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LITERATURE REVIEW

Supporting Co-Regulation and Development of Self-Regulation Skills in Students With Intellectual Disabilities: A Scoping Review[†]

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Abstract
Young people with intellectual disability (ID) frequently have challenges with self-regulation that impact their success and participation in daily life. As they often require additional support with self-regulation, it is important to consider regulatory function and skill development within the context of co-regulatory interactions with caregivers. This scoping review aimed to identify factors associated with improved self-regulation and co-regulation in young people with ID. The review was conducted using Arksey and O'Malley's (2005) framework, with 142 full-text records reviewed and critically appraised. The diverse factors that affect regulatory function in young people with ID fit within the five categories identified in the model of factors contributing to self-regulation enactment — biology, skills, motivation, caregiver support, and environmental context — highlighting the relevance of this model to regulatory function for this population. This review's findings allow this model to be refined further for young people with ID, identifying the unique factors contributing to self-regulation enactment for this population and intervention characteristics that may support regulatory function for these individuals.

Keywords: child and adolescent; regulation; global developmental delay; special education; inclusive education; social-emotional learning

Self-regulation is the process by which an individual independently monitors, directs, and adjusts their thoughts, attention, emotions, and behaviours to reach a desired goal or match the demands and social expectations of the contexts in which they function (Nader-Grosbois, 2011). Effective self-regulation supports an individual's stability and success within their environmental context and adaptability between contexts (Szwed, 2016; Vieillevoye & Nader-Grosbois, 2008). Executive functions (EFs), self-determination, and self-management are constructs related to self-regulation, sometimes used interchangeably. EFs are higher order processes required for self-regulated behaviour, often categorised as either cool EFs, which relate to cognitive processes (e.g., planning and working memory), or hot EFs, which relate to emotion and motivational systems (e.g., inhibition; Loveall et al., 2017). Self-determination is a particular form of self-regulation that relates to conscious and purposeful actions and the choices a person makes to direct the course of their own lives (Wehmeyer, 2007).

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It includes a person's abilities and opportunities to be involved in making decisions that affect them (Wehmeyer, 2007). Self-management is the act of self-regulating behaviours using specific procedures, including self-monitoring, self-evaluation, and self-reinforcement (King-Sears & Carpenter, 2005).

Self-regulation skills develop from birth through adulthood and are linked to a variety of important outcomes for young people, including improved wellbeing, positive social interactions, and academic achievement (Murray & Hamoudi, 2016; Szwed, 2016). Self-regulation skills develop through responsive interactions with caregivers who provide regulatory support and scaffolding, a process known as co-regulation (Rosanbalm & Murray, 2017). Certain populations, including young people with intellectual disability (ID) or global developmental delay (GDD), have specific challenges with self-regulation, frequently demonstrating delays or deficits in this area compared to typically developing peers (Caplan & Baker, 2017; Cuskelly et al., 2016; Vieillevoye & Nader-Grosbois, 2008). ID is a neurodevelopmental disorder that presents with deficits in intellectual functioning and adaptive behaviour, often co-occurring with other diagnoses such as autism and genetic syndromes (Abbeduto & McDuffie, 2010; American Psychiatric Association, 2013). As clinical assessment can be unreliable in early childhood, children aged under 5 years with delays in intellectual functioning receive an interim diagnosis of GDD (American Psychiatric Association, 2013).

Self-regulation skills are linked to positive school outcomes for young people with disabilities and may be the most critical factor for the success of inclusive school placements (Nowell et al., 2019; Szwed, 2016; Westwood, 2003). The Australian Curriculum highlights the importance of developing self-regulation skills for all students, within the Personal and Social Capability learning continuum (Australian Curriculum, Assessment and Reporting Authority, 2023). Many schools target this curriculum area using social-emotional learning (SEL) programs. Although research evidence indicates effective SEL supports improved emotional wellbeing, pro-social behaviour, and academic performance for many students (Collie et al., 2012), these programs are designed for students with average to above average intelligence and are often not accessible for students with language impairments, learning difficulties, and regulatory challenges (BC Centre for Ability, 2016; Nowell et al., 2019). Regulatory interventions traditionally used for students with ID tend to target narrower skill sets through explicit instruction or highly individualised behaviourist approaches implemented by skilled practitioners (Embregts, 2000; Luber, 2018; Wehmeyer et al., 2003). Although effective, these interventions may not be accessible to all educators, particularly those in inclusive settings who may lack training in special education pedagogy. Given the importance of co-regulatory interactions with caregivers in self-regulation skill development, it is critical to consider the needs, knowledge, and skills of educational staff supporting students with ID in schools. While students with ID in particular may benefit from interventions that incorporate co-regulation supports (BC Centre for Ability, 2016), little is known about co-regulation between students with ID, their teachers and support staff. There is also a general gap in school-based practice, with less than 10% of self-regulation interventions in primary schools incorporating co-regulation supports (Murray et al., 2016), although research highlights the importance of co-regulation supports for all students (Housman et al., 2018). Emerging interventions targeting emotional dysregulation in young people with autism and accompanying intellectual impairment show potential for improving emotional and behavioural regulation and strengthening co-regulation supports in the home (Beck et al., 2022). No programs available are designed specifically for students with ID in educational settings that target self-regulation skill development comprehensively by addressing emotional, behavioural, and cognitive regulation within the context of co-regulatory interactions with caregivers. A better understanding of factors affecting self-regulation and co-regulation among young people with ID is needed through synthesising relevant research findings, best practice guides and expert opinion to inform evidence-based interventions for this population.

Methods

A scoping review of the literature was done using the first five stages of Arksey and O'Malley's (2005) framework, with the quality of the literature also assessed (Daudt et al., 2013). Stage 1 included

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development of the guiding research question: *What factors are associated with improved co-regulation and self-regulation for children with ID?*

Search Strategy

In Stage 2, relevant studies were identified by conducting a literature search across three databases with search terms related to *co-regulation*, *self-regulation*, *child*, and *intellectual disability*. A broad, multidisciplinary database drawing on both white and grey literature was chosen (ProQuest), as well as two discipline-specific databases (CINAHL and PsycINFO), to allow for a thorough search and to capture results relevant to fields of allied health and education. Following a preliminary review of search results, the search strategy was refined to exclude terms related to *specific learning disorders*, *transcriptional co-regulation*, and *dopaminergic co-regulation*. The search was limited to peer-reviewed full-text English-language publications published between January 2000 and April 2022. All authors agreed on the search strategy and search terms, with the first author conducting the search and screening. The final search yielded 564 records. Duplicate records were removed, with remaining titles and abstracts screened and included if they (a) contained terms linked to co-regulation and/or self-regulation; (b) included individuals aged 0–18 years, or those of unspecified age classified as 'children', 'adolescents', 'school-age' or 'youth'; and (c) included individuals with a diagnosis associated with ID, GDD, or a *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; American Psychiatric Association, 2013) classification of autism with accompanying intellectual impairment (ASD-ID). This resulted in 179 records included.

Data Screening, Extraction, and Synthesis

In Stage 3, records were selected for inclusion by reviewing the full-text and assessing their quality using JBI critical appraisal tools (JBI, n.d.), which are a suite of checklists for reviewers to evaluate the calibre and trustworthiness of published research papers and text evidence, such as opinion papers. The quality of each record reviewed was rated (1 = *low* to 5 = *high*) against JBI checklist criteria. Records were excluded if (a) the full text could not be sourced online, purchased or loaned through the university library; (b) the content was unrelated to co-regulation or self-regulation; (c) the population did not include 'children', 'adolescents', or individuals aged 0–18 years with a diagnosis of ID, GDD, or ASD-ID; or (d) the quality of reporting was assessed as low or unreliable. A total of 142 records were included in the final analysis (see Figure 1). The first author completed this phase, documenting each step in the process, and seeking support from the co-authors with decision-making for ambiguous records.

In Stage 4, quantitative and qualitative data were extracted and charted to capture study characteristics and information directly related to the research question. The model of factors contributing to self-regulation enactment was used as a conceptual framework for this review (see Figure 2; Murray et al., 2015). This model examines self-regulation in context, giving consideration to personal and environmental factors influencing self-regulation across five different categories: *biology*, *skills*, *motivation*, *caregiver support*, and *environmental context* (Murray et al., 2015). Extracted data were charted against these categories by the first author, with themes and subthemes developed inductively.

In Stage 5, the data were analysed further and summarised to refine themes and subthemes. The research team met to discuss the appropriateness of final themes. The findings, including study characteristics and a summary of the themes, are presented as follows. Further information on the themes addressed by each record is also available in the supplementary material provided.

Findings

Study Characteristics

Of the 142 records in this scoping review, 23 were classified as text or opinion papers, according to JBI critical appraisal categories, five were qualitative studies, and 114 quantitative studies. Most research

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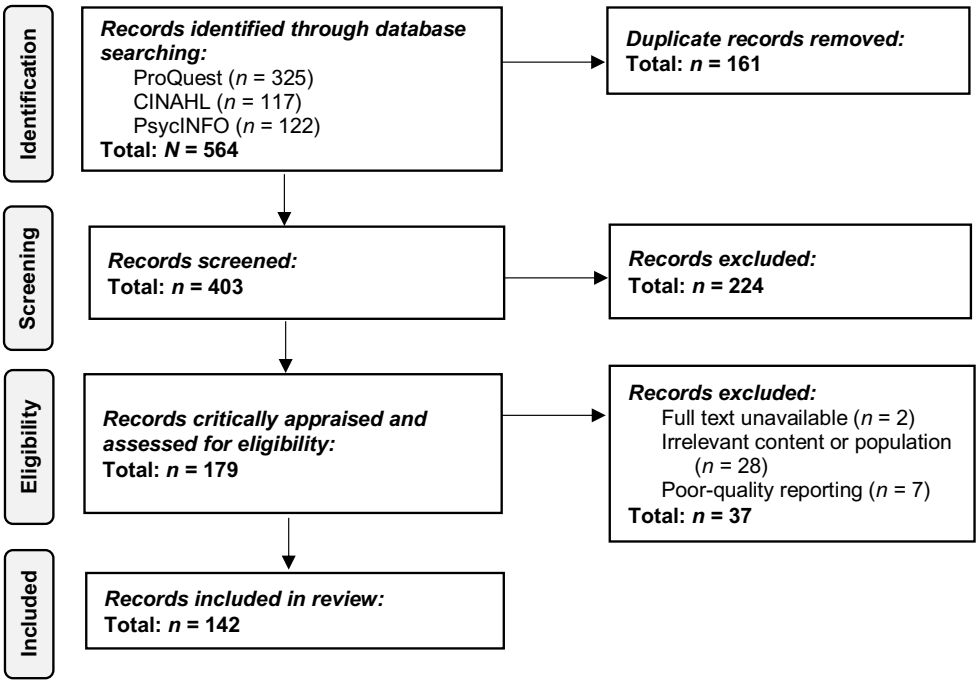

Figure 1. PRISMA Flow Diagram.

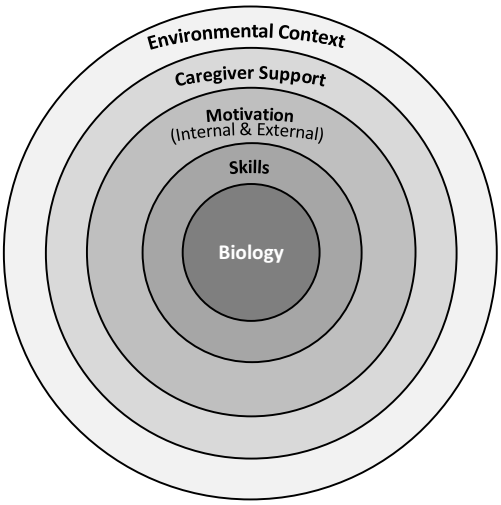

Figure 2. Factors Contributing to Self-Regulation Enactment (Murray et al., 2015, p. 11).

was descriptive or exploratory, with some experimental research emerging (see Figure 3). Most records ($n = 84$) targeted young people with ID or GDD as the primary diagnosis, with the remaining records ($n = 58$) including individuals with ASD-ID. Target populations included early childhood (0–3 years; $n = 46$), primary school aged (4–12 years; $n = 101$), and secondary school aged (13–18 years; $n = 99$), with many records including participants across multiple age groups.

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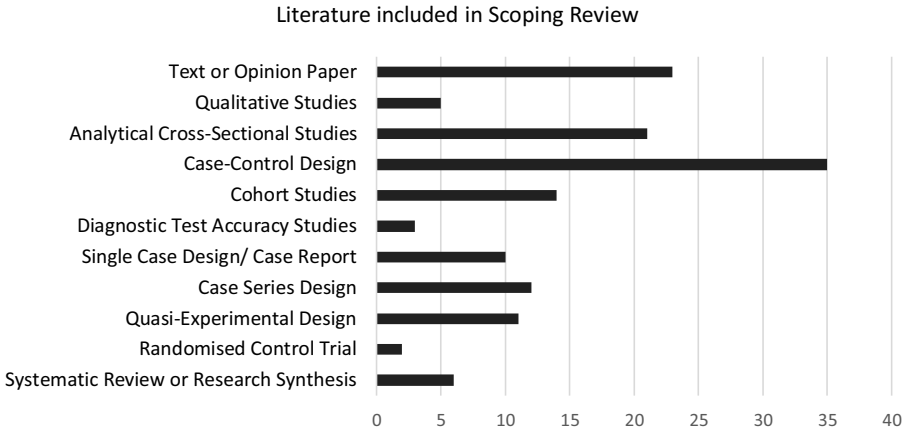

Figure 3. Included Literature Based on JBI Categories ($N = 142$).

Themes and Subthemes

Data related to the research question were extracted from full-text records and charted against the categories *biology*, *skills*, *motivation*, *caregiver support*, and *environmental context*. One additional category, *intervention characteristics*, was included to capture data about targeted interventions for young people with ID that impacted on self-regulation and/or co-regulation. Themes and subthemes that emerged following thematic analysis are outlined in Table 1.

Biology

Young people with ID have more challenges with self-regulation than their typically developing peers (Cuskelly et al., 2016). Many child-specific factors influence enactment of self-regulation skills, including temperament, diagnosis, and intellectual functioning (Cuskelly & Stubbins, 2006; Daunhauer & Fidler, 2013a; Vieillevoye & Nader-Grosbois, 2008; Zhu et al., 2016). A different self-regulation profile and different patterns of skill development are apparent for young people with different diagnoses associated with ID, such as Down syndrome, fragile X syndrome (FXS), or ASD-ID (Daunhauer & Fidler, 2013a, 2013b; Zhu et al., 2016). Intelligence seems to be important, with research generally showing positive associations between mental age or IQ and component areas of self-regulation in young people with ID (Gilmore et al., 2003; McIntyre et al., 2006; Vieillevoye & Nader-Grosbois, 2008), although these associations may be influenced by diagnosis or environmental context (Esbensen et al., 2021; Hauser-Cram et al., 2001; Plesa Skwerer et al., 2019). There are also clear associations between physiological processes and self-regulation in young people with ID, with sleep, pain, and physiological stress response influencing self-regulation enactment (Daunhauer & Fidler, 2013a; Demchak & Bossert, 2005; Shelton et al., 2020). The impact of biological sex on self-regulation is less clear, with inconsistent results reported in relation to ID as a broad construct. There are clearer links between biological sex and self-regulation for young people with ASD-ID (i.e., girls have greater challenges with emotional reactivity and maladaptive behaviour) and those with FXS (i.e., boys have greater challenges with physiological arousal, social anxiety, and behaviour; Bolourian, 2018; Klusek, 2012; Northrup et al., 2021; Protic et al., 2022). Chronological age influences self-regulation in complex ways. There are different periods for development of self-regulation skills in young people with ID, although aetiology may have an impact on developmental trajectory (Esbensen et al., 2021; Northrup et al., 2021). Key periods for growth in regulation of behaviour and emotion typically occur between the ages of 3 and 6 years (Baurain & Nader-Grosbois, 2012; Caplan & Baker, 2017), with regulation of behaviour and attention progressing during adolescence (Esbensen et al., 2021; Loveall et al., 2017; Plesa Skwerer et al., 2019). Adolescence may present challenges with emotional regulation in certain

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Table 1. Factors Affecting Co-Regulation and Self-Regulation in Young People With Intellectual Disability

Category	Themes	Subthemes	Number of records addressing each theme ($N = 142$)	Type of evidence supporting each theme		
				Quantitative research evidence	*Qualitative research evidence*	*Expert opinion or textual evidence*
Biology	• Diagnosis and phenotype	• Intellectual disability (ID); Down syndrome; fragile X syndrome; Williams syndrome; Prader–Willi syndrome; ASD-ID; physical disability with ID; attention-deficit/hyperactivity disorder with ID; epilepsy with ID; trauma with ID	$n = 105$ (74%)	✓	✓	✓
	• Intellectual functioning	• Mental age; developmental age; IQ	$n = 37$ (26%)	✓		✓
	• Temperament	• Impulsivity; effortful control; emotional reactivity	$n = 5$ (4%)	✓		✓
	• Biological and physiological factors	• Biological sex; physiological processes; pain and discomfort; sleep and fatigue	$n = 32$ (23%)	✓		✓
	• Chronological age	• Developmental trajectories; importance of early intervention	$n = 40$ (28%)	✓		✓
Skills (self-regulation skills and related attributes)	• Self-concept	• Self-awareness; self-perception; self-efficacy	$n = 17$ (12%)	✓	✓	✓
	• Socio-emotional	• Theory of mind; social-emotional problem-solving; social information processing; adaptive coping strategies	$n = 30$ (21%)	✓	✓	✓
	• Language and communication	• Self-talk; interpersonal communication skills	$n = 33$ (23%)	✓		✓
	• Cognition and executive functioning	• Visual spatial skills; time processing abilities; problem-solving skills; shifting; inhibition	$n = 44$ (31%)	✓		✓
	• Self-determination	• Choice-making skills; goal setting and attainment skills; self-management skills	$n = 14$ (10%)			✓
	• Play and leisure	• Pretend play; self-directed leisure activity	$n = 4$ (3%)	✓		✓
	• Persistence	• Persistence in the face of challenge; persistent effort	$n = 7$ (5%)	✓		✓
	• Adaptive functioning	• Overall adaptive behaviour	$n = 5$ (4%)	✓		

(*Continued*)

Table 1. (*Continued*)

Category	Themes	Subthemes	Number of records addressing each theme ($N = 142$)	Type of evidence supporting each theme		
				Quantitative research evidence	*Qualitative research evidence*	*Expert opinion or textual evidence*
Motivation	• Intrinsic motivation	• Motivational beliefs; locus of control; mastery motivation	$n = 19$ (13%)	✓		✓
	• External supports for autonomous motivation	• Using novelty and personally meaningful activities; supporting success and sense of self-efficacy; supporting social engagement and connectedness; autonomy-supportive caregiver interactions	$n = 27$ (19%)	✓	✓	✓
Caregiver support	• Caregiver wellbeing	• Caregiver stress; caregiver social support; caregiver coping skills	$n = 19$ (13%)	✓	✓	✓
	• Caregiver–child relationships and interactions	• Quality of relationships; positive and responsive interactions; autonomy-supportive interactions	$n = 53$ (37%)	✓	✓	✓
	• Caregiver expectations and beliefs	• High expectations for the child; caregiver self-efficacy	$n = 14$ (10%)	✓		✓
	• Caregiver skills and knowledge	• Observation skills; responsiveness; scaffolding skills; knowledge of child characteristics; general education level	$n = 28$ (20%)	✓		✓
	• Supporting child growth and success	• Providing learning opportunities; planning; collaboration and consistency	$n = 15$ (11%)	✓	✓	✓
Environmental context	• Social	• Relationships with peers; cultural factors; socioeconomic factors; organisational environment	$n = 37$ (26%)	✓	✓	✓
	• Temporal	• Timing; predictability; transition	$n = 9$ (6%)	✓	✓	✓
	• Physical	• Sensory input; distractions; environmental modifications; positioning	$n = 5$ (4%)	✓	✓	✓
	• Task characteristics	• Personal meaning and individualisation; structure; self-care	$n = 28$ (20%)	✓	✓	✓

(*Continued*)

Table 1. (*Continued*)

Category	Themes	Subthemes	Number of records addressing each theme ($N = 142$)	Type of evidence supporting each theme		
				Quantitative research evidence	*Qualitative research evidence*	*Expert opinion or textual evidence*
Intervention characteristics	• Self-determination	• Meaningful choice-making; involvement in planning	$n = 13$ (9%)	✓		✓
	• Self-management	• Self-monitoring; self-instruction; self-evaluation; self-reinforcement	$n = 24$ (17%)	✓		✓
	• Positive behaviour interventions and supports	• Functional behavioural assessment; building supportive environments; developing adaptive regulation skills; incorporating individual strengths and preferences; facilitating positive and consistent support by caregivers	$n = 22$ (15%)	✓		✓
	• Cognitive behavioural therapy	• Cognitive training; behavioural strategies; sequence of intervention	$n = 7$ (5%)	✓		✓
	• Explicit instruction	• Targeted self-regulation skills and strategies; effective pedagogy	$n = 8$ (6%)	✓	✓	✓
	• Arts-based	• Music; musical theatre	$n = 2$ (1%)	✓	✓	✓
	• Physical activity	• Exercise; outdoor activities; individualised physical activity	$n = 3$ (2%)			✓
	• Mindfulness-based	• Mindfulness for young people with ID; mindfulness for caregivers	$n = 7$ (5%)	✓		✓
	• Relationships-based	• Responsive interactions; attachment-focused strategies; co-regulation skills	$n = 12$ (8%)	✓		✓
	• Caregiver wellbeing–focused	• Caregiver stress; social support	$n = 4$ (3%)			✓
	• Environmental	• Sensory-adapted environments	$n = 2$ (1%)	✓		
	• Technology-based training and supports	• Multimedia instruction and training; video feedback; audio/visual prompting systems; electronic self-management systems; augmentative and alternative communication systems; environmental control systems	$n = 22$ (15%)	✓		✓
	• Health-related	• Gastrointestinal, pain-related; sleep-related	$n = 2$ (1%)	✓		✓
	• Pharmaceutical	• Psychotropic medications	$n = 17$ (12%)	✓		✓
	• Multi-component	• Interventions addressing the child and caregiver; combined intervention approaches	$n = 11$ (8%)	✓		✓

populations, including those with ASD-ID (Northrup et al., 2021; Plesa Skwerer et al., 2019). Behavioural regulation in children with ID is relatively stable in middle childhood (6–12 years), providing opportunities for improvement in regulation of attention and emotional reactivity (Bolourian, 2018; Esbensen et al., 2021; Marquis, 2017; Northrup et al., 2021).

Skills

Diverse skills and attributes are important contributors to self-regulation and co-regulation in young people with ID, with a strong focus on socio-emotional skills, cognition, EF, and communication skills. Self-awareness and a positive perception of one's own abilities (Hall & Theron, 2016; Nader-Grosbois, 2014); social information processing skills (Nader-Grosbois et al., 2013); pretend play skills and the ability to engage in self-directed leisure activity (Gilmore & Cuskelly, 2014; Miodrag, 2009; Nader-Grosbois & Vieillevoye, 2012); and selected self-determination skills such as choice-making skills, goal setting and attainment skills, and self-management skills (Luber, 2018; Wehmeyer, 2007) were all identified as important. Persistence (Gilmore et al., 2003), cognitive skills such as problem-solving (Nader-Grosbois, 2014), specific EFs including shifting and inhibition (Cuskelly & Stubbins, 2006; Esbensen et al., 2021), and learned coping strategies (Sullivan et al., 2012) are important for self-regulation and co-regulation. Despite some ambiguity about associations between language skills and regulation in young people with ID (Cuskelly et al., 2016; Cuskelly & Stubbins, 2006; Nader-Grosbois & Lefèvre, 2011; Vieillevoye & Nader-Grosbois, 2008), the overwhelming opinion of experts is that communication skills are important to support adaptive self-regulation (De Schipper & Schuengel, 2010; des Portes, 2020; Marquis, 2017; Sadler, 2019; Vieillevoye & Nader-Grosbois, 2008).

Motivation

Intrinsic motivation is considered essential for the enactment of self-regulated behaviour and is associated with improved functioning and emotional wellbeing in young people with ID (Cuskelly et al., 2013; Patrick et al., 2004; Strnadová, 2020). Developing and facilitating intrinsic motivation in this population are important to support self-regulation (Cuskelly et al., 2013). Several factors external to the young person can support intrinsic motivation, including use of novel and personally meaningful activities (Foshay & Ludlow, 2005; Gilmore & Cuskelly, 2013; Wehmeyer & Shogren, 2020; Zyga et al., 2018), supporting success and a sense of self-efficacy (Gilmore & Cuskelly, 2013; Schunk & DiBenedetto, 2020), social engagement and connectedness (Gilmore & Cuskelly, 2013; Nader-Grosbois, 2014; Patrick et al., 2004), and autonomy-supportive interactions with caregivers (Gilmore & Cuskelly, 2013; Glenn & Cunningham, 2002).

Caregiver support

Caregiver–child relationships and interactions was the strongest theme after child-diagnosis, highlighting the critical contribution of caregivers to self-regulation enactment for young people with ID. Caregiver-related factors contributing to effective self-regulation and co-regulation included positive and autonomy-supportive relationships between caregivers and young people, responsive and consistent caregiver interactions, high expectations by caregivers, good caregiver self-efficacy and wellbeing, strong caregiver observation and scaffolding skills, and caregiver engagement in targeted and collaborative planning for young people across contexts (De Schipper & Schuengel, 2010; Green & Baker, 2011; Hall & Theron, 2016; Hauser-Cram et al., 2001; King-Sears & Carpenter, 2005; Norona & Baker, 2014; Van der Veek et al., 2009).

Environmental context

Inclusive, responsive, and autonomy-supportive social environments that facilitate positive and supportive relationships with peers were consistently identified as critical to facilitating self-regulation

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in young people with ID (Gilmore & Cuskelly, 2014; Sullivan et al., 2012; Wehmeyer, 2007). Other environmental factors important for supporting regulation included sensory input, task characteristics, and the duration, pace, timing and predictability of activities (Demchak & Bossert, 2005; des Portes, 2020; Nader-Grosbois & Lefèvre, 2011). Finally, cultural background and the socioeconomic status of young people and their caregivers affect self-regulation enactment (des Portes, 2020; Macfarlane et al., 2020). Young people with ID from different socioeconomic backgrounds and diverse ethnic groups differed on some constructs related to self-regulation, including self-management and self-determination (Raley et al., 2020; Rodgers & Lipscombe, 2005). Ethnicity influenced factors important for co-regulation such as caregiver perceptions, caregiver expectations, and caregiver–child interactions (Caplan & Baker, 2017; Macfarlane et al., 2020), as well as how caregiver interactions shaped the child's self-regulatory development (Caplan & Baker, 2017).

Intervention characteristics

Diverse interventions associated with improved self-regulation and co-regulation for young people with ID were identified in the literature, and typically addressed one or more of the five categories in Murray et al.'s (2015) model. For example, medical interventions tended to address biological factors such as sleep or pain, while explicit instruction addressed individuals' skills. Several intervention approaches had an impact across categories, targeting the young person's skills, motivational supports, caregiver interactions, and environmental factors. However, most interventions focused on improving the young person's skills via rich learning opportunities and supporting caregivers to respond positively and proactively to regulatory challenges. Few interventions incorporated elements that supported caregiver wellbeing, considered environmental adjustments, or addressed autonomous motivation explicitly. There is high-quality evidence to support the efficacy of positive behaviour interventions and supports (PBIS) and self-management strategies in facilitating development of self-regulation skills in young people with ID (Embregts, 2000; King-Sears, 2008; Kuntz & Carter, 2019; Sadler, 2019). Technology-based supports, including software-based training packages, multimedia instruction, audio and/or visual prompting systems, electronic activity schedules, video modelling, simulation training, electronic self-management systems, augmentative and alternative communication systems, and environmental control systems, are associated with supporting independence, self-direction, skill development and intrinsic motivation in young people with ID (Douglas & Uphold, 2014; Foshay & Ludlow, 2005; Gilson et al., 2017; Lancioni et al., 2017). Finally, there is preliminary evidence to support using mindfulness strategies and cognitive behavioural therapy to enhance emotional wellbeing and adaptive coping strategies in young people with ID, particularly when their caregivers are involved in the intervention (Beck et al., 2022; Parent et al., 2016; Singh et al., 2017; te Brinke et al., 2022).

Discussion

The findings of this scoping review support the relevance of Murray et al.'s (2015) model for young people with ID. Themes and subthemes identified in the literature allow this model to be refined to address the unique needs and experiences of this population and their caregivers (see Figure 4).

The impact of chronological age on self-regulation in young people with ID appears to be consistent with neurodevelopmental research in the general population, with two key periods for self-regulation development linked to significant brain plasticity in early childhood and again in adolescence (Murray et al., 2015). This highlights the importance of early intervention (Baker et al., 2010; Bolourian, 2018) and ongoing efforts to develop self-regulation skills in young people with ID throughout childhood and particularly into adolescence. Given the complexity of biological, skill-related, motivational, and contextual factors influencing self-regulation enactment for young people with ID, blanket approaches to intervention are unlikely to cater to individuals' needs. Careful consideration of each young person's unique profile and environmental context will be necessary for successful outcomes. Physical health and wellbeing are of foundational importance for young people with ID, necessitating explicit

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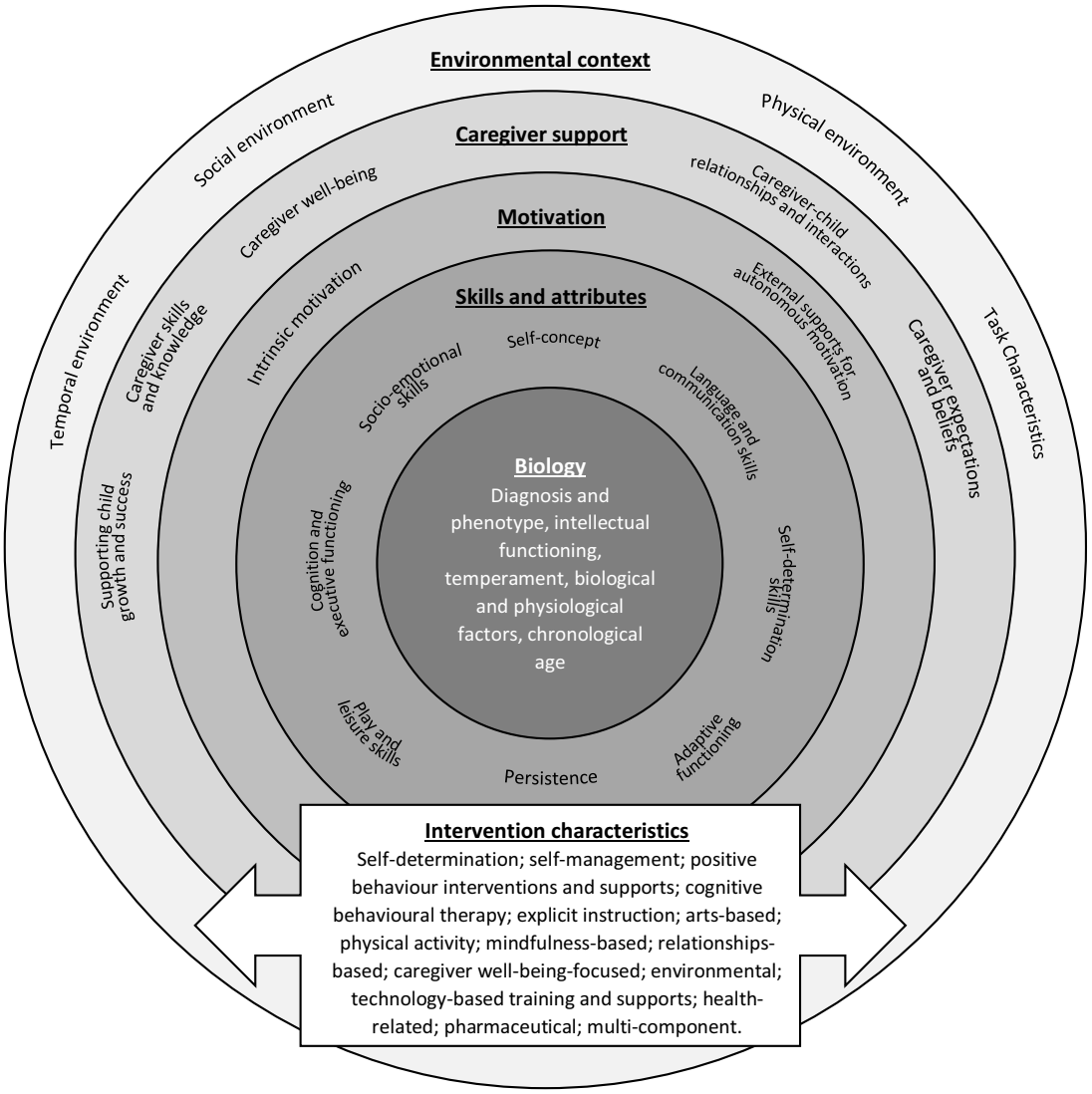

Figure 4. Factors Contributing to Self-Regulation Enactment for Young People With Intellectual Disability.

monitoring of factors such as nutritional intake, hydration, sleep, physical activity, bowel health, oral hygiene, and postural support (Demchak & Bossert, 2005). Daily routines should be designed to meet individuals' physical needs to the greatest extent possible, with health-related interventions utilised as necessary.

Caregivers have a central role in developing self-regulation skills in young people with ID, yet few regulatory interventions target caregiver skills, knowledge, expectations, and wellbeing explicitly. This is despite parents and educators of young people with ID being at higher risk of diminished wellbeing, and concerns about the training and skill levels of paid caregivers in inclusive education settings (Forlin et al., 2008; Miodrag, 2009; Royal Commission into Violence, Abuse, Neglect and Exploitation of People with Disability, 2019). Programs targeting self-regulation for young people with ID should support caregiver wellbeing and capacity building as a priority alongside child outcomes. The broader social environment should also be considered, with inclusive environments promoted that foster connection with peers. School-based interventions should consider organisational culture, inclusive

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practices, staff wellbeing, and the relationships and interactions among the young person with ID, their classroom staff, and peers.

The wide range of literature, which connects specific skills and attributes to regulatory outcomes in young people with ID, supports the relevance of explicit skills instruction for these individuals and calls for the development of a targeted assessment and curriculum package aimed at developing these skills. Educators and allied health professionals who support young people with ID and their families would benefit from a comprehensive resource that allows them to assess skills relevant for self-regulation and progress the young person along a continuum in a coordinated way. An intervention of this nature would support the development of therapy plans and individualised education plans that target self-regulation for young people with ID explicitly, and support schools and organisations to ensure comprehensive planning and intervention across childhood and adolescence.

Although there is ongoing debate over the value of using external rewards with young people with ID, the findings of this review suggest externally controlled reward systems may interfere with intrinsic motivation and should only be used briefly in the initial stages of teaching a new skill (Sigafoos et al., 2020; Wehmeyer & Shogren, 2020). Caregivers of young people with ID should be supported to implement strategies that facilitate autonomous motivation, including use of person-centred and strengths-based approaches (Wehmeyer & Shogren, 2020). Self-management interventions including self-reinforcement can also be used to facilitate more autonomous motivation and support development of self-regulation skills (Cuskelly et al., 2013; Embregts, 2000; Sigafoos et al., 2020; Wehmeyer et al., 2003).

Multiple factors identified in this scoping review reinforce the application of self-determination theory (Deci & Ryan, 1985) in supporting self-regulation in young people with ID by meeting their individual needs for autonomy, competence, and relatedness (Wehmeyer & Shogren, 2020). Self-determination is a particularly important construct with relevance to this population in relation to (a) the regulatory skills they possess, (b) their motivation to act in a self-regulated way, (c) the expectations and opportunities provided by caregivers, and (d) the way in which the social environment influences self-regulation enactment (Wehmeyer, 2007; Wehmeyer & Shogren, 2020). A variety of interventions reported in the literature make use of self-determination strategies to support the development of self-regulation-related skills in this population (Agran et al., 2006; Kuntz & Carter, 2019; Luber, 2018), suggesting that strategies to build self-determination should be included in regulatory interventions for young people with ID.

Research evidence supports the effectiveness of PBIS and self-management strategies in promoting self-regulation in young people with ID (Embregts, 2000; King-Sears, 2008; Kuntz & Carter, 2019; Sadler, 2019). As these approaches can be individualised and implemented across a range of contexts, they should be considered when designing interventions for this population. However, research should also continue to investigate the effectiveness of interventions incorporating mindfulness strategies, adapted cognitive behavioural therapy approaches, and technology-based supports. This variety is important to ensure interventions can be matched to the individual needs of young people with ID, the values and priorities of their families, and the diversity of their educational environments.

Limitations

The records included in this review came from a wide range of sources across three academic databases, including quantitative and qualitative research articles, opinion papers, editorials, books, and dissertations, but a hand search of journals and the reference lists of relevant literature was not performed due to time constraints. Some relevant literature may have been missed as a result. Another limitation was that a broad classification of ID was used in the search strategy rather than utilising a specific diagnosis. Although this has provided a good starting point for understanding factors influencing self-regulation enactment in young people with ID, the results of this research may be too broad to support the development of interventions for populations with more specific diagnoses. Given the findings of this review highlight the contribution of diagnosis to self-regulation, future

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experimental research should investigate the effectiveness of regulatory interventions across different diagnostic categories associated with ID to ensure their validity.

Conclusion

Young people with ID have challenges with self-regulation, yet no programs are available that support regulatory function and skill development comprehensively for this population. A better understanding of factors influencing self-regulation and co-regulation for young people with ID is needed to inform the development of appropriate interventions. The findings of this scoping review allow Murray et al.'s (2015) model of factors contributing to self-regulation enactment to be refined for young people with ID by identifying specific factors that impact on self-regulation enactment in this population, as well as intervention characteristics that will likely facilitate co-regulatory support and development of self-regulation skills for these individuals. This information supports a more comprehensive understanding of regulatory function and development in young people with ID and should be used to inform the creation of holistic interventions that address the identified needs of these individuals and their caregivers within the context of their natural environments. This review has identified the need for rigorous experimental research to investigate the effectiveness of interventions targeting regulatory function and skill development for this population.

Supplementary material. The supplementary material for this article can be found at https://doi.org/10.1017/jsi.2024.3

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