6th International Conference on Software Development and Technologies for Enhancing Accessibility and Fighting Infoexclusion (DSAI 2015)

Need and Perspectives of Internet-based interventions for common specific language disorders and connected specific learning disabilities in childhood and Youth

F. Haverkamp[1,2], Y. Mohamad[3]1

[1] University of aplied science Bochum,2 Children`s Hospital University of Bonn
[3] Fraunhofer Institute for Applied Information Technology (FIT) Fraunhoferinstitute St. Augustin

Abstract

In the last century medical progress has substantially reduced the morbidity and mortality in somatic diseases. However there is a "new morbidity" with an increase of psychomotor developmental, learning, behavioral and mental disorders often with an initial onset in about 20% of childhood. A social gradient in terms of health inequalities is known. Reducing this new morbidity of child and adolescent health problems is a major public health priority. In this context alternative, complementary strategies for prevention or treatment are needed.
At the example of expressive language disorder and consecutive risks in developing a specific reading and writing disability we would like to discuss in this survey potential future preventional perspectives.

Keywords: Internet-based interventions; language disorder; diagnosis; reading disability; writing disability; literacy

1. Introduction

The term New Morbidity refers to the increase of specific chronic diseases like obesity and diabetes but also for psychomotor developmental, behavior and learning disorders or – disabilities in childhood and adolescence like reading and writing disability. Many diseases and developmental problems were also influenced by unhealthy lifestyles and unhealthy socioecological environments occurring especially in families living in poverty, mostly associated with lower educational status. This social gradient for health and education has been also described as social health inequality as the result of many various effects like limited access to health services and educational institutions, sedentary life style etc. [15]. For children living in poverty it is known that early adverse circumstances were strongly associated with lower cognitive ability in childhood and adolescence. These were detectable on measures of verbal ability, memory, speed and concentration in midlife. There is empirical evidence that these long term intergenerational effects were mostly explained by the effects of adversity on childhood or adolescent cognitive development or by differences in educational attainment and adult social class [29]. The complex confounding etiology of biological and non-biological effects on child`s health and development refers to corresponding individual and structural partially new strategies for prevention [9].

1.1. Relevance of educational system on child health and psychomotor development

With respect to the early onset of behavioral and psychomotor developmental disorders in childhood the educational system like kindergarten or school are important elements of activities aimed to promote childhood

* Corresponding author. Tel.: +49-2241-14-2846; fax: +49-2241-14-2846.
E-mail address: med-3-concept@t-online.de; yehya.mohamad@fit.fraunhofer.de

mental and neurocognitive health especially concerning language, speech as well as literacy development in general but especially for families living in poverty [30].

Probably due to their often associated migrational background [38] the native language competence in the respective descendants especially those living in poverty is often limited whereas simultaneously the prevalence of language disorders often connected with specific learning disabilities in this subgroup is increased.

1.2. Connectivity of Language disorder and Specific Reading and Writing Learning Disability

Research indicates developmental interactions between language impairments and difficulties acquiring literacy skills, the development of memory skills and more general nonverbal abilities throughout middle childhood, adolescence and beyond [633]. Still more broadly, children with language difficulties are at risk of less successful developmental and educational outcomes. There is evidence that children growing up with language impairment experience greater difficulties in social interaction than do typical children and adolescents [12]. These children are more vulnerable to academic failure, social exclusion, behavioral and emotional difficulties, and to being bullied [833, 15].

Learning language is thus one of the key developmental tasks facing children in the preschool years [16]. Preschool children who develop specific language impairment (SLI) are usually characterized by having language difficulties from the outset of the language-learning process. Instead of reaching developmental language milestones on schedule (first words around a child's first birthday, word combinations around the child's second birthday), children with SLI are slow from the beginning.

Children with expressive SLI have more difficulty with talking (producing words, also referred to as expressive language) than with understanding what is said to them (comprehending language, also referred to as receptive language).

SLI is much more prevalent than other developmental functions, estimates vary between 3 % and 7 % depending on definitions and statistical criteria employed [31]. Males appear to be more affected than females. There is strong evidence that SLI runs in families. The majority of children with SLI have a family history of language difficulties, with a first degree relative usually affected. The contribution of genetic factors is most clearly indicated in twin studies, where identical twins have a much higher concordance for SLI than non-identical twins [2].

Until recently, SLI was thought to be a disorder of childhood. Follow-up studies into later childhood and adolescence have revealed that although some appear to "grow out of it", for a significant proportion of children this disorder is persistent (approximately 3 % of adolescents experience SLI) [38]. Those children who appear to "grow out of it" tend to have good comprehension abilities, but even this group of "resolved" children can experience language-related and other information processing difficulties like reading and writing in later childhood [8]. Children with SLI have a high risk to develop a variant of specific learning disability e.g. reading and writing disability which in turn affects negatively academic achievement [20]. Prevalence is between 5-15% in school children. SLI forms one of the largest groups of young people with special needs that professionals are likely to encounter.

Early language intervention with preschool children has the potential to change the developmental course of their language difficulties and improve long-term language but also reading and writing outcomes.

There are both theoretical and practical issues to bear in mind here. Language use, for the most part and certainly in the preschool years, involves interacting with others: hence, it is a joint product, not a solely individual one [36]. The quantity and quality of a child's language performances will vary according to interactional contexts depending on level of familiarity, mood and the environment. This may be particularly pertinent when assessing children from socially disadvantaged backgrounds or shy children, whose language performance may be especially inhibited in unfamiliar settings. Another important consideration facing assessors in many communities is that the child (and/or his or her linguistic environment) may not be monolingual [10]. Comprehensive assessment and contextualized interpretation is needed; a model that takes a sociocultural perspective. This approach provides a more sensitive framework for taking into consideration cultural and linguistic diversity by encompassing not only norm-referenced and criterion- reference measures but also dynamic assessment.

1.3. Need for Assessing Different Dimensions of the Language System

Language is a complex system comprised of a number of dimensions or components that enable an individual to communicate effectively. These include phonology (the sound system), the lexicon (vocabulary), semantics (meaning), grammar (structure), pragmatics (communicative functions and conventions for language use), and discourse (the integration of utterances into longer stretches of conversation or narrative). Language is also a dynamic system whereby different components work together and change throughout development. There is evidence, for example, that early lexical development and grammatical development are highly correlated in

typically developing children [1, 11, 34]. There are also findings from children with language problems suggesting that difficulties with a dimension of language can have cascading effects on other components of language. For example, it is known that delays in lexical acquisition can affect the development of grammar in late talkers and children with SLI [26]. In the auditory modality, this deficit has been hypothesized to interfere with accurate speech perception, and subsequently disrupt the development of phonological and later reading and spelling skills. (Modelling relations between sensory processing, speech perception, orthographic and phonological ability, and literacy achievement. [3].

Thus, the assessment of preschool children's language skills requires that the various dimensions of the language system are considered in constructing a profile of the child's abilities. Measures of a single language dimension are inadequate in ascertaining the nature of a child's difficulties and they are less reliable the younger the child, which is of particular concern in the preschool period [35].

1.4. The Complex Relationship Between Native (English) Proficiency And Academic Achievement

Finally, it is important to note that, although adequate proficiency in the respective native language is seen generally as an important prerequisite to academic success and thus an important aim for early intervention. But the relationship between English proficiency and academic achievement is complex. English Language Learner (ELL) children from families with high socioeconomic status can perform academically as well as, if not better than, native English speakers from lower socioeconomic backgrounds [19]. Children from more advantaged economic backgrounds gained proficiency faster than their less advantaged peers. More studies are needed to take into account multiple predictors of the respective native language proficiency and academic outcomes. They can help to unpack the complex relationship between native language proficiency and child adjustment. Such research is needed in order to better inform public policy and educational policy and practice to advance English language learners' future success 14].

1.5. Overcoming Barriers to Parental Involvement in Educational system Among ELL Families

Among others the following measures were described in literature to overcome barriers to parental involvement in educational systems among ELL families:

- Kindergarten and Schools need to design policies and practices that will effectively engage parents of ELL children [17]. Some of the biggest challenges to engaging families of ELL children include the lack of bilingual staff, differences in communication styles, and differences in the school's and families' expectations about children's development and learning [4]. There is evidence that kindergarten and schools would be wise to think broadly about the many factors that may pose difficulties for parental involvement, including the obvious language barrier. The capacity to communicate with linguistically diverse families is clearly a critical part of engaging families [18]. However, kindergarten and schools need to do more than send notes home in the home language. Better alignment between parents' and educators' expectations with regard to the role of home and school in supporting children's educational development also seems important. In general, we need to know much more about both perceived and real barriers to school involvement among families of ELL children.
- There is empirical evidence that school-age children found in bilingual programs learned English faster than children who attended programs where English was the only instructional language [21]. Being in a bilingual program also helped these children progress academically because they were able to master the academic content in a language that they understood.
- There is also some suggestive evidence that bilingual children may not only perform better academically than their peers educated in English-only environments, but they may also benefit from staying connected to their native culture and may be able to communicate with a much larger number of people [13]
- For future research would investigate the effects of bilingual programs (both early care and education programs and elementary school programs) on long-term outcomes for ELL students. Some work in this area has begun, but more research is needed.

2. Conclusions and Perspectives

As native language competence in kindergarten is an important predictor of later academic achievement e.g. adequate reading and writing abilities, the need for early prevention is evident. Standalone computer software especially web based systems are widely used to support literacy learning for children in school age. While relatively few systems are available for young children aged under seven years using Information and Communication Technology (ICT), there is a growing recognition of the impact of ICT on children's lives, particularly from the USA [27]. Studies indicated [22], that computer can be used as a tool to support learning,

and assist communication, collaboration, creativity and language development in young children. First telehealth studies on children`s literacy provide evidence for the potential use in diagnostic processes [37].

Thus the issue is not, whether technology should be considered and used in early childhood education settings, but how and whether it makes a difference in promoting children's learning and development [28].

According to aforementioned literature an interventional system consisting of different informing, diagnostic and promoting components was proposed (see Fig. 1). The characteristics and demands to this system are related to promotion of language and literacy development e.g. reading and writing. This system should provide a localized user interface to different user groups, to affected children, parents, nursery nurse as well as for teachers. The user interface should be able to show the exercises and all interaction elements in different languages, social and cultural contexts. E.g. the parents should be able to follow the progress of their child in their mother tongue but the teacher will get the same information in the countries language.
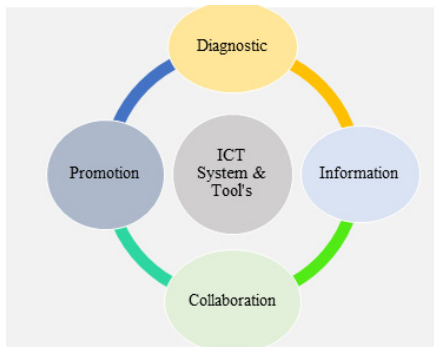

Fig. 1: Interventional System for Language and Literacy

The main components of the proposed system are:
A) Information: Theoretical Knowledge of disabled and not disabled children
  - language development
  - Learning of reading and writing
B) Diagnostic: Comprehensive tools
  - Individual status of language development
  - Reading and writing skills
  - Including all the respective subcomponents
C) Promotion: individual promoting exercises and scenarios (see Fig. 2)
  - Individual promotion based on a dynamic user profile with learning progress and diagnostic results
  - Parental language of origin, here we propose to localize the system to as many languages as possible
  - Family social and educational background
D) Collaboration: collaboration tools between peers of children, teachers and parents (see Fig. 2)
  - Communication between teachers and parents with different language support
  - Communication between peers of children with different language support
  - Support for parents to follow up the performance of their children in their language of origin

There is substantial evidence that IT Approaches support somatic and mental health in adults and adolescents [32].

On the confounding background with the known social gradient for health and education in children often additionally influenced by parental migrational origin the need for a comprehensive approach is evident. Not least to high costs for personal staff the complementary use for IT based promotion is declaratory. Internet interventions so far are developed around theoretically grounded concepts and offer prospects in improving health and developmental outcome. Alternatively children and adolescents may be more likely to respond to alternative delivery strategies such as IT based video or games. The implementation of such a system will utilize recent concepts in the area of computer based training. Virtual environments such as training simulators and video games do an impressive job at modeling the physical dynamics but fall short when modeling the social dynamics of its users. Yet the social dimension is at least as important as graphics for creating and engaging and effective training tools.

Fig. 2 shows the proposed promotion environment with its different components, in the middle the individualized learning collaborative environment, which is based on a user profile with all user preferences. The localized web interface supports the immediate multiple language support of its users from different origin and with different native languages, cultural background and social contexts.
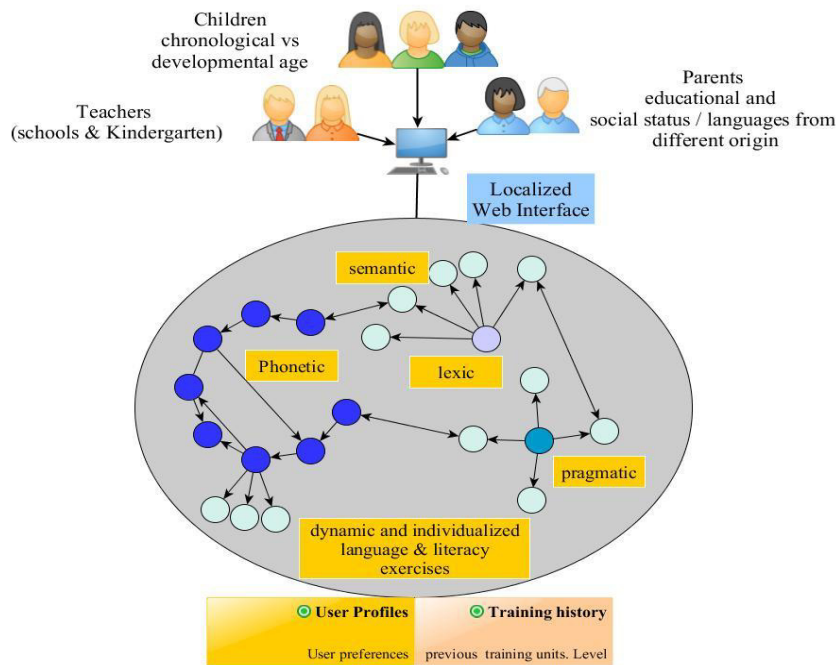

Fig. 2: Overview of the collaborative promotion environment

The authors have implemented a framework in a prototype, considering the aforementioned social context with the following components [24, 25]:

E) Pedagogical interface agents [23]
F) A story played in an animated world, where the training units are encapsulated into it
G) Emotional monitoring and response components

The prototype has the following characteristics:

H) Task/goal orientation
I) Context awareness
J) Personality
K) Time & synchronization.

The proposed system will bring many features and advantages to its users:

a) Telemedicine to connect families with therapist and other experts
b) Complex assessment of language and literacy skills (see Fig. 2)
c) Professional Information about normal and disturbed language and literacy development
d) Removal of former barriers in the educational system
e) Neurocognitive language and literacy training programs for

References

1. Bassano D, Laaha S, Maillochon I. & Dressler WU.Early acquisition of verb grammar and lexical development: Evidence from periphrastic constructions in French and Austrian German. First Language 2004; 24:33–70.
2. Bishop DV. The role of genes in the etiology of specific language impairment. J Commun Disord 2002;35:311-28.
3. Boets B, Wouters J, van Wieringen A, De Smedt B, Ghesquière P. Modelling relations between sensory processing, speech perception, orthographic and phonological ability, and literacy achievement. Brain Lang 2008;106:29-40.
4. Castro, D., Ayankoya, B., & Kasprzak, C. New voices, nuevas voces: guide to cultural & linguistic diversity in early childhood. Baltimore, MD: Paul H. Brookes. 2011
5. Catts HW, Fey ME, Tomblin JB, Zhang X. A longitudinal investigation of reading outcomes in children with language impairments. J Speech Lang Hear Res 2002;45:1142-57.
6. Conti-Ramsden G, Botting N. Classification of children with specific language impairment: longitudinal considerations. J Speech Lang Hear Res 1999;42:1195-204.

7.　Conti-Ramsden G, Durkin K. Phonological short-term memory, language and literacy: developmental relationships in early adolescence in young people with SLI. J Child Psychol Psychiatry 2007; 48:47-56.

8.　Conti-Ramsden G, Durkin K, Simkin Z, Knox E. Specific language impairment and school outcomes. I: identifying and explaining variability at the end of compulsory education. Int J Lang Commun Disord 2009;44:15-35.

9.　Coker TR, Thomas T, Chung, J. Does Well-Child Care have a Future in Pediatrics? Pediatrics, 2013;131, Suppl. 2, 149-159.

10.　Crutchley A, Botting N, Conti-Ramsden G. Bilingualism and specific language impairment in children attending language units. Eur J Disord Commun 1997;32:267-76.

11.　Dionne G, Tremblay R, Boivin M, Laplante D, Pérusse D. Physical aggression and expressive vocabulary in 19-month-old twins. Dev Psychol 2003;39:261-73.

12.　Durkin K, Conti-Ramsden G. Language, social behavior, and the quality of friendships in adolescents with and without a history of specific language impairment. Child Dev 2007;78:1441-57.

13.　Golash-Boza, T. Assessing the Advantages of Bilingualism for the Children of Immigrants. International Migration Review 2005; 39:721–753

14.　Halle T, Hair E, Wandner L, McNamara M, Chien N. Predictors and Outcomes of Early vs. Later English Language Proficiency Among English Language Learners. Early Child Res Q 2012;27:1-20.

15.　Haverkamp F. Krankheitsprävention und soziale Lebenslage In: Hoefert HG & Klotter C, editors, Krankheitsprävention in der Kontroverse Pabst Science 2014; 386-401

16.　Haverkamp, F. Früherkennung und Förderung von schulischen Vorläuferfähigkeiten zur Verbesserung der schulischen Partizipation von Kindern aus armen und bildungsfernen Familien: Zur Bedeutung der auditiven Wahrnehmung In: Balz HJ, Benz B. & Kuhlmann C. editors, Soziale Inklusion: Grundlagen, Strategien und Projekte in der Sozialen Arbeit.. Wiesbaden (VS) 2012; 259-266.

17.　Hernandez AE, Hofmann J, Kotz SA. Age of acquisition modulates neural activity for both regular and irregular syntactic functions. Neuroimage 2007;36:912-23.MacSwan J, PrayL, . Learning English Bilingually: Age of Onset of Exposure and Rate of Acquisition. Bilingual Research Journal; Fall 2005; 29, 3; Research Library p. 653

18.　Kagan SL, Garcia BE. Educating culturally and linguistically diverse pre schoolers: Moving the agenda. Early Childhood Research Quarterly 1991; 6: 427-;43.

19.　Krashen S, Brown CL The Ameliorating Effects of High Socioeconomic Status: A Secondary Analysis Bilingual Research Journal: The Journal of the National Association for Bilingual Education 2005;29:185-196

20.　Lagae L. Learning disabilities:definitions, epidemiology, diagnosis and intervention strategies. Pediatr Clin North Am 2008;55:1259-68

21.　MacSwan, J, Pray, L.(2005): Learning English Bilingually: Age of Onset of Exposure and Rate of Acquisition Among English Language Learners in a Bilingual Education Program. Bilingual Research Journal 2005; 29:653-678.

22.　McCarrick, K., & Li, X. (2007). Buried Treasure: The Impact of Computer Use on Young Children's Social, Cognitive, Language Development and Motivation. AACE Journal, 15, 73-95.

23.　Mohamad Y., Tebarth H. (2001). Evaluation in the Development of a tele-medical Training System. Universal Access in HCI: Towards an Information Society for All. Volume 3 of the Proceedings of HCI International 2001. New Orleans: Lawrence Erlbaum Associates

24.　Mohamad Y., Hammer S., Haverkamp F., Nöker M., Tebarth H.: Evaluational Study: Training with Animated Pedagogical Agents. ICCHP 2002: 117-124

25.　Mohamad, Y. (2005). Integration von Emotionaler Intelligenz in Interface Agenten am Beispiel einer Trainingssoftware für lernbehinderte Kinder. [Integration of Emotional Intelligence in Interface Agents: The example of a Training Software for Learning-Disabled Children.]: Shaker; ISBN-10: 3832244638, ISBN-13: 978-3832244637

26.　.Moyle J, Stokes SF, Klee T. Early language delay and specific language impairment. Developmental Disabilities Research Reviews 2011; 17:160-169

27.　Nikolopoulou, K. (2014). ICT Integration in Preschool Classes: Examples of Practices in Greece. Creative Education, 5, 402-410. http://dx.doi.org/10.4236/ce.2014.56050

28.　Parette, H., Quesenberry, A., & Blum, C. (2010). Missing the Boat with Technology Usage in Early Childhood Settings: A 21st Century View of Developmentally Appropriate Practice. Early Childhood Education Journal, 37, 335-343. http://dx.doi.org/10.1007/s10643-009-0352-x

29.　Richards M, Wadsworth ME. Long term effects of early adversity on cognitive function. Arch Dis Child 2004;89:922-7.

30.　Rones M, Hoagwood K. School-based mental health services: a research review. Clin Child Fam Psychol Rev. 2000;3:223-41.

31.　Tomblin JB, Records NL, Buckwalter P, Zhang X, Smith E, O'Brien M. Prevalence of specific language impairment in kindergarten children.J Speech Lang Hear Res 1997; 40:1245-1260.

32.　Siemer CP, Fogel J, Van Voorhees BW. Telemental Health and Web-based Applications in Children and Adolescents. Child Adolesc Psychiatr Clin N Am 2011;20:135-153

33.　St Clair MC, Pickles A, Durkin K, Conti-Ramsden G. A longitudinal study of behavioral, emotional and social difficulties in individuals with a history of specific language impairment (SLI). J Commun Disord 2011;44:186-99

34.　Szagun G. Learning by ear: on the acquisition of case and gender marking by German-speaking children with normal hearing and with cochlear implants. J Child Lang 2004;31:1-30

35.　Thal, D., & Katch, J. Predicaments in early identification of specific language impairment: does the early bird always catch the worm? In K. Cole, P. Dale, & D. Thal (Eds.), Assessment of communication and language Baltimore: Paul H. Brookes 1996. p. 1-28

36.　Thorpe K. Twin children's language development. Early Hum Dev 2006;82:387-95.

37.　Waite MC, Theeodoros DG, Russell TG, Cahill LM. Assessment of children`s literacy via an internet – based telehealth system. Telemed J E health 2010; 16:564-575

38.　Whitehouse EA. Line HJ. Bishop DVP. Qualitative aspects of developmental language impairment relate to language and literacy outcome in adulthood . NT J Lang Comm Dis 2009 ; 44: 489–510

39.　Yu SM, Lin SC. Adirim T. Selected Health Status Measures of Children from US Immigrant Families. ISRN Pediatrics 2013, 1-7.