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Tutorial paper

School-aged children with SLI: The ICF as a framework for collaborative service delivery

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Abstract

Reports of associated disabilities among children with specific language impairment (SLI) and children with other developmental disabilities are widespread. Clinicians require a broader definition of SLI that recognizes associated disabilities because it is their goal to impact children's everyday functioning. In this paper, we explore SLI from a broader perspective in which consideration is given to features known to be common across different developmental disabilities. The World Health Organization's (2001) International Classification of Functioning, Disability and Health (ICF) is utilized as an organizational and conceptual framework for considering how knowledge of commonalities across developmental disabilities may be used to promote collaborative service delivery in an educational setting. This framework can potentially provide a coherent and comprehensive approach to treating SLI and its associated disabilities without overburdening clinical services.

Learning outcomes: As a result of this activity, the reader will be able to: (1) describe the potential role of the ICF in facilitating collaborative service delivery in the school setting; (2) identify and describe the commonalities among SLI and its associated disabilities; and (3) describe how knowledge of commonalities may inform approaches to service delivery. © 2007 Elsevier Inc. All rights reserved.

1. Overview

The term specific language impairment (SLI) is traditionally used to describe children who have significant delays in language in the absence of hearing impairment, oral-motor

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deficits, frank neurological damage, or cognitive delays (Leonard, 1998). The use of the word "specific" suggests that these children's problems are restricted to language. Yet reports of overlap among language impairments, motor deficits, and attention deficits in children with SLI, and indeed among other developmental disabilities, are increasingly prominent in the literature (Beitchman, Brownlie, & Wilson, 1996; Bishop & Adams, 1990; Gallagher, 1999; Hill, 2001; Hill, Bishop, & Nimmo-Smith, 1998; Kaplan, Dewey, Crawford, & Wilson, 2001; Powell & Bishop, 1992). Associated disabilities are so widespread among children with SLI that specific cases are considered the exception rather than the rule (Bishop, 2004).

As mandated by their professional scope of practice, speech-language pathologists (SLPs) typically address the unique language-related problems associated with SLI. Similarly, other professionals focus on the deficits that fall within the scope of their respective professional domains. Yet professional services often converge when children with SLI enter school and their associated disabilities *together* seriously compromise functioning in the academic environment. In this paper, we explore SLI from a broader perspective, particularly as it relates to developing a more comprehensive, coherent, and potentially more effective approach to school-based service delivery.

The World Health Organization's (WHO) International Classification of Functioning, Disability, and Health (ICF) (2001) describes the health and functioning of individuals in everyday contexts, including the school setting. It is utilized here as an organizational structure for exploring how commonalities across developmental disabilities can be used in conjunction with what is known to be distinctive about particular disabilities to create a shared terminology and framework among professionals working in a school setting. This framework is intended to enhance service delivery by suggesting what features of SLI and its associated disabilities could be treated universally within an inclusive classroom, what features could be treated commonly among just those children with related developmental disabilities, and what features must be treated selectively for particular children in order to provide a continuum of services that is both comprehensive and cohesive.

2. Introduction

Historically, SLI has been of interest to researchers who view the disassociation of language from other psychological functions as revealing of the architecture of the human mind (Bishop, 1997; Leonard, 1998; Pinker, 1994; van der Lely, 2005). The construct also has potential clinical value because it helps to define professional scopes of practice and to increase public awareness of the profession's unique expertise in the area of language learning and disorders (Kamhi, 1998). Yet pure cases of language impairment are rare in clinical caseloads (Bishop, 2004). For instance, studies of motor coordination in children with SLI indicate that 40–90 percent of these children also meet the criteria for developmental coordination disorder (DCD) (Hill, 2001). Similarly, the overlap between language impairment and attention deficit hyperactivity disorder (ADHD) has been estimated to be as high as 90 percent, with most studies reporting estimates between 20 and 60 percent (Oram, Fine, Okamoto, & Tannock, 1999). Kaplan et al. (2001) examined comorbidity among seven developmental disorders in a single sample of 179 school-aged

children. In their study, 51.6 percent of the children with a language-learning disability met the criteria for at least one other disorder. Overall, the growing evidence for widespread comorbidity is suggestive. However, large-scale epidemiological studies are needed to verify prevalence rates of comorbidity in representative samples of children with a broad range of developmental disorders.

It has been suggested that the definition of SLI necessarily varies with the purpose for which the definition is employed (Bishop, 2004; Johnston, 1999). Clinicians require broader definitional criteria than researchers because their "goal is to identify children whose language impairments affect everyday functioning" (Bishop, 2004, p. 311). Support for a broader, more functional view of SLI is growing (Bishop, 2004; Fujiki, Spackman, Brinton, & Hall, 2004; Gallagher, 1999; Johnston, 1999). Fujiki et al. (2004) demonstrated that children with SLI experience a range of deficits, among which are problems in emotional regulation, placing their work among those studies suggesting that children with SLI have difficulties in domains other than language. Likewise, Gallagher (1999) cautioned that overlooking emotional/behavioral conditions that co-occur with language impairment may result in an unacceptable risk of underservicing children because their full range of symptoms are not considered. The long-term costs of providing inadequate services are likely to be significant, both for individual children and society as a whole. By recognizing SLI as a broader condition that involves cognitive impairments, Johnston (1999) argued that SLPs are better positioned to secure resources when policy decisions are made because "in today's service economy children with more serious problems often have access to wider ranging, and more frequent, treatment" (p. 171). Indeed, compelling evidence shows that a history of childhood language, motor, or attention impairments is associated with poor outcomes in adolescence and adulthood (Beitchman et al., 2001; Cantell, Smyth, & Ahonen, 1994; Greene, Biederman, Faraone, Sienna, & Garcia-Jetton, 1997; Mannuzza, Klein, Bessler, Malloy, & LaPadula, 1998; Rasmussen & Gillberg, 2000).

Bishop's work on the breadth of conditions associated with SLI is particularly comprehensive and noteworthy (e.g., Bishop, 2002; Bishop & Adams, 1990; Bishop & Norbury, 2005). She recently embraced the WHO's multi-level conceptual framework of human functioning and disability as a means for describing SLI in a broader context (see Bishop, 2004). In this framework, it is recognized that SLI can be viewed from different conceptual levels depending upon one's particular focus (e.g., improving functioning in the classroom versus describing the mechanisms that underlie a disorder). In its current form, the ICF (WHO, 2001) describes human functioning in terms of *body functions and structures* (physiological systems and anatomical parts), *activities* (execution of tasks and actions), and *participation* (involvement in life situations). Disablement is described as impairments or limitations in one or more of these areas. The ICF also identifies *contextual factors* that can interact with and modify the individual's experience of a health condition or disorder, including the *personal* characteristics of the individual (e.g., temperament and coping style) and the surrounding physical, social and attitudinal *environment*. Fig. 1 shows a graphic representation of the ICF conceptual framework.

The utility of the framework is in its focus on the functional implications of health conditions in the contexts that are relevant to people's daily lives. For children, this includes the school setting. Of importance for developmental disabilities such as SLI, the



Fig. 1. The graphic representation of the conceptual framework adopted by the ICF. From the International Classification of Functioning, Disability and Health (WHO, 2001, p. 18). Copyright 2001 by the World Health Organization. Reprinted with permission.

brain and its mental or psychological functions are covered in the body functions and structures category. Hence, deficits in language or cognitive processing would be considered impairments of body functions and structures. Limitations that children with SLI might experience in executing activities and participating in life situations could include problems understanding vocabulary necessary for reading comprehension and difficulty in accessing peer groups for academic and social events. Given that mental or psychological functions are typically identified through behavioral measures, the difference between impairments in body functions and limitations in activities can be indistinct. However, it is nonetheless useful to make a distinction between measures of the specific psychological processes that support language operations and those that examine language ability in everyday contexts (Bishop, 2004).

In the ICF framework, body functions and structures, activities, participation, and contextual factors are inter-related and mutually influence one another. Fundamental to this framework is the concept of *universality* that recognizes disability as "an infinitely various [and] universal feature of the human condition" (Bickenbach, Chatterji, Badley, & Üstün, 1999, p. 1182). The health and functioning of all people, including those with a disability, are considered to be part of a continuum, which highlights the fact that variation in ability is the norm (Zola, 1989). This view of human functioning also is consistent with alternative accounts of SLI presented in the clinical literature (e.g., Leonard, 1991). When functioning is viewed along a continuum from the biological to the social, boundaries between conditions become more permeable. From such a perspective, the conditions associated with SLI can be organized cohesively to account for the full range of abilities and disabilities that characterize these children. Moreover, this perspective promotes respect for individual differences in ability, and as such, is aligned with inclusive policies and practices that support "a system of equity for students with exceptionalities" and "a commitment to educate each child to the maximum extent through placement, instruction, and support in the most heterogeneous and appropriate educational environment" (Winzer, 2002, p. 40).

It may be useful to consider SLI within a continuum of human functioning given the burgeoning literature on co-morbidity, concerns about the specificity of SLI, and educational policies regarding inclusion. If SLI is viewed with its associated developmental disabilities, then not only do children with a primary diagnosis of SLI stand to benefit from the provision of comprehensive services, but so do those children with developmental problems in other areas. Yet it is necessary to proceed in a coherent manner to ensure that service providers are not overwhelmed with the demand to assess and to treat so broadly that large caseloads are expanded even further. Specifically, we suggest how professionals can use what is known about the commonalities across categories of developmental disabilities in conjunction with what is known to be distinct about these developmental disabilities to organize and coordinate their services. Although commonalities are highlighted, this implies neither a causal account of developmental disabilities (see Karmiloff-Smith, 1998 for discussion) nor the abandonment of current diagnostic categories in favor of a unitary construct, such as atypical brain development (e.g., Gilger & Kaplan, 2001). As Bishop (2004) points out, "we cannot afford to simply abandon the diagnostic labels" because "quite simply, a label provides a shorthand description of a child's problems that provides access to appropriate services" (p. 317). Therefore, it is our contention that understanding what is common across categories of disorders together with what is distinct may enhance service provision by suggesting what features of SLI and its associated disabilities may be treated universally, commonly, or selectively within a framework for comprehensive school-based services.

3. Illustrative literature review

Following from the reports of frequent overlap among developmental disabilities in language, motor coordination, and attention, a more detailed review of the literature is presented here that highlights specific commonalties among these groups of children. As the ultimate purpose of this review is to illustrate how information about commonalties can be used to inform service delivery, the literature included in this section is necessarily illustrative rather than exhaustive. Building upon the example of Bishop (2004), the WHO's ICF is utilized as an organizational framework within which to explore some of the commonalities across developmental disorders at three of the levels of the ICF-body functions and structures, activities, and participation. As noted by Bishop, measures of cognitive processing are assumed to be indicators of underlying psychological functioning; thus, evidence of commonalities in this area fit within the body functions and structures level of the ICF. Specifically, research shows that children with SLI, DCD, and ADHD all have been found to display limitations in cognitive processes such as speed of processing, working memory, and executive functioning (Gillam & Hoffman, 2004; Gillam, Hoffman, Marler, & Wynn-Dancy, 2002; Mandich, Buckolz, & Polatajko, 2002, 2003; Martinussen, Hayden, Hogg-Johnson, & Tannock, 2005; Wilson & McKenzie, 1998). Executive functioning is "an umbrella term for all of the complex set of cognitive processes that underlie flexible goal-directed responses to novel or difficult situations" (Hughes & Graham, 2002, p. 131). Processes that are typically included within the domain of executive functioning include "inhibiting actions, restraining and delaying responses, attending selectively, setting goals, planning, and organizing, as well

as maintaining and shifting [cognitive] set" (Singer & Bashir, 1999, p. 266). These higher level processes are supported by a limited capacity working memory system that "temporarily maintains and stores information, [and] supports human thought processes by providing an interface between perception, long-term memory, and action" (Baddeley, 2003, p. 829), as well as by the overall speed with which the system processes information (Kail & Hall, 2001).

For example, children with SLI do not process information as quickly as their typically developing peers (Miller, Kail, Leonard, & Tomblin, 2001) and perform poorer on working memory tasks that require simultaneous storage and processing of information (Hoffman & Gillam, 2004; Marton & Schwartz, 2003; Weismer, Evans, & Hesketh, 1999). In addition to these differences in processing and working memory, children with SLI demonstrate difficulty with other cognitive functions such as selective and sustained attention, problem solving, and regulation of emotion (Fujiki et al., 2004; Johnston, 1999; Noterdaeme, Amorosa, Mildenberger, Sitter, & Minow, 2001). With respect to children with DCD, a meta-analytic review of 50 studies examining information processing abilities revealed a mild but pervasive deficit in the ability of these children to process visual-spatial information when compared to their typically developing peers (Wilson & McKenzie, 1998). Dewey, Crawford, Kaplan, and Wilson (2003) found that children with DCD also demonstrated poorer performance on verbal and visual memory tasks as compared to those children who were merely suspected of DCD and those who were developing typically. Not unlike children with SLI, children with DCD also display deficits in executive functions, such as regulating and inhibiting behavioral responses (Mandich et al., 2002; Mandich, Buckolz, & Polatajko, 2003). Behavioral inhibition also is a primary impairment in children with ADHD (Barkley, 1997; Berlin, Bohlin, Nyberg, & Janols, 2004; Berlin, Bohlin, & Rydell, 2003). Further, cognitive processes that are impaired in both children with SLI and DCD also have been implicated in ADHD, including emotional regulation (Berlin et al., 2004), working memory (Karatekin, 2004; Martinussen, Hayden, Hogg-Johnson, & Tannock, 2005), and processing speed (Kalff et al., 2002; Willcutt, Pennington, Olson, Chhabildas, & Hulslander, 2005).

In addition to cognitive processing commonalities at the body functions and structures level, evidence also suggests that commonalities exist across children with SLI, DCD, and ADHD at the activity and participation levels of the ICF.¹ Academic activities are among the most important in children's lives because they form the foundation for long-term vocational success and social adjustment. A considerable body of literature suggests that children with SLI, DCD, and ADHD are at risk for significant academic problems (Beitchman, Wilson, Brownlie, Walters, & Lancee, 1996; Dewey, Crawford, Wilson, & Kaplan, 2004; Zentall, 1993). Children with language-related disorders are particularly vulnerable to academic problems because of the "lifelong need to acquire language, to learn with language, and to apply accrued knowledge of language to learning tasks, such as reading and writing" (Bashir & Scavuzzo, 1992). Indeed, the connection between oral

¹ The WHO (2001) states that Activities and Participation may be treated as a single dimension because it is not always possible to distinguish between the execution of an activity and involvement in a social situation (e.g., the activity of talking generally takes place in the context of a social interaction). Therefore, a distinction will not be made between commonalities at the Activities level and those at the Participation level.

language deficits and later reading problems is well established (Catts, Fey, Tomblin, & Zhang, 2002; Leonard, 1998; Schuele, 2004). Evidence also suggests that children with SLI are less skilled at written language tasks, such as composing narratives (Fey, Catts, Proctor-Williams, Tomblin, & Zhang, 2004; Mackie & Dockrell, 2004). The scope of academic limitations experienced by children with DCD and ADHD also includes problems in reading (DeShazo, Lyman, & Klinger, 2002; Dewey, Kaplan, Crawford, & Wilson, 2002; Zentall, 1993), as well as in related areas such as spelling (Dewey et al., 2002; Zentall, 1993). Like their peers with SLI, children with DCD and ADHD also have difficulty with written language tasks (DeShazo et al., 2002; Dewey et al., 2002). For children with DCD, difficulties extend beyond those related to handwriting to include problems with proofreading and editing, punctuation, and capitalization (Dewey et al., 2002). For children with ADHD, underachievement in written language has been measured by tasks requiring identification and correction of errors in written passages, as well as by tasks that require composition of text (DeShazo et al., 2002).

Children with SLI also differ from their typically developing peers in their acquisition of basic number skills and knowledge, which taken together with the linguistic demands of many aspects of mathematics, places them at risk for problems in mathematical achievement (Cowan, Donlan, Newton, & Lloyd, 2005). Limitations in mathematical achievement, including difficulties with both computational and word-based problem solving, also are present in children with ADHD (Lucangeli & Cabrele, 2006; Zentall, 1993). Indeed, Zentall noted that math computation is the academic activity that children with ADHD are most likely to fall behind in relative to their peers. The mathematical achievement of children with DCD has yet to receive systematic attention in the literature; however, the results of one study indicate that at least some children with motor coordination problems do not perform as well as their typically developing peers in this academic area (Dewey & Kaplan, 1994). Ultimately, all of these children are at risk for poorer long-term outcomes, with studies indicating that many academic problems persist beyond childhood (Barkley, 2002; Beitchman, Wilson et al., 1996; Cantell et al., 1994; Young et al., 2002).

Another commonality among children with SLI, DCD, and ADHD at the level of activity and participation are the frequent reports of deficits in the area of social competence (Fujiki, Brinton, & Todd, 1996; Mandich, Polatajko, & Rodger, 2003; Nixon, 2001). For example, children with SLI are more reticent and withdrawn than their typically developing peers (Fujiki, Brinton, Hart, & Fitzgerald, 1999; Fujiki, Brinton, Isaacson, & Summers, 2001). They are less proficient at joining peer groups and may make minimal contributions when working in cooperative groups with their peers (Brinton, Fujiki, & Higbee, 1998; Brinton, Fujiki, Spencer, & Robinson, 1997; Craig & Washington, 1993). Furthermore, teacher ratings of children with SLI reveal them to be less socially competent than their peers and more likely to display behavioral difficulties (Fujiki et al., 1996). The repercussions of such social problems can include fewer reciprocal friendships, peer rejection, and peer victimization (Conti-Ramsden & Botting, 2004; Fujiki, Brinton, Morgan, & Hart, 1999). Similar to children with SLI, social interaction problems figure prominently in studies of children with DCD and ADHD (Miller, Missiuna, Macnab, Malloy-Miller, & Polatajko, 2001; Missiuna, Gaines, & Pollock, 2002; Nixon, 2001; Stormont, 2001). For example, parents report that the psychosocial consequences

associated with DCD include feelings of failure and incompetence, low self-esteem and self-efficacy, and exclusion from social participation (Mandich, Polatajko et al., 2003). Moreover, children with DCD are not unaware of their social problems. Compared to their typically developing peers, these children have lower levels of perceived social support and higher levels of anxiety (Skinner & Piek, 2001). The significance of social competence problems is just as evident in children with ADHD, and some researchers suggest that even though these children "are primarily identified by their motor and attention problems, it is the problems in the social realm that most significantly impede their development" (Nixon, 2001, p. 177). Indeed, much like children with SLI, children with ADHD are at particular risk for peer rejection (Hodgens, Cole, & Boldizar, 2000; Landau & Moore, 1991) and peer victimization (Shea & Wiener, 2003).

In summary, the preceding literature demonstrates that a number of commonalities across a wide range of behaviors are shared by children with SLI, DCD, and ADHD. Using the ICF framework (WHO, 2001), these commonalities can be organized according to two levels of functioning. At the body functions and structures level, commonalities among these children are reflected in specific aspects of cognitive processing that can be compromised, such as processing speed, working memory, or executive functioning. At the activities and participation level, these children have been found to be vulnerable to problems in academic and social functioning. Yet organizing commonalities across developmental disabilities is not the only function of the ICF within the context of schoolbased service delivery. The ICF also can provide a shared conceptual framework and language for professionals from different disciplinary backgrounds. As will be explored in the subsequent section, this has important implications for service delivery within the schools.

4. Implications for service delivery

The commonalities identified in the literature offer support for the argument that developmental disabilities, such as SLI, may be viewed within a broader context in which account is taken of both its unique features as well as the features it shares with other associated developmental disorders. The fact that children identified as having SLI are at risk for psychosocial and academic problems, together with the accumulating evidence of comorbidity among developmental language, motor, and attention problems, reinforces the need for a collaborative approach to service provision that can address the multiple needs of these children. Friend and Cook (1990) define collaboration as "a style for interaction between at least two co-equal parties voluntarily engaged in shared decision making as they work toward a common goal" (p. 72). Diversity in the knowledge and skills of each party in a collaboration is considered valuable and necessary to "create, strengthen, and maintain" the collaborative relationship (Walther-Thomas, Korinek, McLaughlin, & Williams, 2000, p. 5). Ultimately, collaboration is intended to be synergistic, with the potential for outcomes that are greater than what could have been achieved by any one individual on her or his own. Certainly, the importance of collaborative service delivery in addressing the needs of children with SLI, as well as children with other developmental disabilities, is well recognized (DuPaul & Power, 2000; Missiuna et al., 2002; Prelock,

2000). Yet recognition is not synonymous with implementation and many challenges have been identified to developing effective collaboration in schools² (Coben, Thomas, Sattler, & Morsink, 1997; Pershey & Rapking, 2003). For example, there are reports in the education literature that teachers often view the recommendations of special education professionals as unreasonable, overly time consuming, and unfair to the students in their classroom who do not have disabilities (Coben et al., 1997). In other words, teachers may feel that they do not have sufficient resources to meet the needs of both the child with a disability and the rest of the students in the classroom. Within the speech-language pathology literature, there is much discussion and debate about the growing demand for classroom-based services and the various challenges this poses for how SLPs work with educators and how they deliver services within schools (Ehren, 2000; Prelock, 2000). Finally, contributors to both professional literatures have identified the absence of a shared vocabulary and language as a barrier to communication with professionals from other disciplines (Coben et al., 1997; Friend & Cook, 1990; Soutar-Hynes, 1996).

Barriers to communication are of particular importance given that establishing a common language and framework are essential aspects of successful collaboration (Giacomini, 2004; Giangreco, 2000). Within education, collaborators often represent a variety of professional backgrounds and each individual brings terminology and perspectives that are specific to her or his discipline. The challenge, then, is to develop a common ground among professionals that transcends disciplinary boundaries. In this respect, professionals "need to be disposed to being ongoing learners who are open to new ideas and are committed to developing shared frameworks with practitioners from other disciplines" (Pershey & Rapking, 2003, p. 219). The ICF provides an entry point for developing both the shared language and conceptual framework that is necessary for successful collaboration in a school setting. In fact, one of the specific aims of the ICF is "to provide a unified and standard language" to describe the health and functioning of individuals (WHO, 2001, p. 3). The ICF's emphasis upon functioning rather than on medical conditions should ease its translation into an educational setting (e.g., VanAuker-Ergle, 2003). As will be discussed shortly, universality, one of the core principles on which the ICF is founded has already been embraced within education. Thus, the concepts underlying the ICF will likely be familiar to educators even though the particulars may not. With their knowledge of the ICF, SLPs would be positioned to facilitate the translation of any unfamiliar language for their educator colleagues. As has been shown, the ICF also can serve as a scaffold for organizing what is known to be common across developmental disabilities in language, motor coordination, and attention, as well as those qualities that are unique to particular developmental disabilities. Additionally, the ICF recognizes that there is an interaction among the biological, functional, and social components of human functioning. It is these permeable boundaries that then facilitate a broader view of SLI in which both the abilities and disabilities of these children are recognized as part of a continuum of human functioning.

² It is beyond the scope of the current work to outline all of the challenges to developing effective collaborations in education; however, several resources are available that offer detailed guidance on how to build and maintain collaborative teams in school settings (e.g., Dettmer, Thurston, & Dyck, 2005; Friend & Cook, 2000; Walther-Thomas et al., 2000).

In sum, the ICF facilitates collaborative service delivery by: (1) providing a unified terminology and common framework for collaborative teams; (2) organizing commonalities across children with developmental language, motor, and attention problems; (3) situating commonalities along a continuum of ability. In turn, knowledge of the commonalities at each level of functioning informs service delivery in the school setting by signifying what features of developmental disabilities can be treated universally, commonly, and selectively within a continuum of approaches to intervention. As shown in Fig. 2, at one end of this continuum are approaches that can be applied universally within the classroom to address the needs of all students, including those students with developmental disabilities. Further along the continuum are approaches that can be applied commonly to address the needs of just those students with developmental disabilities. Finally, approaches that are applied selectively are highly specialized and specific to the needs of children with particular disabilities. Thus, the continuum of approaches we are proposing incorporates contemporary views on school-based service delivery for children with SLI in addition to suggesting innovations. These approaches have the potential to enhance service delivery by reducing some of the barriers to effective collaboration that have been identified by teachers and SLPs while simultaneously offering a continuum of services for students that is both comprehensive and cohesive. Although evidence is emerging to support collaborative service delivery in the schools (e.g., Hadley, Simmerman, Long, & Luna, 2000; Throneburg, Calvert, Sturm, Paramboukas, & Paul, 2000), further research in this area is needed. Empirical investigation of the components of our proposed framework should provide an opportunity to advance evidence-based practice in speech-language pathology.

The next three subsections explore the proposed continuum of approaches to service delivery in greater detail, with the role of the SLP in relation to each approach highlighted throughout. The universal and common approaches to service delivery will likely be new to



Fig. 2. Approaches to service delivery are placed along a continuum, ranging from those that can be applied universally to address the learning needs of all students to those that are applied selectively and are highly specialized to address the particular needs of students with developmental disabilities. Students who are developing typically are represented by the white dotted shapes and students with SLI, DCD, or ADHD are represented by the solid grey shapes.

SLPs while those that are selective are expected to be widely known and accepted within the profession. Our intention is to build upon the foundations of practice that have been established in speech-language pathology and education by reorganizing and refining current ideas in these disciplines while also introducing innovations to both professions. One of the innovations, in our view, rests in our focus on the commonalities across SLI, DCD, and ADHD and how such knowledge opens up opportunities for service delivery that are not typically considered in relation to these groups of children. Additionally, the introduction of the ICF conceptual framework and language as a potential guide to professionals in delivering collaborative services in schools is likewise innovative.

4.1. Universal approaches to service delivery

A central tenet of the ICF is that it embraces the notion of universality in which disability is assumed to be an intrinsic part of human functioning. Thus, a universal view advocates respect for individual differences in ability, and as such, it promotes inclusion through the creation of tools and environments that have the flexibility to accommodate wide variation in functioning (Bickenbach et al., 1999). To place this universal view in context, an example from the field of architecture may be useful. In architecture, buildings and public spaces are designed from the outset to be accessible to the widest variety of individuals possible. For example, automatic doors in public buildings make it possible for both the person using a wheelchair or the person pushing a child's stroller to enter a building without assistance. In other words, the same design feature that permits the individual with a disability to access public places also benefits "those who do not have disabilities per se but may have unrecognized situational needs, challenges, or preferences" (Rose, Meyer, & Hitchcock, 2005, p. 3). Within education, this universal perspective on functioning is exemplified through the concept of universal design for *learning*, described as "the design of instructional materials and activities that allows the learning goals to be achievable by individuals with wide differences in their abilities to see, hear, speak, move, read, write, understand English, attend, organize, engage, and remember" (Orkwis & McLane, 1998, p. 10). Just as in the field of architecture, universal design for learning places an emphasis on anticipating the needs of a range of individuals in advance. Flexibility is built into the curriculum at the outset during the planning phase. This is in contrast to more traditional approaches to curriculum development that focus on developing static material that must be modified after the fact on an ad hoc basis for individual students. In architecture, this would be analogous to retrofitting a building with a ramp, which is considered more costly and less efficient than planning for that feature to be part of the building at the outset. By incorporating flexibility into the design of the curriculum, opportunities for multi-dimensional learning are optimized and the need for individual accommodations is minimized (Curry, 2003). This does not mean that universal design for learning promotes a 'one-size-fits-all' or 'least common denominator' curriculum. Indeed, "universal design is not ordinarily achieved by uniformity of any kind but rather... universally designed instruction provides alternatives" (Orkwis & McLane, 1998, p. 9).

There are three principles of universal design for learning, each of which is outlined in Table 1. Definitions and methods of implementation for each principle are provided to

Principles ^a	Methods ^b
1. Provide multiple means of representation by offering learners various ways of acquiring information and knowledge	Provide multiple examples Highlight critical features Provide multiple media and formats Support background context
2. Provide multiple means of expression by providing learners alternatives for demonstrating what they know	Provide flexible models of skilled performance Provide opportunities to practice with supports Provide ongoing, relevant feedback Offer flexible opportunities for demonstrating skill
3. Provide multiple means of engagement by tapping into learners' interests, offering appropriate challenges, and increasing motivation	Offer choices of content and tools Offer adjustable levels of challenge Offer choices of rewards Offer choices of learning context

Principles and methods of universal design for learning

Table 1

^a Center for Applied Special Technology[©] (CAST, 2006).

^b Reprinted with permission from Hall, Meyer, and Strangman (2005). For more information, please visit www.harvardeducationpress.org.

indicate how universal design for learning affects presentation of curricular content, assessment of student learning, and involvement of students in the learning process. Common across all three principles is the notion that a universally designed curriculum has multiple levels that can be adjusted to meet individual abilities and preferences. Thus, universal design for learning permits consideration of how a variety of contextual factors, such as the format of academic materials, teachers' instructional styles, and students' own learning styles, may be interacting with the students' level of ability to affect academic functioning.

Exactly how do these principles of universal design for learning relate to the provision of collaborative services for children with developmental language, motor, or attention problems? The very fact that these developmental disabilities share many commonalities suggests that some intervention approaches may be suitable for children with different primary diagnoses. More specifically, the commonalities children with SLI, DCD, and ADHD share at the level of cognitive processing can be addressed, at least in part, by the types of environmental supports that are inherent to universal design for learning. Certainly, the principles of universal design for learning are consistent with strategies that scaffold learning by varying the cognitive processing demands of educational tasks (e.g., helping students organize and remember material from a classroom lesson or textbook by using a diagram, chart, or outline). The use of such strategies also is in accordance with suggestions provided by clinical scientists who study the implications of cognitive processing for the assessment and treatment of children with SLI (Gillam, 1997; Montgomery, 2002; Snyder, Dabasinskas, & O'Connor, 2002). As illustrative examples, Kidspiration[®] and AspireREADERTM are computer software programs that support academic skills such as reading and writing by adjusting the cognitive demands of these tasks at multiple levels. The former permits students to create a story using a graphic organizer and then transform their graphic representation into a text outline that forms the basis for more detailed written work. The latter presents digital books in a read-aloud format and can be customized to present text at different reading speeds or to highlight text word-by-word or sentence-by-sentence. The features contained in these (and other) software programs alter the cognitive demands of reading and writing on several dimensions, including planning, organizing, processing, and retaining information. The National Center on Accessing the General Curriculum has assembled published research on the effectiveness of a variety of educational tools, including software programs and other technology. These reviews are available on the website for the Center for Applied Special Technology (http://www.cast.org/publications/ncac/index.html).

The emphasis that universal design for learning places on curriculum accessibility is in agreement with the growing demand for SLPs to deliver functional, classroom-based interventions (see Norris, 1997 for discussion). That is, a universally designed curriculum focuses on providing learning supports to students across all academic subjects throughout the school day. Thus, this approach to intervention arguably is both ecologically valid and intensive. Although empirical evaluation is required to validate this claim, the results of Gillam et al. (2005) suggest that such investigation is warranted. Specifically, these researchers found that the intensity of services, whether delivered by a computer or a clinician, was an important factor in treatment outcome. Also of importance to SLPs is the emphasis that universal design for learning places on front-end planning. Rather than focusing on modifying the language demands of the curriculum on a case-by-case basis, SLPs could become much more involved in initial development and planning of the curriculum through their district or school curriculum committee. Admittedly, this would require a substantial up-front investment of SLP resources; however, the resources currently devoted to making ad hoc curriculum adaptations would be reduced. The need for SLPs to be more involved in curriculum development has been expressed in the literature (Blosser & Neidecker, 2002; Paul, 2007; Whitmire, 2002), and is consistent with currently defined roles and responsibilities for school-based SLPs (ASHA, 2000).

It is also of note that a universal design approach to curriculum development and instruction has implications for teachers who have the demanding task of meeting the needs of *all* students in their classrooms. As mentioned previously, insufficient teacher resources are one of the challenges to collaboration that have been identified in the literature (Coben et al., 1997). By using tools and strategies that are consistent with the principles of universal design for learning, teachers should be better positioned to customize the curriculum across a wide range of student abilities and learning style preferences, whether those students have an identified developmental disability, are at risk for academic failure, or are developing typically.

In sum, we have suggested that the primary role of the SLP in the universal design for learning approach is at the level of curriculum planning and development (e.g., providing information about the language demands of the curricular content and the processing demands of the instructional methods for presenting that content in the classroom). Importantly, this approach is of potential benefit to children with SLI, DCD, and ADHD because it suggests curricular adaptations that compensate for common limitations at the level of cognitive processing. As such, universal design for learning is a worthy approach to service delivery in the schools; however, it alone cannot address the complete needs of children with SLI, DCD, or ADHD. As stated previously, commonalities among these groups of children suggest a continuum of approaches in which consideration is given to

what may be treated universally, commonly, and selectively. Thus far, we have described the possible benefits of a universal design for learning approach to treating commonalities across SLI, DCD, and ADHD at the cognitive processing level. Now, we will outline how commonalities can inform service delivery by considering what may be treated commonly among just those children with developmental disabilities in language, motor coordination, or attention.

4.2. Common approaches to service delivery

As illustrated in the literature, children with developmental disabilities in language, motor coordination, and attention all experience limitations in functioning at the activity and participation level of the ICF. These social difficulties extend beyond classroom interactions to affect these children's participation in all aspects of school life. Indeed, the literature recognizes that the problems these children face in the social realm are multifaceted and complex (Fujiki et al., 1999; Larkin & Summers, 2004; Stormont, 2001), which in turn suggests that collaborative approaches are important for achieving effective intervention. One particular form of collaboration that may assist teams in designing common treatments for social problems is known as interactive teaming. In this approach, team members provide direct services to students through intervention as well as indirect services through their role as collaborators on the team. The mutual exchange of knowledge and skills among team members is highly valued and is a key component of this approach. In this respect, interactive teaming is similar to the transdisciplinary model of service delivery that figures prominently in the early intervention literature (Woodruff & McGonigel, 1988). That is, professionals are encouraged to share their expertise in ways that transcend disciplinary boundaries when this would best meet the needs of students. Yet interactive teaming is also distinct from a transdisciplinary model of service delivery. Specifically, interactive teaming does not necessitate choosing a single intervention agent to represent the team as is the case in early intervention. Rather, the benefits of interactive teaming are in the team's ability to provide multiple concurrent interventions that are cohesive, and which promote generalization of skills across academic contexts (Thomas, Correa, & Morsink, 2001). The emphasis of interactive teaming on bridging boundaries between disciplines reinforces a point highlighted previously; that is, sharing a conceptual framework and common language is essential for successful collaboration. Accordingly, the ICF framework could facilitate the implementation of an interactive teaming approach by providing the necessary framework for communication and knowledge exchange among team members.

Given the multifaceted nature of the social problems experienced by children with SLI, DCD, and ADHD, a potential advantage of interactive teaming is its emphasis on incorporating multiple perspectives and sources of knowledge into the intervention process. Together, the team can develop a shared set of socially relevant goals. For example, the quality of peer interactions could be addressed by teaching verbal strategies for accessing and participating in peer activities, decreasing negative behavior, and increasing participation in desirable peer activities, such as a group sport like basketball. In this case, the team might include a physical education teacher, occupational therapist (OT), and SLP who would jointly develop an intervention plan. The SLP could identify the

nonverbal behaviors and cues that need to be interpreted during the game and the terminology needed to "talk" to players on the floor (e.g., how to call out plays or identify the open player on the court). The physical education teacher or OT could contribute by identifying the specific skills and knowledge the students would need to play the game. Once the shared goals and a common venue for intervention have been established, the team would take joint responsibility for implementing the intervention program and monitoring progress. The SLP may begin by identifying the language demands of the game for the other professionals, and developing verbal routines and cues for the student players. In a small-group intervention setting, she could introduce these verbal behaviors directly to the students and serve as a model for her colleagues. Further implementation might be carried out by the teacher or OT with the SLP returning to monitor progress and suggest revisions as needed. By devising shared goals and a common intervention, the team can maximize the use of their resources while potentially minimizing overlaps or gaps in services that occur when service providers function independently rather than as a coordinated unit (Giangreco, 2000). Undoubtedly, this would require a substantial up-front investment of the team's resources. Much like the front-end loading of universal design for learning, the benefits of interactive teaming may be realized over the long term in its effectiveness and efficiency. Owing to the flexibility of this approach, the particular professionals involved in the implementation of the intervention could change over time as the students' needs evolve. Presumably the advantage of adopting this approach would be realized in the team's ability to provide intervention that is comprehensive and integrated, with the potential for synergistic outcomes. However, validation of such benefits would have to be verified through a program evaluation.

4.3. Selective approaches to service delivery

Both universal design for learning and interactive teaming are consistent with collaborative practices that aim to provide comprehensive services to all students with developmental disabilities. Further, if SLI is indeed a disorder with multiple facets then it is important that these children receive the comprehensive services they need to address the full range of their disabilities. This does not mean that SLPs, or any other professional, need become a 'generalist provider.' It is fully recognized that children with SLI exhibit language-based deficits that will not have been fully addressed by either the universal or the common approaches to service delivery (e.g., limitations in production of complex syntax and word finding problems; Paul, 2007). Techniques for treating these types of deficits in a school setting are familiar to SLPs and have been described elsewhere (see Paul, 2007). We embrace these techniques and delivery modes in the "selective" approach in our proposed continuum and suggest how even these specialized services can be informed by a better understanding of the commonalities that children with SLI share with those who have related diagnoses, as well as by involvement in the collaborative process.

For instance, professionals who are aware of the full range of disabilities that occur in children with SLI, DCD, and ADHD may be more likely to make appropriate referrals to their colleagues. Additionally, the knowledge and skills that are shared during the collaborative process may shape what is done selectively in intervention. For example, the expertise that SLPs provide about the language demands of classroom instruction can

heighten school counsellors' awareness of the language complexity of the social scripts used in social skills training programs. This, in turn, can lead to additional collaboration between SLPs and school counsellors to modify the language demands of these scripts. Alternatively, the strategies OTs use to lessen the motor demands of handwriting for children with DCD (e.g., keyboarding) also can prove useful to SLPs who wish to target production of written narratives without adding to the complexity of the task by requiring a handwritten response. Thus, the selective services we envision incorporate both widely accepted treatment practices familiar to SLPs and encourage professionals to consider how the knowledge, strategies, and techniques of others can inform their own practice. The potential enhancements that could arise from such cross-discipline fertilization would seem to warrant efforts in this direction. It is this very notion that is at the core of contemporary interprofessional initiatives (Health Canada, 2006).

5. Summary

In this paper, we contemplate the benefits of considering SLI from a broader perspective, particularly as it relates to developing a coherent and more in-depth approach to collaborative service delivery. The argument that SLI should be viewed as a broader disorder involving more than impairment in language is based partly on frequent reports of comorbidity among developmental disabilities in language, motor coordination, and attention, as well as by accumulating evidence that children with SLI are at significant risk for poor long-term outcomes. More specifically, we suggest how knowledge of commonalities across three frequently co-occurring developmental disorders - SLI, DCD, and ADHD - can be used to inform collaborative service delivery within an educational context. We also propose that the WHO's ICF can serve as an organizational framework to describe these commonalities and capture the full range of abilities and disabilities that characterize children with SLI. A review of the literature illustrates that commonalities among SLI, DCD, and ADHD exist at multiple levels. For example, compromised cognitive processing abilities reflect shared features at the level of body functions and structures while vulnerabilities in academic and social functioning reflect commonalities in activities and participation. In addition to providing an organizational structure for observed commonalities, the ICF supports the collaborative process by providing the common language and conceptual framework that is necessary for successful cross-disciplinary communication. Furthermore, knowledge of those characteristics that are common across developmental disabilities in language, motor coordination, and attention has implications for the way that services are delivered. Specifically, a continuum of approaches is described in which interventions that can be applied universally, commonly, and selectively are combined with the intent of enhancing collaborative service delivery.

Following from the concept of universality that is embraced in the ICF, the hallmark feature of the universal design for learning approach is accommodating variation in human functioning. Thus, an emphasis is placed on creating educational tools and learning environments that are flexible and which can meet the needs of all students. The goal is to build flexibility into the curriculum at the outset thereby optimizing student learning and minimizing the need for ad-hoc accommodations. Over time, this may lead to more effective collaboration and more efficient use of professional resources, a possible benefit that would require verification through program evaluation. Moreover, the limitations in cognitive processing that are common across children with SLI, DCD, and ADHD can be addressed through the kinds of curricular and instructional adaptations that are suggested by this approach. In addition to approaches that can be applied universally, there are also approaches that may be applied commonly for just those children with SLI, DCD, or ADHD. Specifically, the social participation problems reported in all three groups of children seem particularly well suited to a collaborative approach to service delivery given their multifaceted nature. Interactive teaming is one particular form of collaboration that may facilitate the design and implementation of such common treatments because of its emphasis on mutually shared goals. Finally, approaches that are applied selectively focus on the aspects of particular disorders that are unlikely to have been addressed by the two previously discussed approaches. For instance, SLPs may selectively treat certain linguistic deficits that are uniquely associated with SLI whereas OTs may selectively treat certain fine motor deficits that are uniquely associated with DCD. In other words, it is not only recognized that specialized services are an essential component of effective service delivery, we have incorporated them within our proposed continuum of service. However, even these specialized services can be informed by the mutual exchange of knowledge and skills that occurs during the collaborative process. Together, these approaches to service delivery may reduce barriers to effective collaboration, while also offering a continuum of services for students that has the potential to be comprehensive, cohesive, and synergistic.

6. Conclusion

When children with SLI are viewed from a broader perspective, the breadth of their problems in areas beyond language functioning becomes increasingly evident. Indeed, the literature reviewed here indicates that children with SLI are at risk for having additional developmental problems, two of which are motor coordination and attention deficits. Moreover, children with SLI are known to be at risk for academic and social difficulties, both of which seriously compromise their quality of life. As Johnston (1999) notes, if SLI is considered a more pervasive problem then SLPs may be better positioned to advocate for more resources to provide services to these children. In her paper, Johnston logically evaluated the costs and benefits of viewing SLI as a broader disorder involving cognitive deficits. Faced with the uncertainty of the current evidence base, she concluded that the short-term costs of providing additional services to children with SLI in the school years are outweighed by the potential long-term costs to the children, their families, and society if their disorder is inadequately treated and persists into adulthood. Like Johnston, what we have presented is a reasoned argument for viewing SLI and school-based service delivery in a broader context; however, validation of our position will require empirical investigation.

If children with SLI are to receive comprehensive services, how might this be achieved? At the outset of this paper, we noted that professional services necessarily converge when children with SLI enter school and their combined deficits significantly compromise academic functioning. This suggests that collaborative service delivery may be well positioned to address the full range of deficits associated with SLI and its related disabilities. Two key components of effective collaboration include establishing a common language and shared framework. The World Health Organization's ICF provides a conceptual framework that can facilitate collaboration and cross-discipline communication. Moreover, the ICF can be used to organize coherently the broad array of disabilities that are associated with SLI, including those that are unique to SLI and those that are common across different developmental disorders. With this organizational framework in place, SLPs and other members of the school-based team may be better positioned to mobilize professional resources. Specifically, the framework presented here suggests a continuum of approaches in which consideration is given to what features of SLI and its associated disabilities can be treated universally, what features can be treated commonly, and what features must be treated selectively. By proposing this framework for collaborative school-based service delivery, we raise the possibility for partnerships between researchers, clinicians, and policy makers to empirically validate these ideas, and in so doing, contribute to the evidentiary base in clinical practice.

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