BILINGUAL CURRICULUM MATERIALS SUPPORTING SIGNED LANGUAGE AS A FIRST LANGUAGE FOR DEAF STUDENTS:
The integration of technology, learning and teaching

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Abstract: Considering Deaf children and adults as bilingual - their first language is a Signed Language (SL) and the second language is learned via print - provides professionals with a paradigm to be used for creating better learning opportunities. In this paper, Greek Sign Language ((G)SL)) [4] as a first language (L1) is the base language we use to present certain bilingual methodological teaching and learning considerations. This work is the result of a long journey from the initial thinking of the American Sign Language Curriculum and its influence on the development of the (G)SL curriculum in Greece. The paper offers discussion of innovative educational multimedia material that are easily accessed via online web portals, developed for teaching (G)SL as an L1 to pre-school and primary school Deaf children. In this work, SL as L1 is a resource that fully enables Deaf children to learn an L2 via print, supporting their bilingual acquisition capabilities. In developing curricula and supporting materials, we consider two important foundational components: Deaf native signers and near native signers as language role models for Deaf children, parents and teachers; and the development and interaction with digital educational materials. Thus, collaboration between educational and technology professionals and members of the Deaf community is critical. This bilingual model can be incorporated into any SL. (G)SL is used as a model to display innovative practices merging SL (L1), print (L2), technology and creative instructional and assessment materials, maximized by understanding the visual nature of SL and its advantages for school learning. The penultimate goal is Deaf students to become successful bilingual learners to fully function in the world today and tomorrow.

Keywords: Signed Language as first language. Signed Language curriculum. Signed Language learning. Bilingual Deaf teaching material. Deaf Signed Language role models.

MATERIAIS CURRICULARES BILÍNGUES QUE APOIAM A LÍNGUA DE SINAIS COMO PRIMEIRA LÍNGUA PARA ALUNOS SURDOS:
A integração da tecnologia, aprendizagem e ensino

Resumo: Considerar as crianças e adultos Surdos como bilíngues - sua primeira língua é a Língua de Sinais (SL) e a segunda língua é aprendida via escrita - fornece aos profissionais um paradigma a ser utilizado para criar melhores oportunidades de aprendizagem. Neste artigo, a Língua de Sinais Grega ((G)SL)) como primeira língua (L1) é a língua base que usamos para apresentar algumas considerações metodológicas de ensino e aprendizagem bilíngues. Este trabalho é o resultado de uma longa jornada

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[4] In this paper, we will use (G)SL to indicate that we are discussing Greek Signed Language but content and technology can be used for any SL.

desde o pensamento inicial do Currículo de Língua de Sinais Americana e sua influência no desenvolvimento do currículo de (G)SL na Grécia. O artigo discute materiais multimídia educacionais inovadores que são facilmente acessados por meio de portais online, desenvolvidos para o ensino de (G)SL como L1 para crianças Surdas da pré-escola e do ensino fundamental. Neste trabalho, a LS como L1 é um recurso que permite que crianças Surdas aprendam uma L2 via escrita, apoiando suas capacidades de aquisição bilíngue. Ao desenvolver currículos e materiais de apoio, consideramos dois componentes fundamentais importantes: a importância de sinalizadores nativos Surdos e quase nativos como modelos linguisticos para crianças Surdas, seus pais e professores; e o desenvolvimento e interação com materiais educativos digitais. Assim, é fundamental a colaboração entre profissionais de educação e tecnologia e membros da comunidade Surda. Este modelo bilingue pode ser incorporado em qualquer LS. A (G)SL é usada como um modelo para exibir práticas inovadoras mesclando a LS (L1), escrita (L2), tecnologia e materiais criativos de instrução e avaliação, maximizados pela compreensão da natureza visual da LS e suas vantagens para o aprendizado escolar. O penúltimo objetivo é que os alunos Surdos se tornem aprendizes bilíngues bem-sucedidos que possam funcionar plenamente no mundo de hoje e de amanhã.

Palavras-chave: Língua de Sinais como primeira língua. Currículo de Língua de Sinais. Aprendizagem de Línguas de Sinais. Material didático para Surdos bilíngues. Modelos de Língua de Sinais Surdos.

MATERIALES DEL CURRÍCULO BILINGÜE QUE APOYAN EL LENGUA DE SEÑAS COMO PRIMERA LENGUA PARA ESTUDIANTES SORDOS: La integración de la tecnología, el aprendizaje y la enseñanza

Resumen: Considerar a los niños y adultos Sordos como bilingües, su primer idioma es la lengua de señas (LS) y su segundo idioma se aprende a través de la escrita, brinda a los profesionales un paradigma para crear mejores oportunidades de aprendizaje. En este artículo, la lengua de señas griega ((G)SL) como primera lengua (L1) es la lengua base que utilizamos para presentar algunas consideraciones metodológicas de la enseñanza y el aprendizaje bilingües. Este trabajo es el resultado de un largo viaje desde el pensamiento inicial del Currículo de Lengua de Señas Americana y su influencia en el desarrollo del currículo de (G)SL en Grecia. El artículo analiza materiales multimedia educativos innovadores a los que se puede acceder fácilmente a través de portales en línea, diseñados para enseñar la (G)SL como L1 a niños Sordos en edad preescolar y primaria. En este trabajo, la LS como L1 es un recurso que permite a los niños Sordos aprender una L2 a través de la escrita, apoyando su adquisición de habilidades bilingües. En el desarrollo de currículos y materiales de apoyo, consideramos dos componentes fundamentales importantes: la importancia de los usuarios de señas nativos sordos y casi nativos como modelos de lengua para los niños Sordos, sus padres y maestros; y el desarrollo e interacción con materiales educativos digitales. Por lo tanto, la colaboración entre los profesionales de la educación y la tecnología y los miembros de la comunidad Sorda es fundamental. Este modelo bilingüe se puede incorporar a cualquier LS. La (G)SL) se utiliza como modelo para mostrar prácticas innovadoras que fusionan la LS (L1), escrita (L2), tecnología y materiales creativos de instrucción y evaluación, maximizado por la comprensión de la naturaleza visual de LS y sus beneficios para el aprendizaje escolar. El penúltimo objetivo es que los estudiantes Sordos se conviertan en aprendices bilingües exitosos que puedan funcionar plenamente en el mundo de hoy y de mañana.

Palabras clave: Lengua de Señas como primera lengua. Currículo de Lengua de Señas. Aprendizaje de Lengua de Señas. Material didáctico para personas sordas bilingües. Modelos de Lengua de Señas para sordos.

Introduction

Consensus has emerged that learning a Signed Language (SL) is essential for Deaf[5] children to thrive and reach their full potential as intellectual and social beings. However, research is lacking on how to teach them a SL as a first language (L1), a lack that affects current educational systems to implement efficient instruction and to take advantage of the latest technology for enhancing classroom learning (see KOMESAROFF, 2003; 2008 for underlying reasons). Viewing SL as a resource (NOVER, 1995; NOVER, RUIZ, 1994), increases opportunities to ensure Deaf children's academic success. Moreover, viewing them as *bilingual* students opens the doors for considerable change and innovation in learning techniques (BAKER, WRIGHT, 2017), for educators to consider the impact of two languages at school: SL, the natural language of the Deaf community; and spoken language via print, the dominant language of the major community.

Our intent is to present ideas that integrate SL, print, and technology to enhance Deaf children's learning language and content. In doing so, this paper recognizes that SL is their L1, and that they should be viewed as bilingual. Acknowledging SL as an L1 impacts how we view the *teaching of language* to them. As with Hearing children, when we discuss the teaching of an L1, what we really mean is teaching *about* language. Hearing curricula is focused on learning *about* the language, because all Hearing students are expected to arrive at school with an L1 intact. Most Deaf students have difficulty in accessing a language auditorily; in engaging in comprehensible interactions; and have little access to peers, conditions that restrict their opportunities to acquire an L1. Having a fluent, usable and interactive language is critical to their school success. Thus, viewing them as bilinguals means that classroom teachers can recruit and rely on their L1 to facilitate their academic success.

Historically, curricula for Deaf children were based on adapting, adjusting, and mirroring the language approach of the Hearing children's curricula. Such a dominant approach resulted in restricting language instruction to spoken language and in the dumbing down of the teaching of a language and the learning of content (LANE, HOFFMEISTER, BAHAN, 1996). Moreover, it limited the availability of curricula with SL as the L1 for Deaf students. With this

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[5] We use *Deaf* to refer to all deaf and hard of hearing individuals whose hearing loss significantly impacts their daily living. We use *Hearing* to refer to everyone who is not Deaf as a cultural distinction.

in mind, we endeavored to develop a curriculum for the bilingual teaching of (G)SL as L1.

Principles for teaching SL as an L1

In achieving academic success, the curriculum for the teaching of SL as an L1 should use the following core principles:

1. Providing an accessible model of SL for its learning as the L1.
2. Providing a format that permits discussing language as a content subject, similar to the one we teach *about* spoken languages (to Hearing students) in school.
3. Providing a mechanism that allows SL to be accessed similar to accessing print. Print has the virtue of permanency, minimises working memory demands, and allows review at a later time.
4. Providing a format for SL that can be handled, saved, edited, and commented upon.
5. Providing a model of SL for learning content subjects (math, science, etc.).

The bilingual teaching of languages for Deaf students involves two major foundational understandings: (1) establishing an environment where the language is to be acquired; and (2) establishing an environment where SL instruction involves teaching *about* SL. In Deaf education, such understanding is not yet clearly elucidated and the primacy of spoken language has led to considering the Deaf child as disabled rather than as bilingual. As with any users of two languages, Deaf people can learn the language of the minority (Deaf) community and the language of the majority (Hearing) community (LADD, 2003). As Deaf bilinguals, their first language is a SL.

In the teaching of any language as an L1, a major goal is to support the development of pupils' language skills in the SL of the classroom and the language of the community (via print) (HOFFMEISTER, CALDWELL-HARRIS, 2014; KOURBETIS, KARIPI 2021; QUADROS, HOFFMEISTER, 2020). We acknowledge that many Deaf children (but not all) arrive at school language deprived (see HENNER, ROBINSON, 2021). In these cases, schooling must create an environment in which learning a SL is necessary prior to learning *about* a SL. The language acquisition goal is separate from the typical 'teaching about language' goal of schools. First, Deaf children must acquire a SL and then gain knowledge *about* it. The educational goal is to be able to use their native language to gain knowledge of the school subjects, including

language.

Greek Signed Language Curriculum

The initial work on the development of a Greek Signed Language Curriculum ((G)SL) began in 1996, when Kourbetis was the Director of the National Institute of the Deaf (NID), working with five residential schools for the Deaf in Greece. Teachers intermittently used SL for general communication purposes with the Deaf students but rarely used SL for classroom instruction. As is typical across the world, students learned (G)SL from older students during recess, during free time, in the dormitories and from a few Deaf adults working as support personnel in the school. Initially, there was only one Deaf teacher working in all five schools.

The need to develop a (G)SL curriculum was apparent but not widely supported by the teachers or the Ministry of Education. In 2000, the status of (G)SL was recognized as a legal language in Greece for educational purposes. When this change occurred, Kourbetis began reviewing available curriculum for SL as an L1 in the world. The results were not encouraging.

In the early 2000's, Hoffmeister with his team at Boston University began working on curriculum development for ASL as L1[6] (HOFFMEISTER, GREENWALD, CZUBEK, DIPERRI, 2003). Due to the long lasting relationship with these authors, a collaboration was established to examine the possibility of using principles of (A)SL as an L1 in the US curriculum in a GSL curriculum.

A first task was to examine the national Greek spoken language curriculum so as to understand its bilingual instruction methodologies. A second one was to gather what little research on the grammatical components of (G)SL existed at the time, although a great deal of information was known on (A)SL and other European SLs. To meet these challenges, a team was established consisting of Greek and American SL specialists, Greek language curriculum developers, linguists working on spoken and SLs, Greek Deaf native signers with experience teaching GSL as an L2 to adults, and Greek Deaf native and near native signers with experience teaching Deaf children.

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[6] For more recent work on ASL we recommend the bilingual curriculum developed by Czubek and Di Perri (2017), which offers an extended in depth approach to teaching Deaf children under the framework of ASL as an L1 and English as an L2.

The Deaf native signers proved to be the most valuable members of the team. The team examined the required grammatical components for instructing ASL as the L1 and translated these ideas into a (G)SL language curriculum. The team then collaborated with the Athens School for the Deaf to implement the new (G)SL as an L1 curriculum. During this implementation period, the team reworked the draft materials to become more formal and standardised, which would be used to support the Hearing teachers working with Deaf children across Greece.

Following this development, the Greek Pedagogical Institute published the first GSL as an L1 curriculum in 2004, which constituted the first multimedia educational material in GSL. The initial research and development resulted in two educational projects[7], identifying solid, cohesive and successful pedagogical practices for Deaf children to learn the grammatical structures of (G)SL as an L1, and creating materials supporting the learning of Greek (print) as an L2. As of now, six countries have established teaching SL as an L1 as a goal. These are Norway, Nigeria, Germany, France, Finland and, as of late by law, Greece[5] (KOURBETIS, 2019).

Signed Languages and Information and Communication Technologies

Since SL does not have an agreed written form, video technology is a crucial part of teaching both language and academic content to Deaf children. This accommodation is consistent with the principles of Universal Design for Learning (UDL), which emphasizes how educational environments should be responsive to individual differences to ensure access for all students (ARMSTRONG, 2003; BOOTH, AINSCOW, 2011; IZZO, BAUER, 2015; UNESCO, 2011). Ideally educational systems provide each student with the opportunity to experience positive learning using different methodologies, tools and materials (MACE, HARDIE, PLACE, 1996; TOMLINSON, 2001). Information and Communication Technologies (ICT), combined with the UDL principles, maximise the development of appropriate training materials and learning environments, and promote accessibility and differentiation (SMITH, THRONE, 2007).

For Deaf students, technological solutions enhance learning in all subject areas.

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[7] For the full Report of the survey see: <http://www.sign1st.eu/en/intellectual-output/>.

Technology can facilitate Deaf students' sharing of their needs, opinions, interpersonal interactions, academic knowledge, and world knowledge (BURNETT, 2010; GENTRY, CHINN, MOULTON, 2004; KOURBETIS, 2013; MICH, PIANTA, MANA, 2013). Visual information is central to ICT as well as to Deaf individuals, who comprehend the world, primarily, through vision (BAHAN, 2006, 2008; KOURBETIS, HATZOPOULOU, 2010; LANE, HOFFMEISTER, BAHAN, 1996). Consequently, integrating the principles of ICT with SL, we are able to create optimal learning environments that are visually accessible to Deaf students, bilingual ones in particular, in which they may share learning and instruction advantages similar to the ones Hearing students share.

Due to the low incidence of hearing loss, viewing Deaf children as bilinguals is not a typical framework for professionals working with them. Looking through a Deaf lens alters one's perspective. With technological tools in hand, what is needed is creative thinking. Thus, for example, when thinking about materials to support bilingual teaching, visual materials must include non static presentations that can be viewed, reviewed, and manipulated in various ways. This is similar to options available with print. Appropriate video technology can be costly but it behooves the international field of Deaf educators to support technology that enhances learning. In line with this, we have developed multimedia materials to support SL as an L1 for Deaf primary grade students. With content drawn from the national curriculum used in all Greek schools, these materials support bilingual teaching and learning of (G)SL as an L1; the learning *about* (G)SL; and the learning of Greek as L2 via print. In the remainder of this article we describe these materials that can be easily accessed online.

Multimedia material for GSL as L1

For three decades we invested in developing materials for Deaf children and their Hearing parents to support learning (G)SL as an L1. Our focus has been on video translations of story books required by the National Greek Curriculum, and on interactive video assessments, in (G)SL and Greek print, available to all users via a multimedia library. Projects include the Digital Multimedia Library, the Online Dictionary, the Hybrid books, the Curriculum-based Assessment instruments, and a newly-developed application for testing expressive SL skills. These components are described in the following sections, and are freely accessible to anyone

interested in teaching Deaf students. All content is produced by native signers, providing meaningful input and optimal language models for the majority of Deaf children who have limited access to quality native SL input, as well as for teachers, parents and other professionals.

The Interactive Digital Multimedia Library (DML) platform, drawing on the UDL principles (BLAMIRES, 1999; CAST, 2018), provides a model of archiving, searching and exploring SL content, based on the availability of video technology (signed video screen) that interacts with an online dictionary (see <http://digital-library.sign1st.eu/>). It is an independent platform for the bilingual teaching and learning of SL (L1) and print (L2), containing 354 signed ebooks with written text (KOURBETIS, KARIPI, BOUKOURAS, 2020). This bilingual design allows Deaf students (their parents and teachers) to view and comprehend a (G)SL) story/narrative and its translation in print (Greek) (see <http://multimedia-library.prosvasimo.iep.edu.gr/grid/title>).

Figure 1: The Sign First Digital Library

Source: Sign First <http://digital-library.sign1st.eu/>.
Note: Signed ebooks as they appear in the Digital Library.

Digital Multimedia Library for learning and teaching

All material was vetted in collaboration with Deaf native signers who worked with SL fluent professionals to ensure the quality of the SL presentations. Figure 1 presents examples of individual ebooks that were created for use in schools and at home. The depicted ebook video

frames are similar to the covers found on books in print. The ebooks are selected from the required stories in the Greek National Curriculum, hence parents and teachers are familiar with their themes. Overall, teachers, students and parents can peruse over 40 titles based on their interests.

Figure 2: Playback of educational material with interactive video subtitles
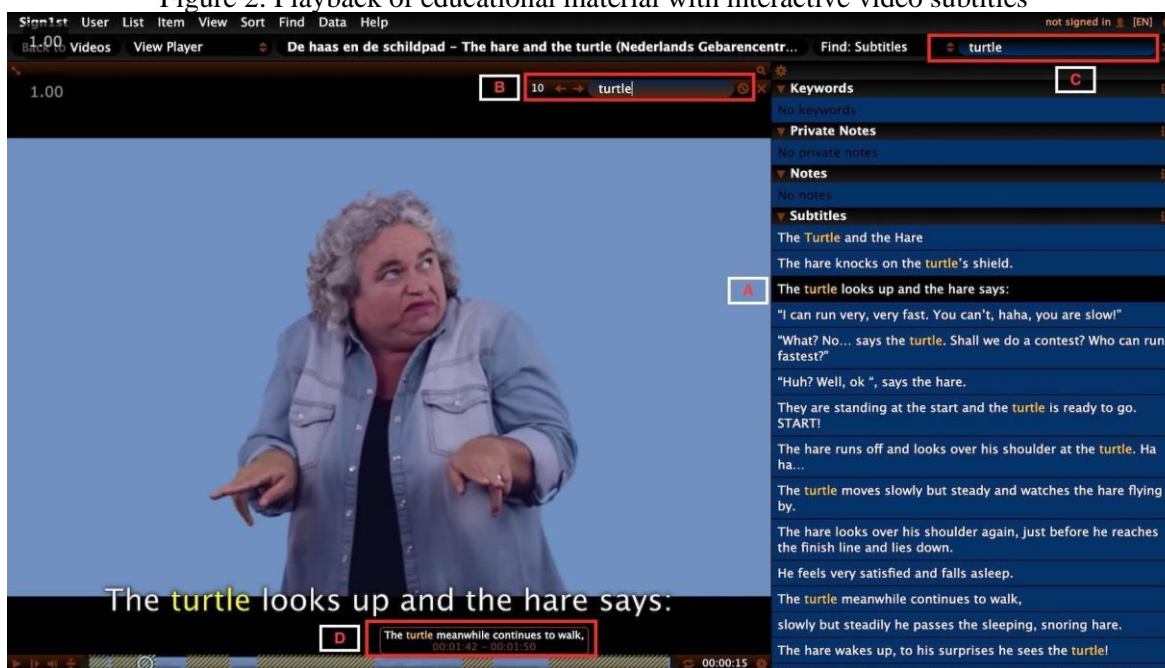
Source: Sign First <http://digital-library.sign1st.eu/>.

A. Browse video using subtitles; B. Search for specific subtitles in the video being played; C. Search for subtitles in all the videos of the platform; D. Presents a timeline highlighted selection.

A large (G)SL corpus of more than forty-four hundred SL videos (the library includes signed segments that range in length from 38 secs to 35 min) has been developed and is available to everyone to support teaching and learning (G)SL and written language (see MOE, WRIGHT, 2013; TUOMI, 2013). The initial focus of such a bilingual component was the depiction of a fluent SL model presenting content that can be manipulated through an interactive process while moving from one language to another. The advantage of this design is that SL stories are able to be viewed from many different vantage points to meet the users' pedagogical needs. For example, when learning Greek, the student can toggle between SL and print to enhance comprehension, or can examine a particular grammatical structure, and return to the SL video to double-check the meaning. Moreover, teachers can select SL and/or print

clips to depict a story sequence, to focus on individual words, phrases or sentences, or to present in an incorrect arrangement to allow students to sort them into the original cohesive story sequence. Hence, each video can be manipulated and used at a later time (e.g., for homework assignments, self evaluation, formal assessment and/or research) and its selected segments (with or without subtitles) can be viewed in its entirety or be identified by a URL address for storage and later recall.

Figure 3: A search for the word/sign COW in the dictionary.

Source: Sign First <http://digital-library.sign1st.eu/>.

Figure 2 presents a SL video in the main window with selectable options; subtitles appear at the bottom of the video; and a sequenced set of subtitles are presented in a separate window to the right, interactive with the SL video. Such interaction allows users to browse the video by selecting/highlighting a range of subtitles; to highlight words and/or phrases within the

subtitles; to obtain and view subtitle content across all videos; to save the selected timeline for later recall; to search for words, signs, phrases in the entire platform; and to view and compare all videos matching the searched word, phrase or sign. This latter *sign* search engine is innovative in Deaf students' language training (BOUKOURAS, GELASTOPOULOU, KOURBETIS, 2014; KOURBETIS, BOUKOURAS, GELASTOPOULOU, 2016). The videos can be downloaded in a WebM format using direct download, and the entire application can be installed for use in schools.

The online SL Dictionary

The online Greek Signed Language Digital Dictionary (SLDD) was developed to support the teaching and learning of (G)SL as an L1. It is the largest available online, open access, interactive dictionary for GSL, containing more than 3,500 signed lexical entries (organised into a taxonomy of signs), plus over 1800 extra phrases and sentences categorised into five types: questions, statements, negation, simple and complex/compound. Overall, it is enriched with content and material that covers the educational needs of elementary education and beyond (KOURBETIS, KARIPI, BOUKOURAS, 2020), including material depicting different signing styles and regional variations (Athens, Thessaloniki, etc.).

At present, the search for Greek words or phrases is completed within a thematic taxonomy (e.g., animals, actions, feelings), using an alphabetic search by subject, grade level, or by scrolling down a list that appears as a result of the search: future planning is to organize it by sign handshape or location (in progress). Furthermore, the dictionary is connected to the digital library, providing students with accessing and learning target signs in meaningful rather than isolated contexts (KOURBETIS, KARIPI, HATZOPOULOU, 2017). An example is given in Figure 3. Searching for the word/sign COW, four different *signs* appear on the right. The sign COW is produced by three[8] native signers, who differ in age and represent regional signing[9]. In addition to the dictionary definition, the search also results in signed stories that contain the target sign.

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[8] In Figure 4, the second and third signer are the same person but with a 20 year age difference.

[9] Think of this variation as possible accent or dialect variation.

Figure 4: Results for Yes or No Question sentence type search.

Τίτλος : "ΑΥΤΙΑ ΜΕΓΑΛΑ, ΜΙΚΡΑ ΤΙ; (Έχει μεγάλα ή μικρά αυτιά;) "	
Κατηγορία : Φράσεις-Προτάσεις	
Τύπος : Ερωτηματική πρόταση	
Περιεχόμενο : Διαζευκτική	
Δομή : -Χωρίς κατηγορία-	
Πηγή : Ι.Ε.Π.	
Project : Sign First	
Copyright : 2018	

Source: Sign First <http://digital-library.sign1st.eu/>.

Search for phrases and sentences

A recent search feature enables the user to view the selected sign/word, phrase or sentence in sentences categorised by *sentence structure* and *sentence type* in both languages. Thus, the users can identify a single word in various sentences containing it. Figure 4 displays a sentence chosen with all its category descriptions (questions, statements, etc.). A category, word or a single sentence is presented in (G)SL (in the window to the right), allowing for direct comparative analysis, among other didactic purposes, in the classroom.

Signing eBooks

A signing ebook is about the creation of a story in SL, focusing on its grammatical components and content, integrating SL with static and moving images via technology. Two types of ebooks have been developed as extensions of the video books discussed above. The first type concerns the creation and development of a student ebook that can be implemented as soon as Deaf student acquires basic conversation in (G)SL; and the second type concerns a *Hybrid Book* (see below). The example depicted in Figure 5, aimed at SL phonology (handshapes) has been developed by teachers, staff and children from the Deaf and Hard of Hearing Argyroupolis Kindergarten, Athens - Greece, in cooperation with the project Sign

First[10]. Students were taught to identify (G)SL handshapes and to produce stories using the target handshapes. A Deaf artist illustrated the pictures (the selected handshapes, the sequence of signs, etc.) (Figure 6) and a Deaf native signer narrated the created story. The signed content also included subtitles to assist those who may not be familiar with SL.

Figure 5: The video version of *A book with…signs*.

Source: Sign First <http://digital-library.sign1st.eu/>.

Figure 6: Illustrated frozen signs and printed version of *A book with…signs*.

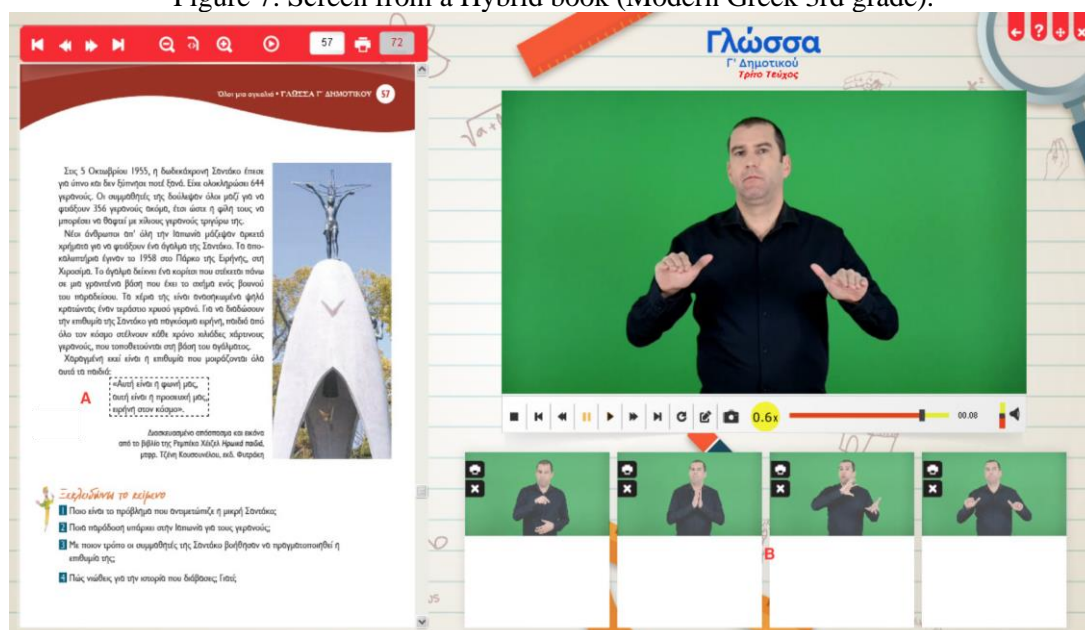Source: Sign First <http://digital-library.sign1st.eu/>.

Obs.: The result is a handshape sequence (e.g., SNAKE CAKE EAT) in frozen forms that the children, their teachers and parents can use to read the story.

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[10] Sign First is an Erasmus+, European Union Programme, for *Teaching European Signed Languages as a First Language*, implemented with partners based in four European countries (Greece, Cyprus, The Netherlands and Switzerland). Visit: http://www.sign1st.eu/en/ .

Hybrid Books

A more comprehensive variation of a signing ebook is known as the *Hybrid Book*[11] (HLADÍK, GŮRA, 2012). Its multimedia form contains two viewer windows. The right window depicts a (G)SL interpretation of a selected (Greek) printed book, which is presented in the left window (Figure 7). Under the SL window are video navigation windows to control the flow of the signing linked to the text (see Interactive Digital Library). These may be also used for printing the sign/word, phrase or sentence by highlighting the text. In addition, voicing of the text by a native speaker may also be integrated. The books included in our Hybrid Books series were also taken from the Greek national curriculum. Thus, videos from the MDL include (G)SL and Greek print of all the required textbooks for the first four grades of elementary school.

Figure 7: Screen from a Hybrid book (Modern Greek 3rd grade).

Source: Sign First <http://digital-library.sign1st.eu/>.

Certain features of the Hybrid Books are of special importance, as they allow Deaf students to control the comprehension of the language under study: controlling the speed of delivery, segmenting the signing, including subtitles, creating frozen frames, and controlling

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[11] The Hybrid Book is used as a model for the creation of educational materials aimed at users with different specificities.

the speed of the (G)SL translation. Some students need to have the signing slowed down and others may wish to speed it up. Also, teachers and students can select segments or view the whole presentation. When viewing the presentation in full screen mode, one can opt to view with or without subtitles. Finally, a unique feature of the Hybrid Books is the ability to take snapshots (still frames/frozen frames) within the signed video. For example, frozen frames can be sequenced to support recall of a sign, a sentence or a story, can be presented alone or with printed text, and can be saved, edited (deleted or moved), or printed for use in tests, homework, presentations among other uses.

As previously mentioned, the interpreting of Greek print to signed texts is conducted in cooperation with experienced Deaf native signers, Deaf tutors and Deaf consultants (all fluent in Greek print) as well as with qualified professional interpreters of (G)SL. We cannot but overemphasize the importance of this collaborative approach to produce high quality and high learnability materials.

Signed Language Assessment

The need for SL measures in schools has been broadly addressed (The Netherlands: HERMANS, KNOORS, VERHOEVEN, 2010; Switzerland: AUDEOUD, HAUG, 2008; Germany: HAUG, 2011; United Kingdom: HERMAN, HOLMES, WOLL, 1999; United States: HOFFMEISTER, NOVOGRODSKY, FISH, BENEDICT, et al., 2013; Greece: KOURBETIS, HATZOPOULOU, 2010). Creating, designing and developing excellent curricula and corresponding materials will be for naught unless we can also assess progress in learning the curriculum content. Methods of assessing the SL of Deaf students has improved in the first two decades of the 21st century (HOFFMEISTER, KUNTZE, FISH, 2013). This section presents a summary of the (G)SL Vocabulary Assessment test (GSLVA), the (G)SL Curriculum Based Signed Language Assessment (CBSLA) (KOURBETIS, KARIPI, BOUKOURAS, 2020), and the American Sign Language Assessment Instrument (ASLAI) (HOFFMEISTER, et. al., 2015; HOFFMEISTER, REIS, 2020).

The Signed Language Vocabulary Assessment Test

The GSLVA[12] is a receptive task with a multiple-choice format that is also available in Dutch and Swiss-German. It is web based (<http://sign1st.eu/diadrastika-test/login.php?logout=true>) and easy to administer, based on the British Sign Language Receptive Test template. There are 35 items overall[13]. The GSLVA should be presented under the same testing conditions each time it is administered. Consistency in test administration ensures that performance comparisons between students and over time are valid and reliable. The multiple-choice format ensures the test results are an objective measure of a student's SL mastery. To implement the test, the administrator assigns a username and password to protect anonymity. The student then fills in the username and password and selects the language version of the test from a drop down menu window. Once an ID is assigned, the teacher/expert enters the student's profile, then may select the student's profile, edit it and/or view results of the individual student's tests. Students' may be added, edited, or deleted within the database.

Once the test administration begins, a screen appears with a short signed video clip (Figure 8). Under the video clip are three static pictures, of which only one corresponds to the target sign. A second picture is a phonological distractor and a third a semantic one, bearing a meaning relationship to the target sign. Students' response is automatically delivered to the database, and the scores are stored in the student database for later teacher perusal. The obtained results determine whether a student is functioning at age level.

The Curriculum Based Signed Language Assessment

The CBSLA is aimed at evaluating comprehension through (G)SL stories and narratives[14] based on Karipi (2015). One aspect of story comprehension is the sequencing of events. Figure 9 presents an example of a format that assesses students' comprehension of story sequence. Two rows of up to eight video clips can be presented in the left window. In the first row, there are seven video clips of a (G)SL story displayed in a random order. Seven video windows in

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[12] This is a test in the data gathering stage to determine reliability, validity and norms. This is an ongoing process and reports will follow.

[13] The SLVA test was produced by Sign First partners (see <http://www.sign1st.eu/en/strategic-partnership/>) and constitutes one of the intellectual outputs of the project.

[14] They are open to all at: <http://www.sign1st.eu/en/assesment-tools/>.

the second row are blank. Students first watch the signed story in the video displayed in the window on the right.

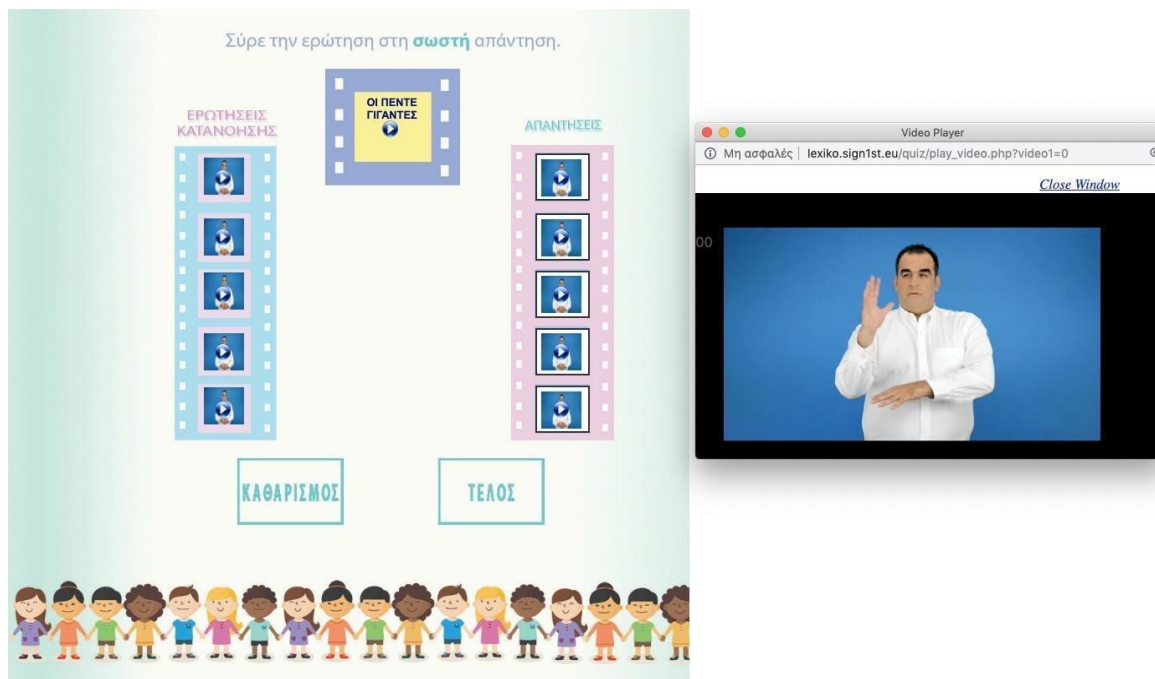Figure 8: Testing screen of the receptive vocabulary assessment
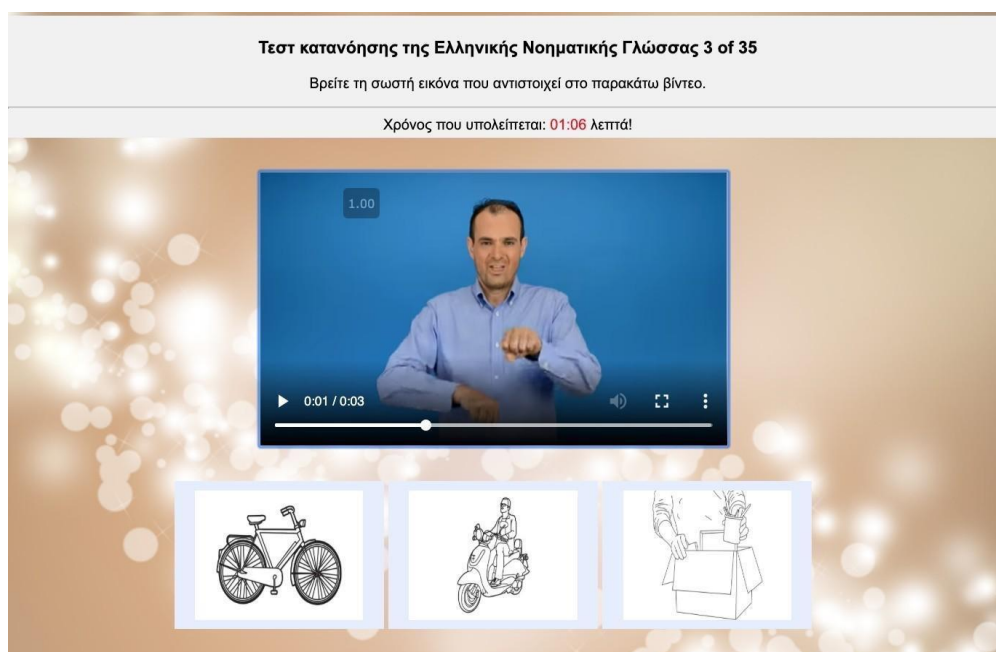
Source: Sign First <http://digital-library.sign1st.eu/>.

Figure 9: Interactive application of SL story comprehension

Source: Sign First <http://digital-library.sign1st.eu/>.

Figure 10: SL video evaluation test matching questions and arranging answers.

Source: Sign First <http://digital-library.sign1st.eu/>.

After students have watched the video of the story, the sequenced clips in the first row are viewed. The students then drag and drop the videos from the first row into the correct sequence to demonstrate understanding of the story. At any point, they can click 'Review' and watch the videos they have sequentially ordered. If the student is not satisfied, she/he can drag and drop the video into another position. When clicking 'Done', the application evaluates student's choices. If the sequencing is correct, a positive message appears; if it is incorrect, the student can rearrange the video windows. Students may view the signed video again to increase success. This process may be repeated until students are able to arrange the correct sequence after a single viewing (of the target video). Another application (see Figure 10) is when students first watch the video of the story and then drag and order the videos to match the signed questions (in the left column) to the signed answers (in the right column).

Overall, this interactive design supports students' memory and comprehension skills through positive reinforcement when the correct choices are made.

American Signed Language Assessment Instrument

The ASLAI has been developed over a period of thirty years[15]. It is a computer based measurement instrument on a platform that presents five windows (see Figure 11) (six windows if the comprehension task is included). Each window presents a question item and four response items, all in ASL. No print is displayed on this assessment. After signing in with a user name and a password to protect privacy, students view a SL overview about the test and how to take the test, followed by explicit instructions prior to each task. Students view each question and select the correct response[16]. Tasks are presented in two formats: 1) ASL sign-to-sign (nine tasks/no pictures) and 2) picture-to-sign (two tasks). Questions and responses consist of single signs, phrases or sentences.

Across each task, and in some cases within a task, items measure level of development for a particular (ASL) linguistic structure. The ASLAI has been developed to determine (ASL) language knowledge and use by Deaf students between the ages of four and eighteen years. There are eleven tasks with 250 test questions providing a comprehensive view of a Deaf student's language knowledge. The tasks include measures of vocabulary extent and depth (e.g., synonyms and antonyms, definitions), simple and complex syntactic knowledge, verbs of motion and location, pluralization and analogical reasoning.

As students complete the ASLAI, their scores are presented on an individual Student Evaluation Report (receptive scores). Reports are available for individual age related task scores, average task scores for a classroom, and/or average scores within a grade level in a specific school. Scores are normed from a national pool of Deaf students in three categories: all Deaf Students, Deaf Students of Deaf Parents, or Deaf Students of Hearing Parents. Within these categories norms are derived from over 2000 students. Some tasks have been revised over time but remain valid and reliable across the previous twenty years (HOFFMEISTER, REIS, 2020).

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[15] The research version was developed at the Center of the Study of Communication and the Deaf at Boston University (HOFFMEISTER, FISH, HENNER, BENEDICT, ROSENBURG, 2015).

[16] The ASLAI is available on the computer with cursor selection or on an ipad with touch selection (HOFFMEISTER, REIS, 2020).

Figure 11: Sample depicting a question and four responses from the ASLAI.
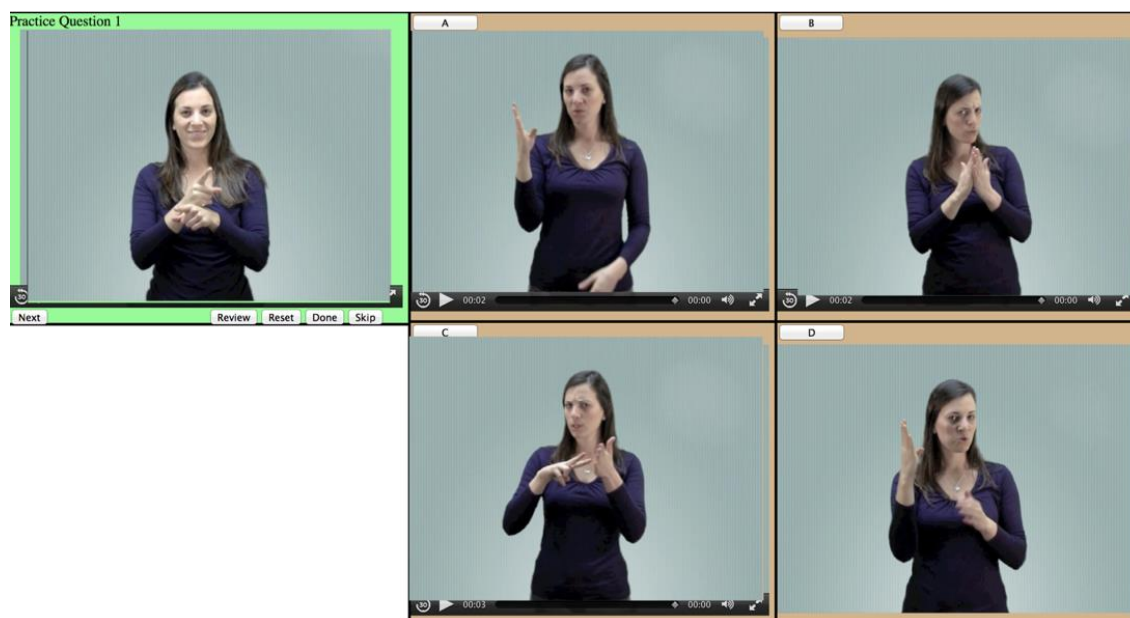
Source: ASLAI, V2.0 (HOFFMEISTER, REIS, 2020).

In sum, ASLAI scores are explained in detail for individual students (national norms) and within their age group (national and within school). Knowledge of ASL in Deaf children facilitates learning of English as measured by reading print (HOFFMEISTER, 2000; HOFFMEISTER, CALDWELL-HARRIS, 2014; HOFFMEISTER, HENNER, CALDWELL-HARRIS, NOVOGRODSKY, 2021; HOFFMEISTER, HENNER, NOVOGRODSKY, CALDWELL-HARRIS, 2021; HRASTINSKI, WILBUR, 2016; KOURBETIS, HATZOPOULOU 2010; NIEDERBERGER, 2008; ORMEL, HERMANS, KNOORS, VERHOEVEN, 2012; WOLL, 1998) and can also identify potential learning problems in Deaf students (HENNER, NOVOGRODSKY, REIS, HOFFMEISTER, 2018).

Best Practices of SL Instruction

We have identified some of the best practices for teaching SL as an L1 to Deaf students, based on visual language strategies with particular socio-linguistic and cultural conditions in use by the Deaf community:

1. Systematic exposure must occur within a natural language acquisition process (input).

2. Instruction in learning SL as an L1 must be clearly separated from the learning *about* the grammatical components of the SL (acquiring vs. learning *about* the language).

3. Students need frequent exposure in the target language in and out of the classroom (modeling).

4. Educational activities should always be interesting (motivation).

5. Activities should always focus on the natural use of SL (focus on meaning in interaction).

6. Mistakes have enormous pedagogical value and require discussion within the classroom (production errors).

It is critical to structure language input to ensure that Deaf students understand the clear separation of a SL from a spoken language, either as speech or in print. For Deaf bilingual classrooms to work, the major aim is twofold. Learning SL as an L1 is focused on input, which, in turn, should follow a typical language acquisition sequence. SL must be the sole language of the classroom during the initial instructional time period when students first enter school[17]. When students are capable of meaningful exchanges in SL, the next step is learning *about* SL as a content subject. At this stage students also begin to learn the L2 (and *about* the L2). Once SL is learned, then SL (L1) is used as the delivery of information about L2. The L2 is delivered via print rendering the learning from two types of visual and accessible languages (CALDWELL-HARRIS, 2021; HOFFMEISTER, CALDWELL-HARRIS, 2014). It is critical that Deaf students understand that there are two separate arms of a language discussion: one about learning and discussing SL (L1) and one about learning and discussing L2.

Old and new vocabulary should be integrated using interactive communication techniques: narratives, dialogues, games, stories, etc. Instructors should model language for students, repeating and expanding during interactions. They should use varied language structures when possible, and incorporate objects, images, drawings, and other visual media to enable comprehension of input.

These initial strategies will enhance the clarity of delivery, thus furthering comprehension and avoiding confusion that comes from language mixing. Students should be immersed in SL-

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[17] Deaf children who learn SL at home need to be evaluated as to their fluency and comprehension. Language input should initially begin at home but where not available school must step in.

only instruction during the first half of the day of their initial year in school. During this time students will begin to *acquire* language. As they become more proficient in extracting meaning from the input, they will also be able to produce comprehensible messages.

Teaching the manual alphabet and teaching or using speech during learning and discussing of SL must be avoided as these can lead to confusion about whether SL or print is the language of the classroom. If speech must be part of the curriculum, its instruction should be conducted outside of the classroom or if no separate space is available, within a designated area of the classroom. The teacher might wish to consider taping off a section of the classroom separating the teaching of SL from the teaching of print or speech. Instruction should be supported with objects, images, drawings, and other visual media to ensure comprehension.

Finally, creative and active strategies to assess and monitor progress should be completed on both receptive and productive language skills. In addition, the use of SL text (video) can be implemented to determine levels of comprehension over time. These texts should be structured to require increasingly advanced vocabulary and sentence structure. To assess students' language production, students can be asked to produce signs via video, using varied discourse frameworks, such as narrative, questions and answers, text delivery, among others. These videos of students signing should be captured at regular intervals, or as often as is practical. Student videos can be shared and stored for future use in classrooms. Teachers can view videos collected at different times to determine progress in individual students.

The Future

Parents of Deaf children are often discouraged about their learning SL and their child's learning SL. We have reviewed materials available for learning SL as an L1 to encourage parents, teachers and others to think out of the box. Everyone involved in a Deaf student education can benefit from the presented applications, which integrate SL as an L1 using current video technology and print as an L2. As students become more fluent in SL, their involvement in the learning process grows and their capability to handle incoming information is enhanced (FAJARDO, PARRA, CAÑAS, 2010; HOCKINGS, BRETT, TERENTJEVS, 2012; MICH, PIANTA, MANA, 2013; SMITH, THRONE, 2007; TOMLINSON, 2001). Learning about grammar while improving vocabulary knowledge in (G)SL will support learning written Greek

as an L2. The result is wider access to educational materials and higher academic achievement (KOURBETIS, HATZOPOULOU, KARIPI, BOUKOURAS, GELASTOPOULOU, 2017).

Teachers have reported benefiting from access to materials for teaching (G)SL as an L1 by obtaining: a) pre-recorded video narratives by native signers to be used in teaching; b) curriculum based assessment material; and c) video narratives by native signers to improve their own learning of SL in a supportive and non threatening way. The applications explored in this paper can be used by all students (Deaf and Hearing), teachers and parents. Such broader usage and practice make it more viable to further develop and adapt to various environments. This is a pay it forward idea. Allowing learning of a SL to improve comprehension can only lead to a better future for Deaf children, their teachers and society in general.

Acknowledgments

References

ARMSTRONG, F. Difference, discourse and democracy: the making and breaking of policy in the marketplace. **International Journal of Inclusive Education**, v.7, n.3, p. 241- 257, 2003.

AUDEOUD, M.; HAUG, T. "Grundsätzlich wollen wir Tests, die alle sprachlichen Ebenen überprüfen!" - Eine Pilot-Studie zum Bedarf an Gebärdensprachtests für hörgeschädigte Kinder an Deutschschweizer Hörgeschädigtenschulen ("Basically, we want tests that check all language levels!" - A pilot study on the need for sign language tests for hearing-impaired

children at Swiss-German schools for the hearing-impaired). **Hörgeschädigtenpädagogik**, v. 62, n.1, 2008, p. 15–20.

BAHAN, B. Face-to-face tradition in the American deaf community: dynamics of the teller, the tale, and the audience. *In*: BAUMAN, D.; NELSON, J.; ROSE, H. (Eds.), **Signing the body poetic**. Berkeley, CA: University of California Press, 2006, p. 21-50.

BAHAN, B. Upon the formation of a visual variety of the human race. *In*: BAUMAN, H. D. L. (Ed.), **Open your eyes: Deaf studies talking**. Minneapolis, MN: University of Minnesota Press, 2008, p. 83-100.

BAKER, C.; WRIGHT, W. **Foundations of bilingual education and bilingualism**. 6th ed. Clevedon, UK: Multilingual Matters, 2017.

BLAMIRES, M. Universal design for learning: Reestablishing differentiations as part of the inclusion agenda? **Support for Learning**, v.14, n.4, p. 158-163, 1999.

BOOTH, T.; AINSCOW, M. **Index for inclusion: Developing learning and participation in schools**. 3rd ed. London: Centre for Studies on Inclusive Education, 2011.

BOUKOURAS, K.; GELASTOPOULOU, M.; KOURBETIS, V. Διαδραστικό βίντεο και ψηφιακό αποθετήριο στην υπηρεσία της εκπαίδευσης κωφών μαθητών (Interactive video and digital repository serving the education of deaf students). *In*: ZARANIS, Nikolas; ANASTASIADIS, Panos (Eds.), **The 9th National Conference with International Participation: Information and Communication Technologies in Education**. Rethymnon, Greece: University of Crete, 2014, p. 848- 854.

BURNETT, C. Technology and literacy in early childhood educational settings: A review of research. **Journal of Early Childhood Literacy**, v.10, n.3, p. 247–270, 2010.

CALDWELL-HARRIS, C. L. Theoretical underpinnings of acquiring English via print. *In*: ENNS, C.; HENNER, J.; MCQUARRIE, L. (Eds.), **Discussing bilingualism in deaf children.** Essays in Honor of Robert Hoffmeister. New York: Routledge, 2021. p. 73-95.

CAST. **Universal design for learning guidelines version 2.2** [graphic organizer]. Wakefield, MA: Author, 2018.

CZUBEK, T. A.; DI PERRI, K. A. **Bilingual Grammar Curriculum: ASL & English**. US: Bedrock Literacy & Educational Services, 2017.

FAJARDO, I.; PARRA, E.; CANAS, J. J. Do sign language videos improve web navigation for deaf signer users? **Journal of Deaf Studies and Deaf Education**, v.15, n.3, p. 242-262, 2010.

GENTRY, M. M.; CHINN, K. M.; MOULTON, R. D. Effectiveness of multimedia reading

materials when used with children who are deaf. **American Annals of the Deaf**, v.149, n.5, p. 394-403, 2004.

HAUG, T. Approaching sign language test construction: Adaptation of the German Sign Language Receptive Skills Test. **Journal of Deaf Studies and Deaf Education**, v.16, n.3, p. 343-361, 2011.

HERMAN, R.; HOLMES, S.; WOLL, B. **Assessing BSL Development - Receptive Skills Test**. Coleford, UK: The Forest Bookshop, 1999.

HERMANS, D.; KNOORS, H.; VERHOEVEN, L. Assessment of Sign Language Development: The Case of Deaf Children in the Netherlands. **Journal of Deaf Studies and Deaf Education**, v.15, n.2, p. 107-119, 2010.

HENNER, J.; NOVOGRODSKY, R.; REIS, J.; HOFFMEISTER, R. Recent issues in the use of Signed Language Assessments for diagnosis of language disorders in signing deaf and hard of hearing children. **Journal of Deaf Studies and Deaf Education**, v.23, n.4, p. 307-316, 2018.

HENNER, J.; ROBINSON, O. Signs of oppression in the Academy: The case of signed languages. *In*: Clements, G.; Petray, M. J. (Eds.), **Linguistic Discrimination in US Higher Education**. New York, NY: Routledge, 2021, p. 92-109.

HLADÍK, P.; GŮRA, T. The hybrid book-one document for all in the latest development. *In*: MIESENBERGER, K.; KARSHMER, A.; PENAZ, P.; ZAGLER, W. (Eds.), **Computers Helping People with Special Needs, Lecture Notes in Computer Science**. Berlin Heidelberg: Springer-Verlag, 2012, p. 18-24.

HOCKINGS, C.; BRETT, P.; TERENTJEVS, M. Making a difference-inclusive learning and teaching in higher education through open educational resources. **Distance Education**, v.33, n.2, p. 237-252, 2012.

HOFFMEISTER, R. A piece of the puzzle: ASL and reading comprehension in deaf children. *In*: CHAMBERLAIN, C.; MORFORD, J. P.; MAYBERRY, R. I. (Eds.), **Language acquisition by eye**. Mahwah, N.J: Lawrence Erlbaum Associates, 2000, p. 143–163.

HOFFMEISTER, R. J.; CALDWELL-HARRIS, C. L. Acquiring English as a second language via print: The task for deaf children. **Cognition**, v.132, n.2, 2014, p. 229–242.

HOFFMEISTER, R.; FISH, S.; BENEDICT, R.; HENNER, J.; ROSENBURG, P. **American Sign Language Assessment Instrument (ASLAI):** *Revision 4*. Boston, MA: Boston University Center for the Study of Communication and the Deaf, Boston University, 2015.

HOFFMEISTER, R.; GREENWALD, J.; CZUBEK, T.; DIPERRI, K. **Comprehensive American Sign Language Curriculum**. Boston, MA: Boston University, 2003.

HOFFMEISTER, R.; HENNER, J.; CALDWELL-HARRIS, C.; NOVOGRODSKY, R. Deaf Children's ASL vocabulary and ASL syntax knowledge supports English knowledge. **Journal of Deaf Studies and Deaf Education**, v. 27, n. 1, p. 37–47, 2021.

HOFFMEISTER, R. J.; KUNTZE, M.; FISH, S. Assessing American Sign Language. *In*: KUNNAN, A. J. (Ed.), **The Companion to Language Assessment Vol. 4**. Assessment Around the World. Malden, MA: Wiley-Blackwell, 2013.

HOFFMEISTER, R.; REIS, J. **American Signed Language Assessment Instrument** (v.2.0). Northboro, MA: ASL Ed Center, 2020.

HRASTINSKI, I.; WILBUR, R. Academic achievement of deaf and hard-of-hearing students in an ASL/English Bilingual Program. **Journal of Deaf Studies and Deaf Education**, v.21, n.2, p. 156-170, 2016.

IZZO, M. V.; BAUER, W. M. Universal design for learning: Enhancing achievement and employment of STEM students with disabilities. **Universal Access in the Information Society**, v.14, n.1, p. 17-27, 2015.

KARIPI, S. **Κοίτα με! Κάτι σου λέω …** (Look at me ! I am telling you something…). Greek Sign Language for A- B Grades. Athens: I.E.P, 2015.

KOMESAROFF, L. R. Deaf education and underlying structures of power in communication. **Australian Journal of Communication**, v.30, n.3, p. 43–59, 2003.

KOMESAROFF, L. **Disabling pedagogy: Power, politics and deaf Education**. Washington, D. C: Gallaudet University Press, 2008.

KOURBETIS, V. The importance of teaching GSL as the first Language. Research on state-of-the-art of teaching Sign Language as a first language. Presentation at the European University of Cyprus, Nicosia, CY, January 2019.

KOURBETIS, V. Design and development of accessible educational and teaching material for deaf students in Greece. *In*: STEPHANIDIS, C.; ANTONA, M. (Eds.), **Universal access in human-computer interaction**. Applications and services for quality of life. UAHCI 2013. Lecture notes in computer science, Vol. 8011. Berlin, Heidelberg: Springer, 2013, p. 172–178.

KOURBETIS, V.; HATZOPOULOU, M. **Μπορώ και με τα μάτια μου** (I can with my eyes as well). Athens, GR: Kastaniotis Editions, 2010.

KOURBETIS, V.; HATZOPOULOU, M.; KARIPI S.; BOUKOURAS K.; GELASTOPOULOU, M. Teaching European sign languages as a first language: Can they be taught without the use of ICT? Paper presented at the International Conference on Information,

Communication Technologies in Education, Rhodes, Greece, 6 - 8 July, 2017.

KOURBETIS, V.; KARIPI, S. How can you talk about bilingual education of the deaf if you do not teach sign language as a first language? *In*: ENNS, C.; HENNER, J.; MCQUARRIE, L. (Eds.), **Discussing Bilingualism in Deaf Children:** *Essays in Honor of Robert Hoffmeister*. New York, NY: Routledge, 2021, p. 113-131.

KOURBETIS, V.; KARIPI, S.; BOUKOURAS, K. Digital Accessibility in the education of the deaf in Greece. *In*: ANTONA, M.; STEPHANIDIS, C. (Eds.), **Universal Access in Human-Computer Interaction.** Applications and Practice. Lecture Notes In Computer Science. Berlin Heidelberg: Springer, 2020, p. 1–18.

KOURBETIS, V.; KARIPI, S.; HATZOPOULOU, M. Teaching European sign languages as a first language. *In*: GOUSSIA, F. (Ed.), **The 4th Conference: New Pedagogue**. Athens: Neos Pedagogos, 2017, p. 684- 692.

LADD, P. **Understanding Deaf culture: In Search of Deafhood.** Clevedon: Multilingual Matters Ltd., 2003.

LANE, H. L.; HOFFMEISTER, R.; BAHAN, B. J. **A Journey Into the Deaf-World**. San Diego, CA: Dawn Sign Press, 1996.

MACE, R. L.; HARDIE, G. J.; PLACE, J. P. **Accessible Environments: Toward Universal Design.** USA: The Center for Universal Design, 1996.

MICH, O.; PIANTA, E.; MANA, N. Interactive stories and exercises with dynamic feedback for improving reading comprehension skills in deaf children. **Computers and Education**, v.65, p. 34-44, 2013.

MOE, S.; WRIGHT, M. Can accessible digital formats improve reading skills, habits and educational level for dyslectic youngsters? *In*: STEPHANIDIS, C.; ANTONA, M. (Eds.), **Universal access in human-computer interaction.** Applications and services for quality of life. UAHCI 2013. Lecture notes in computer science, Vol. 8011. Berlin, Heidelberg: Springer, 2013, p.172-178.

NIEDERBERGER, N. Does the knowledge of a natural sign language facilitate deaf children's learning to read and write? Insights from French Sign Language and written French data. *In*: PLAZA-PUST, C.; MORALES-LOPEZE, E. (Eds.), **Sign bilingualism.** Philadelphia, PA: John Benjamins Publishing Company, 2008, p. 29–50.

NOVER, S. M. Politics and Language: American Sign Language and English in Deaf Education. *In*: LUCAS, C. (Ed.), **Sociolinguistics in Deaf Communities.** Washington, DC: Gallaudet University Press, 1995, p. 109-161.

NOVER, S. M.; RUIZ, R. The politics of America sign language in deaf education. *In*: SCHICK, B.; MOELLER, M. P. (Eds.), **The use of sign language in instructional settings:** Current concepts and controversies. Omaha, Neb.: Boys Town National Research Hospital, 1994, p. 73-84.

ORMEL, E.; HERMANS, D.; KNOORS, H.; VERHOEVEN, L. Cross-language effects in visual word recognition: The case of bilingual deaf children. **Bilingualism: Language and Cognition**, v.15, n.2, 2012, p. 288–303.

QUADROS, R. M.; HOFFMEISTER, R. The politics of L1 sign language pedagogy. *In*: ROSEN, R. S. (Ed.), **The Routledge Handbook of Sign Language Pedagogy**. New York: Routledge, 2020, p. 129-142.

SMITH, G.; THRONE, S. **Differentiating instruction with technology in K-5 classrooms**. Belmont, CA: International Society for Technology in Education, 2007.

TOMLINSON, C. A. **How to differentiate instruction in mixed-ability classrooms**. 2nd ed. Alexandria, VA: Association for Supervision and Curriculum Development, 2001.

TUOMI, I. Open educational resources and the transformation of education. **European Journal of Education**, v.48, n.1, p. 58-78, 2013.

UNESCO. **ICTs in education for people with special needs.** Review of innovative practice. New York: Unesco, Institute for Information Technologies in Education, 2011.

WOLL, B. The development of signed and spoken language. *In*: GREGORY, S.; KNIGHT, P.; MCCRACKEN, W.; POWERS, S.; WATSON, L. (Eds.), **Issues in deaf education.** Abingdon, GB: David Fulton Publishers, 1998, p. 58–69.

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