ($R^2 = 0.226$, $F(4,122) = 8.88$, $p < 0.001$, $R^2 = 0.227$, $F(8,119) = 4.34$, $p < 0.001$), but the change between model one and two was not ($\Delta R^2 = 0.002$, $\Delta p = 0.990$). The valence of the DCD and non-DCD identities along with the importance of the DCD identities predicted wellbeing, no other variables were found to be significant, the addition of memory-based information (valence and importance) did not add any predictive power. Coefficients of both models can be found in Table 5.

RQ5: What, if any, is the Temporal Relationship Between Memories and Identities? And do these Findings Differ Across Groups (DCD Diagnosed Versus DCD Self-Identified)? And for the DCD Diagnosed Group how is this Related to Age of Diagnosis?

As an attempt to describe the temporal aspects of the DCD-related identity cued memories provided by the dDCD and sDCD participants, we categorised them into occurring during pre-school (pre 4 years of age), primary school (4 to 11 years of age), secondary school (12 years to 17 years), emerging adulthood (18 to 25 years), and adulthood (26 years and above). This was also included for the non-DCD-related identity cued memories as a comparison. These data can be found in Fig. 4. Note that the period at primary school is associated with the highest frequency of DCD-related memories and that these are particularly negatively valenced in nature.

In order to consider the temporal relationship between identity formation and memories, we plotted data on the temporal gap between these events and used this to determine appropriate bins to use to collapse the data. All memory data was reformulated as distance in years from the age at which the associated self-concept emerged (e.g., a memory from one year before self-emergence was − 1; a memory from three years after self-emergence was + 3). We captured the time frame in eight 5-year bins: less than − 7 years, − 7 to − 3 years, − 2 to 3 years, 4 to 9 years, 10 to 15 years, 16 to 20 years, 21 to 25 years, and more than 25 years. The number of instances that each participant had a memory-identity pair which fell into one of these bins (temporal gaps) was counted and an average taken across each bin to allow for unequal group sizes. Data comparing the two groups (dDCD and sDCD) can be found in the top pane of Fig. 5.

Figure 5 indicates a temporal clustering of memories around the period in which identities emerged (− 2 to 3 years), with a similar pattern shown in both the dDCD and sDCD groups. A repeated measures ANOVA comparing groups (dDCD vs. sDCD) across bins (less than − 7 years, − 7 to − 3 years, − 2 to 3 years, 4 to 9 years, 10 to 15 years, 16 to 20 years, 21 to 25 years, and more than 25 years) found only a significant main effect of bin ($F(7,903) = 18.585$, $p < 0.001$, partial $\eta^2 = 0.126$, $\mathrm{BF}_{\mathrm{inc}} = \infty$), neither group ($F(1,129) = 0.639$, $p = 0.425$, partial $\eta^2 = 0.005$, $\mathrm{BF}_{\mathrm{inc}} = 0.061$) nor the interaction between group and bin ($F(7,903) = 0.581$, $p = 0.772$, partial $\eta^2 = 0.004$, $\mathrm{BF}_{\mathrm{inc}} = 0.003$) was significant. The temporal relationships between memory and identity formation were also compared for DCD and non-DCD aspects of the self. For this analysis, and given the non-significant effect of group above, data was collapsed. Data can be found in the bottom pane of Fig. 5. A main effect of bin was found ($F(7, 910) = 25.64$, $p < 0.001$, partial $\eta^2 = 0.165$, $\mathrm{BF}_{\mathrm{inc}} = \infty$) alongside an interaction between bin and type of identity-memory ($F(7,910) = 5.26$, $p < 0.001$, partial $\eta^2 = 0.039$, $\mathrm{BF}_{\mathrm{inc}} = 11.46$). Type of identity-memory statement is not reported, as this is proportional data and all participants provided both DCD and non-DCD statements/memories a difference would only occur if fewer of one type of identity-memory were provided.

In order to consider the temporal relationship between diagnosis and memory we plotted data on the temporal gap between diagnosis and the named memories, this was done

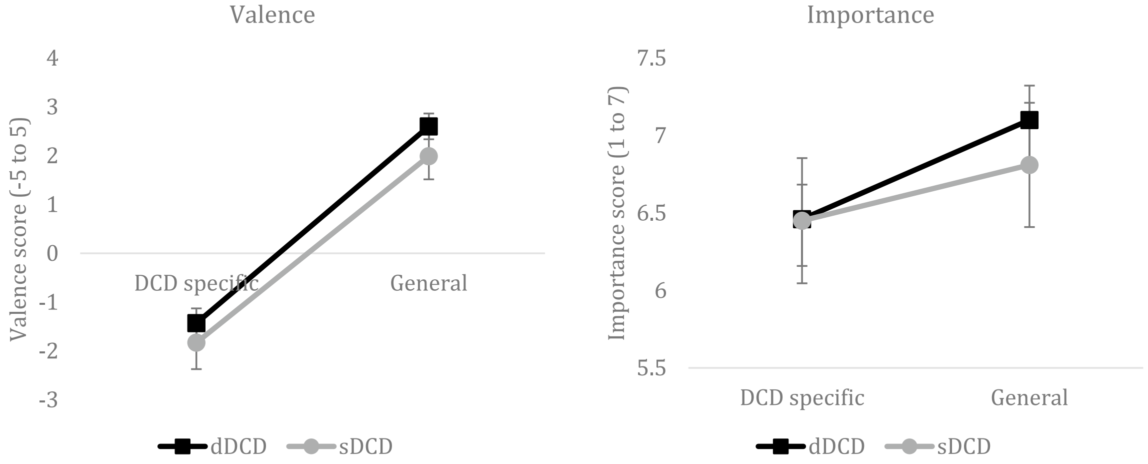


Fig. 3 An illustration of the group and memory type differences for valence and importance memory ratings. Error bars represent standard error

Table 5 Regression coefficients when considering factors which predict wellbeing

		β	SE	Standardised β	t	p	BF_{inc}
Model 1	Identity: non-DCD valence	1.83	0.656	0.261	2.79	0.006	21.47*
	Identity: DCD valence	1.67	0.520	0.286	3.24	0.002	15.06*
	Identity: non-DCD importance	0.567	0.840	0.064	0.675	0.501	
	Identity: DCD importance	− 1.85	0.620	− 0.270	− 2.99	0.003	6.16*
Model 2	Identity: non-DCD valence	2.02	0.805	0.288	2.51	0.013	19.17*
	Identity: DCD valence	1.83	0.660	0.310	2.77	0.006	11.96*
	Identity: non-DCD importance	0.522	0.902	0.059	0.579	0.563	
	Identity: DCD importance	− 2.03	0.725	− 0.295	− 2.79	0.006	8.21*
	Memory: non-DCD valence	− 0.233	0.688	− 0.038	− 0.340	0.734	
	Memory: DCD valence	− 0.191	0.580	− 0.036	− 0.330	0.742	
	Memory: non-DCD importance	0.060	0.752	0.008	0.080	0.936	
	Memory: DCD importance	0.196	0.773	0.027	0.253	0.801	

* denotes a significant effect

in the same way as described above using the same 5-year bins as before. This was only done for the dDCD group as we needed an age of diagnosis. Data can be seen in Fig. 6, which indicates that the majority of DCD-related memories were from the bin around the period of diagnosis (the − 2 to 3 year bin), which has a higher mean frequency of memories compared to other bins aside from the period < − 7 years before diagnosis. The increased accessibility to memories from the earliest period (< − 7 years before diagnosis) may reflect the high frequency of memories associated with DCD from primary school years (as shown in Fig. 4).

General Discussion

The second study replicated and extended a number of key findings from Study 1. Firstly, replicating Study 1 (as reported in the supplementary materials), there was no significant difference between dDCD and sDCD groups in terms of the valence and importance for non-DCD-related self-concepts. While we found the importance of DCD related self-concepts to be higher in the dDCD group compared to the sDCD group, this finding was not replicated in study 2 (however, note that Bayesian analysis suggests insufficient evidence to conclude either a significant or a non-significant effect in Study 2). We next examined the difference between valence and importance ratings of DCD-related compared to non-DCD-related self-concepts by group. Here, we fully replicated the findings in Study 1: There was no significant effect of group, nor interaction between group and self-concept type (DCD-related vs. non-DCD-related). There was a significant main effect of self-concept type, with both dDCD and sDCD groups rating their DCD-related self-concepts as more negative and less important than their non-DCD-related self-concepts. Of note, these DCD-related self-concepts were not just more negative than the non-DCD related self-concepts—they had average ratings (in both dDCD and sDCD groups) of less than 0 (on a − 5 to + 5 scale), indicating that they tended to be negatively (rather than positively) valenced in nature. The replication

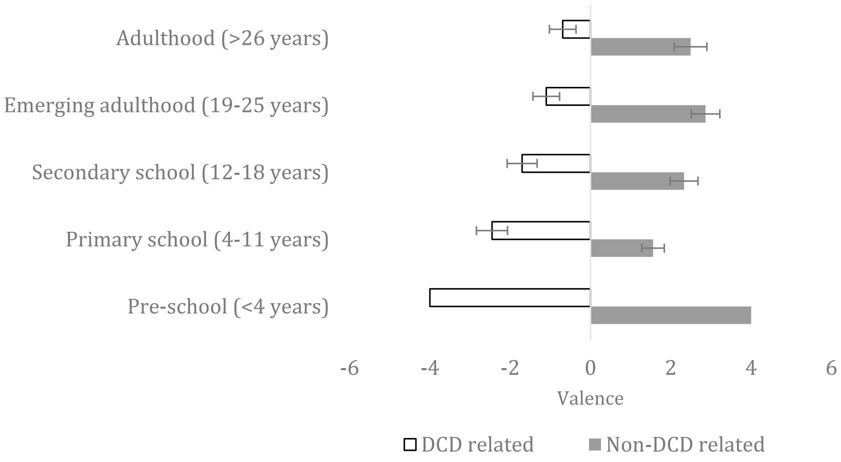
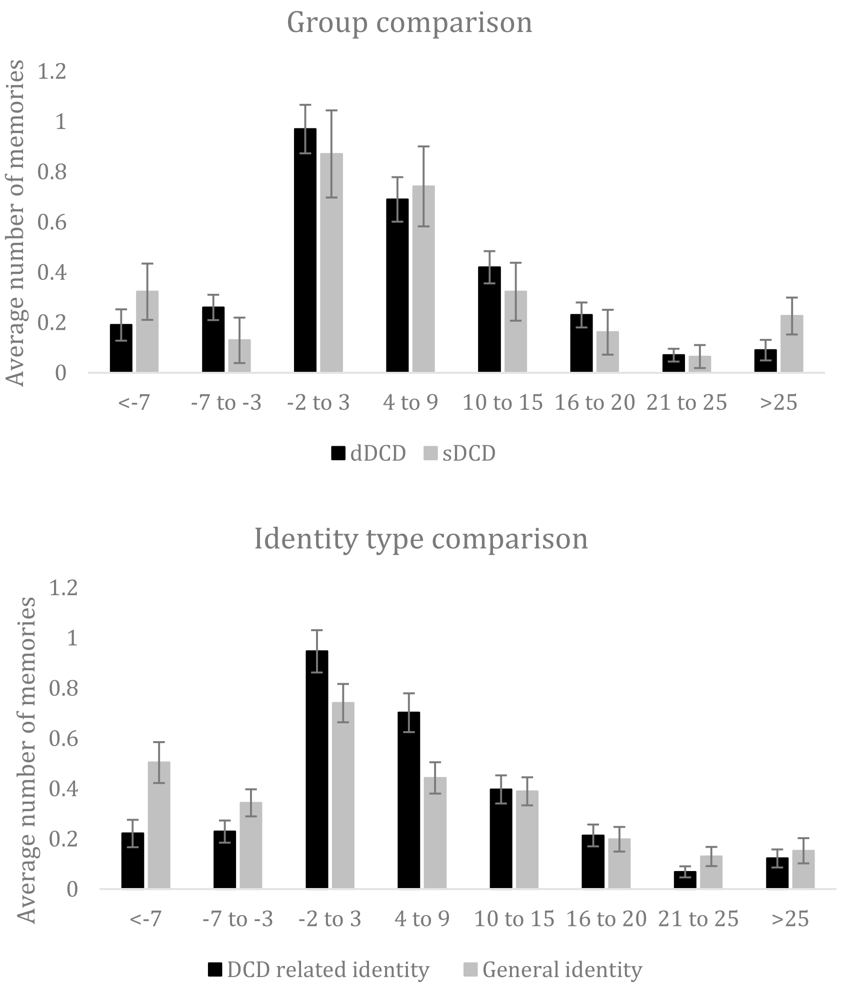


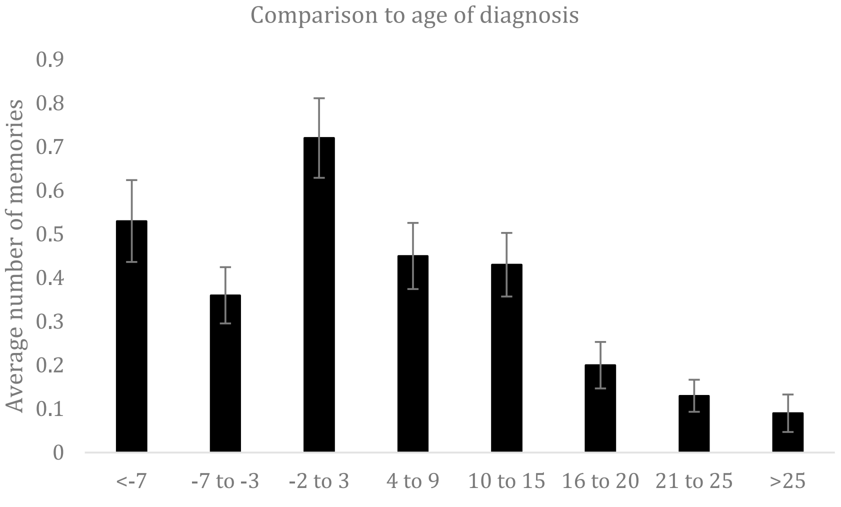
Fig. 4 Average valence for the DCD related and non-DCD related memories categorised by stage of life. Memory counts are for pre-school $N = 1$ for DCD-related and $N = 1$ for non-DCD-related, for primary school $N = 119$ for DCD-related and $N = 52$ for non-DCD-related, for secondary school $N = 91$ for DCD-related and $N = 82$ for non-DCD-related, for emerging adulthood $N = 78$ for DCD-related and $N = 103$ for non-DCD-related and for adulthood $N = 91$ for DCD-related and $N = 130$ for non-DCD-related



Group comparison

Identity type comparison

Fig. 5 Temporal distribution of memories around age of identity emergence. Error bars represent standard error. The top pane compares the dDCD and the sDCD group, the bottom pane compares the DCD related memories as compared to non-DCD-related memories. The *x*-axis shows years centred around the memory which is at time point 0



Comparison to age of diagnosis

Fig. 6 Temporal distribution of memories around age of diagnosis for the dDCD group only. The *x*-axis showing years centred around diagnosis which is at time point 0. Error bars represent standard error

of the finding that these negative DCD-related self-concepts were also rated as significantly less important supports the proposal that participants exhibited a self-protective bias, in that negative aspects of self-concept are not conceptualised as central to identity (e.g. Alicke & Sedikides, 2009; Hands et al., 2020). Finally, we replicated the findings that dDCD and sDCD groups did not differ in well-being scores (here measured using the PWB scale with mean values for the dDCD group: 80.5, SD = 16.4, and for the sDCD group: 79.3, SD = 13.7) and that, within the dDCD group, age of diagnosis had no relationship with valence or importance of DCD-related self-concepts, nor well-being score.

Extending beyond the above replications, the examination of self-related memories in Study 2 elucidated the cognitive mechanisms that support self-concepts in DCD. For both groups, DCD-related memories tended to be rated as more negative and less important than non-DCD-related memories, matching the pattern shown for self-concepts. Correlational analyses showed that, in all cases, there were significant positive correlations between ratings for memories and self-concepts (i.e., more positively valenced self-concepts were associated with more positively valenced memories, and more important self-concepts were associated with more important memories). Of particular note, only the valence of self-concepts (both DCD-related and non-DCD-related) and importance of DCD-related self-concepts predicted well-being—memory valence/importance had no significant effect. This replicates earlier work (Rathbone et al., 2015) showing that self-concept valence, and not autobiographical memory valence, was correlated with a battery of well-being scales in both younger and older adults.

Analysis of the distribution of memories cued by self-concepts showed clear temporal clustering, suggesting that (in both diagnosed and self-identified DCD) memories provide a scaffold for self-knowledge (e.g. Conway, 2005; Rathbone et al., 2019). This is the first study to demonstrate this effect for self-concepts associated with a neurodevelopmental condition and, to our knowledge, the first to examine the phenomenological features (e.g., importance and valence) of DCD-related autobiographical memories. A key finding was that memories associated with DCD-related identities were often of events experienced in childhood (53% of memories were from participants' school years) and frequently negative in nature. Memories from primary school years associated with DCD had an average valence of -2.43 (on a -5 to $+5$ scale), suggesting that negative DCD-related events from childhood can create long-term memories that may underpin negative self-concepts and, by association, lower levels of well-being. As discussed above, it was the valence ratings of self-concepts, rather than their associated memories, that predicted well-being scores in Study 2. Thus, whilst these negatively valenced memories are not directly associated with poorer levels of well-being, they do support negative self-concepts that are correlated with well-being measures. The close association between self-concepts and the memories they cue is shown in both the temporal clustering and the correlational results on importance and valence. We propose that both DCD-related self-concepts and, by association, memories play an important role in shaping well-being in DCD. This finding has important implications for the development of further research and, potentially, intervention studies designed to support well-being in DCD. For example, research suggests that self-esteem can be increased by focusing on positive self-concepts and associated memories, using a similar method to that used in study 2 (Niveau et al., 2022). It might therefore be possible to boost wellbeing by encouraging people with DCD to focus on the positive aspects of their self-concept and the memories that support them. A further avenue of research could examine in more detail the negative memories from early childhood that seem to underpin DCD-related self-concepts. Although beyond the scope of the present study, qualitative analysis of the content of these memories (i.e., what makes early memories associated with DCD so negative) could be used to inform educators and parents on the best way to approach DCD diagnosis with children and support children with DCD to ensure they feel included and positive about themselves and their abilities.

Furthermore, we propose that a number of other findings may have important implications for the field of DCD, specifically around the impact of diagnosis. This is the first research providing evidence that there is no difference in well-being between people who are diagnosed with DCD compared to those who are self-identified. In addition, diagnosis status and, if diagnosed, age of diagnosis was not related to valence of self-concepts (i.e., how positive people feel about their identity), regardless of whether the self-concept was associated with DCD or not. As noted earlier, this contrasts with previous literature that highlights the positive effects of diagnosis (e.g. O'Connor et al., 2018; Wilson et al., 2013) and thus requires further investigation. As previously suggested, diagnosis may result in some positive emotional outcomes, but it is possible that the lack of support and understanding around DCD results in no clear tangible benefits of having a diagnosis, therefore, no clear positive impact on self-concept or wellbeing. This may be further impacted by issues surrounding the complexity and heterogeneity of DCD (e.g., Meachon, 2023). What does seem clear is that DCD (whether diagnosed or self-identified) is associated with lower levels of well-being. In Study 1, we demonstrated this contrast with a non-DCD group (anxiety was higher and psychological well-being lower in both DCD groups compared to the non-DCD group), and in Study 2, we explored this finding in more detail by examining the valence of self-concepts and associated memories. As discussed above, we suggest that further research into self-concepts and the memories that support them could be a promising avenue for understanding what drives lower levels of well-being in DCD.

The findings from the current study can feed back into the Environmental Stress Hypothesis. This posits that poor motor skills can lead to difficulties with social resources and personal resources which in turn result in internalising problems (Cairney et al., 2013; Mancini et al., 2016). The findings of the current study expand on how those social resources and personal resources experienced during childhood can then, through the formation of memory and development of a sense of self perpetuate through into adulthood to influence well-being later in life.

There were several limitations to these studies. First, there were unequal sample sizes for the dDCD compared to sDCD groups in Study 2 and the small sample size for the sDCD group makes it harder to interpret different effects for dDCD compared to sDCD groups. In spite of this, we found strong evidence for many of the effects found. Second, as both studies were internet-based we were not able to verify diagnosis/DCD-related symptomatology. However, inclusion of the ADC in Study 2 allowed a comparison of quantitative differences across the two groups. The outcome of the ADC did suggest that DCD-based symptoms were equally present in both the diagnosed and self-identified groups suggesting no clear difference between these groups in terms of how their motor difficulties affect activities of daily living. When looking closely at individual scores on the ADC, it was apparent that a minority of participants in both the dDCD and the sDCD groups did not meet the scales' classification of 'probable DCD.' Despite this, the decision was made not to exclude participants on the basis of this. This could have meant that some participants in both the sDCD and dDCD groups would not meet the diagnostic criteria for DCD. However, given that the dDCD group have been diagnosed, this may suggest that the ADC lacks sensitivity. Either way, this small minority is unlikely to have diluted the effects found here.

In spite of these limitations, the studies presented have a number of strengths. Across two studies, we replicate key findings showing that participants with both diagnosed and self-identified DCD experience lower well-being and rate their DCD-related identities as negatively valenced (compared to non-DCD-related aspects of their identity). In both studies, the valence of self-concepts was a significant predictor of well-being scores, suggesting these are an important area for future research.

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Declarations

Competing Interests The authors declare no competing interests.

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