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RESEARCH REPORT

What is in a name: Taxonomy of speech sound disorders from a cross-linguistic perspective

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Abstract

Background: In response to the call for papers under the theme "What is in a name" proposed by the Scientific Child Speech Committee of the International Association of Communication Sciences and Disorders (IALP), the current paper discusses taxonomy and its relation to speech sound disorders (SSD) from a cross-linguistic perspective.

Aims: This paper starts with a brief description of specific SSD frameworks and nomenclature.

Methods & Procedures: The authors draw from international theoretical and clinical research which underscore the importance of taxonomy systems in SSD.

Outcomes & Results: The current papers stresses the importance of the contribution to differential diagnosis and prognosis of children with protracted speech profiles on the bases of taxonomy profiles and systems for SSD.

Conclusions & Implications: The advantages and shortcomings of taxonomy in SSD are also discussed from a cross-linguistic context. The language of focus includes the Greek dialectal variation of Cypriot-Greek.

KEYWORDS
articulation, disorder, speech and language therapists

WHAT THIS PAPER ADDS

The paper adds to the importance of taxonomy and SSD subsystems which allow differential diagnosis of SSD and the implementation of appropriate intervention methods.

What is already known on this subject

- The use of various taxonomy systems regarding SSD are widely available for English-speaking populations. Such systems in the cross-linguistic framework remain underexplored.

What this paper adds to existing knowledge

- The paper underscores the need for the development, adaptation and use of taxonomy systems that will add to the existing databases and taxonomy subsystems used in English

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

- Potential clinical implications include the development and implementation of taxonomy systems in profile SSD productions in children.

INTRODUCTION

Taxonomy is a compound noun derived from the Greek 'taksi' = arrangement and 'nomos' = law, and it is defined as a system for naming and categorizing things into ordered subgroups and/or categories (*Merriam-Webster's Collegiate Dictionary*, 1999). In the context of commu sciences and disorders with a particular reference to speech sound disorders (SSDs), taxonomy is concerned with describing and defining distinct subcategories according to speech output symptomatology and/or aetiology. SSD is considered one of the most frequent paediatric communication disorders, constituting a significant proportion of the caseloads serviced by speech–language pathologists (SLPs) (Baker & McLeod, 2011; Bowen, 2015; McLeod et al., 2017; Mullen & Schooling, 2010). Despite variability across studies, the incidence and prevalence of SSD in school-age children is estimated to range from 3% to 16%, with figures reaching 40% in the presence of concomitant communication impairments such as developmental language disorder (DLD) (Broomfield & Dodd, 2004; Eadie et al., 2015; Shriberg et al., 1999; Wren et al., 2016). Consequently, SSD as a highly prevalent paediatric disorder warrants early identification and timely intervention, particularly during a significant developmental age period at which phonological acceleration and normalization may occur (Shriberget al., 1994). The literature points out to a number of negative long term-term outcomes of SSD on related language and learning skills, including, phonological awareness skills, literacy development, academic skills, wellbeing, social skills and employment (McCormack & McLeod, 2011; Wren et al., 2016).

Consequently, the profiling of SSDs into distinct categories through the process of differential diagnosis is of utmost importance because it informs evidence-based practice and permits the selection of the appropriate intervention approach. Moreover, a detailed and clearer understanding of the types of errors exhibited by preschoolers with SSD allows clinicians and researchers to form predictions regarding long-term speech and language outcomes (Dodd, 2014; Wren et al., 2016). A key observation to emerge is that preschoolers with atypical speech errors are more likely to present with phonological challenges that persist into the school years (Morgan et al., 2017).

A BRIEF HISTORICAL OVERVIEW OF TAXONOMY IN SSD

During the early years of the field of speech and language pathology–therapy all speech errors were grouped under the overarching themes of 'articulation disorder' and 'speech correction practices' which focused mainly on the type of speech errors and therapy practices for the correction of articulation errors in the form of deletions, substitutions and distortions (Van Riper & Emerick, 1984). It was not until the 1970s when the term 'phonology' surfaced which was mainly concerned with underlying representations and psycholinguistic underpinnings of multiple error patterns exhibited by children with SSD. The theoretical and research interphase of the fields of linguistics and psychology formed the springboard for the development of a new branch of psychology, namely, psycholinguistics, which focuses on the interactions between brain processes and language learning, including typical and atypical aspects of linguistic faculty (for a review, see Berko-Gleason, & Ratner, 1998). The interplay between the theoretical understanding of articulation, phonology and underlying deficits led to the development of variable taxonomies to differentially diagnose SSD. Specifically, a psycholinguistic framework may attempt to explain phonological processing challenges in the form of weak underlying phonological representations accounting for the speech error profiles observed (Stackhouse & Wells, 1997).

Historically, intervention paradigms related to SSD have shifted from treating isolated speech sound errors to approaches remediating multiple phonological processes (for an overview, see Bowen, 2015). Contemporary thinking suggests that articulation and phonological disorders can coexist. The distinction between speech production errors and speech errors associated with phonological processing problems (e.g., underlying representation issues) underscored the need for the description and subgrouping of speech error types according to phonological phenotypes evident in children with SSD. The literature indicates that targeted intervention to match the diagnosed subgroup of SSD yields the best intervention outcomes (e.g., Crosbie et al., 2005), therefore, use of a taxonomy is important.

A growing body of literature has suggested the implementation of different taxonomies with the aim to describe, identify and categorize the diverse speech error phenotypes (observable characteristics), exhibited by children with SSD (for a detailed review, see Bowen, 2015; Waring & Knight, 2013). Taxonomy refers to the science of classification. The three predominant taxonomies consider aetiology, symptomatology, and speech processing. The various taxonomies are reflective of the differing theoretical views on SSD and no single taxonomy is adopted globally by all clinicians and researchers (Waring & Knight, 2013).

The *Speech Disorders Classification System* (Shriberg et al., 2019) is a taxonomy that has been evolving since 1993 and includes four levels: distal causes (etiological processes), proximal causes (speech processes), behavioural phenotypes (clinical typology), and criterial signs of the phenotypes (diagnostic markers). For the latest description of this taxonomy, see Shriberg et al. (2019). The *Psycholinguistic Framework* (Stackhouse & Wells, 1997) considers input, lexical representations and output and aims to identify where the breakdown is occurring for individual children and how this is affecting their speech. It could be argued that this is not a classification system as it does not group children together but looks at each child's individual profile. The *Model for Differential Diagnosis* (Dodd & Gillon, 1995) is based on behavioural descriptions of speech error types and underlying processing profiles for each subgroup. The subgroups include articulation disorder, phonological delay, consistent phonological disorder, inconsistent phonological disorder and childhood apraxia of speech (CAS). One underlying processing difference between the subgroups is their phonological awareness (e.g., Holm et al., 2008; for a summary, see Waring & Knight, 2013). Table 1 presents a brief description of the five-subtype taxonomy of SSDs system (Dodd, 2005).

There are similarities between the three classification systems discussed by Waring and Knight (2013: 38) and 'the challenge ahead is to construct an inclusive, universally agreed-upon classification system that meets the needs of clinicians and researchers'.

THE IMPORTANCE OF TAXONOMY

It is acknowledged in the literature that children with SSDs are a heterogeneous group; differences include, age of referral, varying severities, aetiology, speech characteristics, comorbidities and intervention responsiveness (Dodd, 2014; Waring & Knight, 2013). Given that children with SSD comprise a heterogeneous group, grouping such groups into clinically validated subcategories allows for more precision in terms of differential diagnosis, prognosis and targeted intervention. Along these lines, differential diagnosis informs the most suitable therapy approach which can result in the optimum treatment outcomes (Baker & McLeod, 2011; Dodd et al., 2014). In the absence of differential diagnosis vis-à-vis a 'taxonomized' SSD subgroup, an appropriate intervention approach may not be selected. An intervention should be selected to match the diagnosed subgroup; children respond differently to different interventions due to differences in underlying processing that underly each subgroup of SSD (Crosbie et al., 2005).

The selection of an intervention approach that is not the most appropriate for a particular client raises ethical issues and concerns about inefficient use of resources, including, funding and time (the clinician's, client's and family's time) (Law & McKean, 2019). If an intervention approach selected is not the best fit for the client's presenting difficulties this can also result in a longer period of time for the disorder to be remediated which prolongs the possible negative short- and long-term effects of SSD. Furthermore, a culmination of these possible issues can impact on the reputation of the individual SLP, their employer and the SLP profession.

Empirically, the implementation of a taxonomy system can be used as a speech therapy 'intervention progress compass' in the sense that pre-treatment error profiles can be compared to post-therapy findings, thus contributing to practice-based evidence (Dodd, 2014). Furthermore, a taxonomy can be used in epidemiological research to identify risk factors and determine possible trajectories of children with SSD. Specifically, Dodd et al. (2014) and Morgan et al. (2017) revealed that speech error types at age 4 years form a robust prognostic factor for persistent SSD at age 7 years. Converging evidence suggests that speech type errors (e.g., inconsistent phonological patterns) form a statistically robust predictive factor in the sense that children with inconsistent/atypical phonological profiles at age 4 years are more likely to present with chronic phonologi-

TABLE 1 Speech sound disorder subtypes.

Subtype	Description
1. Articulation disorder	A difficulty with the motor coordination of speech muscles, leading to imprecise or inaccurate production of speech sounds in the form of substitutions, omissions, distortions and/or additions
2. Delayed phonological acquisition	Typical but delayed phonological profiles
3. Atypical phonological disorder consistent	Atypical phonological profiles with consistent error sound productions
4. Atypical phonological disorder inconsistent	Atypical phonological profiles with inconsistent sound productions
5. Child apraxia of speech (CAS)	Neurologically based motor speech disorder where the precise movements necessary for speech are impaired, resulting in difficulty planning and coordinating the movements needed for speech

Source: Dodd (2005).

cal challenges at age 7 years (Morgan et al., 2017; Petinou & Okalidou, 2006). Moreover, the subgrouping of children with SSD could support decision-making management in service prioritization either for individual providers or to support government policy development about the distribution of public healthcare funds. Use of a taxonomy provides SLPs with data that they can use to advocate and lobby the government for funding for their clients because different subtypes within the taxonomy may have different prognoses and could be useful evidence for prioritization of funds. In accordance with the aforementioned, a well-defined SSD taxonomy system: (1) allows the implementation of a more 'personalized' intervention plan; (2) forms the basis for the prediction of outcomes with or without intervention; and (3) supports decision making in prioritization of individuals on waiting lists (McAllister et al., 2011; Shriberg, Gruber & Kwiatkowski, 1994; Zipoli & Kennedy, 2005).

CROSS-LINGUISTIC APPLICATION OF TAXONOMIES

Although the majority of assessments to assess SSD are published in English (Grech et al., 2022), it is important that research and allocation of public funds for research in assessment and differential diagnosis of SSD considers children who speak languages other than English. This includes monolingual and multilingual children who speak languages other than English and children who speak non-standard varieties or dialects of languages. All children deserve the best evidence-based management of their SSD, regardless of where they live or what language they speak.

McLeod and Verdon (2017) have published a tutorial with some guidelines for SLPs who work with children who do not speak the same language as them, which is increasingly important in the multilingual communities that we live and work in. Although assessments of speech development in other languages are being created (a list of published assessments in a variety of languages is available on the Multilingual Children's Speech website; https://www.csu.edu.au/research/multilingual-speech/speech-assessments), research on the application of taxonomies to the speech of children with SSD who speak languages other than English is less common in the literature.

Dodd's Subgroups of Speech Disorder is one taxonomy that has been researched in different languages. A review of studies that applied this taxonomy in different languages found that children with SSD were classified in similar proportions in the different subgroups cross-linguistically (Ttofari Eecen et al., 2018). For example, the subgroup 'phonological delay' has been found in approximately 50% of the children with SSD in each of the studies reviewed in Australian English, British English, Cantonese, German and Putonghua (Standard Mandarin of Mainland China), with proportions between 43.0% and 57.5% reported (for a list of the cross-linguistic studies mentioned, see Ttofari Eecen et al., 2018). This body of literature supports Dodd's taxonomy, its validity and suitability to be used in multiple languages, and also suggests that similar processing deficits may underlie each subgroup of SSD, regardless of which language is spoken (Ttofari Eecen et al., 2018). Similarities across languages of the proportions of Dodd's subgroups of speech disorder may support the assertion that the types of speech errors observed are indicative of underlying deficits in processing (Crosbie et al., 2005). This is regardless of languages spoken. Whilst each language has specific characteristics, universal grammar posits that there are rules that pertain to all languages (Fromkin et al., 2015).

Furthermore, research with bilingual children (Cantonese–English and Italian–English) has found

that the children had the same characteristics of error patterns in both languages (Dodd et al., 1997; Holm & Dodd, 1999). For example, in the Holm and Dodd (1999) study with Italian–English children, the first child had inconsistency in both languages and the second child demonstrated phonological delay in both languages. The distribution of error patterns for children in both bilingual groups discussed above supports the assertion that similar deficits may underlie the phonological systems of subgroups of SSD, independent of the language spoken (Holm & Dodd, 1999) and that the same interventions that are efficacious with English speakers with SSD may also be suitable for speakers of other languages and/or multilingual speakers. For example, core vocabulary therapy may be a suitable intervention to use with children who have inconsistent speech disorder, whether they speak Australian English, Cantonese or Cypriot-Greek (CG) because the underlying deficit of inconsistency in all these children's systems responds to the same intervention. In understudied languages and dialects (e.g., modern Greek and its dialectal variation of CG) the importance of taxonomies warrants detailed investigation. The application of a given SSD taxonomy system to specific languages necessitates the creation of databases from groups of children with typical and protracted phonological systems and mapping phonetic, phonological and prosodic patterns across different ages/developmental stages. A corpus of SSD data from a given language/dialect group will allow the profiling and distribution of error types to be able to map onto specific taxonomy types. Today, such endeavours remain a challenge both from research and clinical perspectives in understudied dialects such as CG.

THE CYPRIOT-GREEK DIALECT

Cyprus is an island situated in the Eastern Mediterranean Sea. CG is spoken by the Grecophone population of Cyprus and is classified as a South-Eastern dialect of Standard Modern Greek (SMG) (Mackridge, 1985; Newton, 1972). The Greek-speaking population in Cyprus is diglossic in the sense that CG is the vernacular form (low variety) used in everyday communication, whereas SMG (as the high variety) is used in educational settings, government bodies and the media. Recent reports propose the emergence of a dialectical continuum of CG with an emerging 'Koine' or 'urban' form of CG (Tsiplakou et al., 2006). Children in Cyprus are typically exposed to SMG from an early age (e.g., television, internet) and during the early years of schooling (around 3;0–6;0 years of age) (Petinou & Armostis, 2016). According to Rowe and Grohmann (2013), CG-speaking children can be considered as 'discrete bilectal' rather than bilingual speakers of the two varieties, in the sense that speakers can be fluent in both distinct varieties (SMG and CG) but keep them as separate and do not mix features from one language/dialect to the other.

CG contains 19 phones and 31 phonemes (Armosti, 2011; Arvaniti, 2010; Petinou & Theodorou, 2016), including plosives, fricatives, affricates, nasals, laterals and rhotics in word-initial and word-internal positions. Many consonantal segments have geminate (long) realizations, most of which contrast with their singleton (short) counterparts: for example, [l] as in [ˈmila] 'talk' versus [l:] as in [ˈmil:a] 'fat'. The gemination contrast in the case of CG voiceless stops and affricate segments is realized by an aspiration contrast, such as that geminates are produced with aspiration, while singletons are realized as unaspirated: for example, [ˈkato] → 'down' and [ˈkatʰ:os] → 'cat' with voiced stops surfacing as pre-nasalized such as [kuˈᵐbin] 'button' versus [kuˈpin] 'paddle' a significant aspect which differentiates meaning of minimal pair words (Okalidou et al., 2010).

THE STATUS OF TAXONOMIES OF SSDs IN CYPRUS

The profession of SLP in Cyprus is fairly new as it emerged during the early 1990s. Over the last five years there has been an influx of newly graduated SLPs. There are approximately 800 registered SLPs in Cyprus according to the Cyprus Association of Registered Speech and Language Pathologists, established in 1990 (www.speechtherapy.org.cy) and the Cyprus Council of Registered Speech Pathologists established in 2005 (info@strc.org.cy). This creates a significant diversity in the educational and clinical training background of SLPs working in Cyprus with this issue affecting the homogeneity of assessment protocols, use of taxonomies and interpretation of clinical findings including SSD (Theodorou et al., 2022). Despite collective efforts in the development of protocols and checklists through common projects by international consortia (e.g., the European Union's COST Action IS1406 Enhancing Oral Skills in Children Across Europe), in Cyprus the scarcity of standardized speech and language assessment continues to pose a challenge thus creating heterogeneity and lack of uniformity in the interpretation of assessment findings. Each SLP, depending on his/her clinical training expertise and experience, relies on his/her own materials/testing manuals to assess the child. Such tools include single-word probes, usually depicted on pictures. In other cases, SLPs assess phonological skills with the use of phonological assessment batteries standardized in SMG adapted to conform to segmental characteristics (e.g., inclusion of affricate segments and geminate sounds) of CG variety. Speech-error profiles are analysed for

articulation errors (deletions, distortions, omission of segments) and in some cases, for phonological status (phonological process occurrences) (Petinou & Armostis, 2016; Theodorou et al., 2022).

Homogeneity of protocol implementation for assessing and profiling SSD, including using taxonomies, is of paramount importance because it can secure a standardized manner of assessment, enabling SLPs to perform reliable comparisons of results across diverse clinical profiles. Along these lines, the adoption of a 'common clinical code' (Law & McKean, 2019; Theodorou et al., 2022) helps to minimize variability and contributes to increasing reliability and validity of assessment results. To that end, a common framework of evaluation and interpretation of results can be achieved by establishing common criteria and procedures in SSD assessment. Ultimately, shared knowledge and homogeneity of protocols is essential for shared knowledge and homogeneity of protocols is important for research purposes, that is, to research whether interventions are being effective. The implementation of common research-based assessment tools and protocols among the professionals awaits further exploration.

Despite the lack of a nationwide prevalence database on communication disorders in Cyprus, a recent report published by the Educational Psychology Service sector of the Cyprus Ministry of Education & Culture (2016) revelled that during the period 2015–16 approximately 200 children were diagnosed with 'speech production problems', 'phonological problems' and 'problems in receptive and expressive communication'. Although reports on specific prevalence data are of merit, presentation of numeric figures as a group in the absence of a taxonomy-based system, masks issues related to co-morbidity of speech and/or language disorders and different subgroups. This is an issue because different interventions are required for the different subgroups of children with communication difficulties (for further discussion, see Theodorou et al., 2022). Overall, research data based on reports from SLP practitioners in Cyprus, revealed that the heterogeneity of assessment protocols used in combination with elusive policy implementation necessitate the need for adopting internationally based research and clinical protocols and taxonomies (in this case SSD) (Theodorou et al., 2019). Research on the application of taxonomies to different languages and dialects is warranted to identify which principles are cross-linguistic and which are language specific. As per Cyprus context, the need to act drastically and timely is of paramount importance, as of 2023 the government is currently operating and developing the country's first national health system, which claims comprehensive health care for everyone.

DISCUSSION

Communication disorders can affect any individual regardless of age, linguistic, social, and cultural background. As an umbrella term, SSD describes speech output challenges characterized by motor, articulatory, segmental, and suprasegmental production and perception limitations affecting individuals across the globe (Bernhardt & Stemberger, 2017; Bowen, 2015; Bernthal et al., 2013; McLeod & Goldstein, 2012; McLeod & Verdon, 2017). SSD constitute one of the most frequent communication deficits, especially in young children and involve a marked percentage of a clinician's caseload (Baker & McLeod, 2011; Petinou & Theodorou, 2019). Detailed systematic assessment and analysis is warranted for differential diagnosis, leading to targeted intervention. Furthermore, research on prognosis of SSD subgroups with and without intervention is needed.

'What is in a name' as the overarching theme of the current work will continue to challenge researchers and clinicians in the years to come. This is especially true given the linguistic diversity and multiculturalism unfolding across the globe, as the influx of immigrants and refugees increases (Grech, 2019). Now more than ever, SLPs across the world should capitalize on resources related to SSD in their effort to provide best and accurate services to vulnerable populations including children with SSD. Researchers and practitioner SLPs are encouraged to work collaboratively to gather evidence on the application of existing frameworks and practices in cross-linguistic contexts, to encourage practice-based evidence and evidence-based practice. With this in mind, the current paper acknowledges the challenges relevant to such issues and echoes the need for rigorous implementation of taxonomies in order to answer the question 'What's in a name?' Along these lines, cross-linguistic investigations of protracted phonological development have underlined the importance of taxonomy in the sense that different properties respective to a given language (e.g., inflections, morphophonology, prosodic, segmental variables) warrant careful consideration in goal setting and stimuli construction that will stem from differential diagnosis profiles on the bases of a taxonomy system (Bernhardt & Stemberger, 2017). Funding for research of the application of taxonomies in minority languages and dialects is called upon, with researchers using culturally responsive measures and processes. Research in the application of taxonomies of SSD to non-English speaking children is called for, in particular relevance for this paper to CG speaking children. The authors are in the process of collecting data on single case studies of children with SSD who speak CG. SLP clinicians in Cyprus are encouraged to consider the application of current

taxonomies of SSD to children with SSD on their caseloads. Researchers in Cyprus are encouraged to consider studying the application of the taxonomies with greater numbers of children. The dialogue of the application of this taxonomy between clinicians and researchers is one step towards promoting evidence-based practice in the SLP profession in Cyprus when working with CG speakers with SSD. This thematic volume and all issues raised, corroborate towards the need for launching national campaigns with a main goal to raise awareness for all stakeholders, including, health and education professionals, policy makers, and families in order to receive the relevant information about SSD. On a final note, consistency of terminology to be used in different settings and across variable types of SSD is important to improve communication between relevant stakeholders.

CONFLICT OF INTEREST STATEMENT

The authors report no conflict of interest.

DATA AVAILABILITY STATEMENT

The current paper is not associated with raw data.

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