The Aesthetics of OER, Deaf Pedagogy, and Curriculum Design Contra the "Wicked" Policy of Deaf Education

REAs, pedagogía para sordos y diseño curricular contra la "malvada" política de la educación para sordos

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ABSTRACT

Designing inclusive education for deaf learners is a complex dilemma affecting multiple spheres and agents. In the US and Canada, despite considerable work by students, parents, educators, school administrators, curriculum developers, and lawmakers to address education policy about deaf bilingual literacy, the provision of deaf education is a wicked problem exacerbated by gaps in curriculum and pedagogy. Despite increasingly hypermodern technologies and mandated early assessment, most deaf high schoolers in North America have unsatisfactory literacy skills (Qi & Mitchell, 2012). To better manage this "wicked problem" involving policy, pedagogical methods, and curriculum design, we explore how aesthetic forms of knowledge and deaf positive design operations are used in conjunction with Open Educational Resources (OER). We reviewed the literature and constructed a novel framework about OER and e-books in deaf education. The synthesis generated three key takeaways that assisted our understanding of the complex issue. We presented our new framework alongside structured questions to 382 attendees hailing from 20 nations at the WUN/UNESCO Conference (2021, October), focused on inclusive and open access education technologies. We empirically analyzed this rich corpus using qualitative coding and represented our findings using a multipart Ecocycle Model. Following basic analysis, we describe four broader implications for deaf education research about teaching and curriculum using OER and e-book materials. Our analysis shows that deaf curriculum design is an educational problem embedded in a larger policy debate concerning methods and philosophies of pedagogy.

Keywords: deaf pedagogy; deaf curriculum; deaf multimodality; deaf aesthetics; language deprivation; open educational resources.

RESUMEN

Diseñar una educación inclusiva para estudiantes sordos es un dilema complejo que afecta a múltiples esferas y agentes. En los EE.UU. y Canadá, a pesar del esfuerzo considerable de estudiantes, padres, educadores, administradores escolares, desarrolladores de planes de estudios y legisladores para abordar la política educativa sobre alfabetización bilingüe para sordos, esta educación es un problema perverso exacerbado por brechas en currículo y pedagogía. A pesar de tener tecnologías hipermodernas y una evaluación temprana obligatoria, la mayoría de los estudiantes sordos de secundaria en América del Norte tienen habilidades de alfabetización insatisfactorias (Qi & Mitchell, 2012). Para gestionar mejor este "problema perverso", exploramos cómo utilizar las formas estéticas de conocimiento y el diseño enfocado a personas sordas junto con los Recursos Educativos Abiertos (REA). Revisamos la literatura y construimos un marco novedoso sobre REA y libros electrónicos sobre educación para sordos, obteniendo tres conclusiones clave. Presentamos nuestro nuevo marco con preguntas estructuradas a 382 asistentes de 20 países en la Conferencia WUN/UNESCO (octubre de 2021). Analizamos empíricamente este corpus mediante codificación cualitativa y mostramos nuestros hallazgos usando un Modelo de Ecociclo de varias partes. Tras un análisis básico, describimos cuatro implicaciones para la investigación en educación de sordos sobre la enseñanza y el currículo usando REA y materiales de libros electrónicos. Nuestro análisis muestra que el diseño del currículo para sordos es un problema educativo incrustado en un debate político más amplio sobre métodos y filosofías de la pedagogía.

Palabras clave: pedagogía para sordos; currículo para sordos; multimodalidad para sordos; estética para sordos; privación del lenguaje; recursos educativos abiertos.

INTRODUCTION TO WICKED PROBLEMS AND AESTHETICS IN DEAF EDUCATION

Inclusive policy in deaf education is a pervasive, complex dilemma that affects multiple spheres and agents (Kusters et al., 2015). Generally, *wicked problems* describe thorny policy issues with unwieldy inputs and uncertain results that remain problematic for long time periods despite gargantuan efforts toward resolution. Wicked problems are "open-ended, highly interdependent issues that cross agency, stakeholder, jurisdictional, and geopolitical boundaries" (Sydelko et al., 2021, p. 250). They are durable problems that lack "definitive solutions[s]" (Rittel & Webber, 1973, p. 163).

In the US and Canada, wicked problems exist in deaf education despite considerable work by students, parents, educators, school administrators, curriculum developers, and lawmakers (see Snoddon & Paul, 2020). Education policy about deaf bilingual literacy is a wicked problem exacerbated by gaps in curriculum and pedagogy. Despite increasingly hypermodern technologies and mandated early assessment, most deaf high schoolers in North America have unsatisfactory literacy skills (Qi & Mitchell, 2012). Reading and writing require an interdependence of sociocultural and educational processes that interact with familial, political, and economic domains (Garcia, 2009). Literacy is a social practice that begins outside the locus of schooling (Larson & Marsh, 2005) and outside of the purview of law.

Laws like the US *Individuals with Disabilities Education Act* (IDEA, 1990, P. L. 101-476) mainly affect deaf children once they enter schools. Despite enormous efforts to address the issue, a gap occurs precisely during the critical period of language development, which is the most consequential range between birth and age 5 (Hall et al., 2019), and may result in lifelong neurological damage from language deprivation (Gulati, 2019).

Once in schools, deaf students' reading outcomes involve complex variables and multiple stakeholder groups, many of whom have different values, goals, and jurisdictions (Skyer, 2021). Underlying variables include racial, ethnic, cultural, linguistic, and socioeconomic diversity (Foster & Kinuthia, 2003; Skyer 2021). While early and consistent sign access is the most robust predictor of reading attainment (Scott & Henner, 2021), far too few deaf students have full access to teaching and curriculum in sign languages (Karipi & Kourbetis, 2021).

Regardless of placement, few deaf students have specialist literacy teachers and authentic bilingual pedagogy, and fewer still have access to deaf-centric curriculum (Czubek, 2021; Di Perri, 2021; Garcia, 2009). Only a minority of deaf learners have full access to bilingual sign language-based pedagogies and curricula, or deaf-positive ideologies in their schools or wider social milieu (Kennon & Patterson, 2016; Komesaroff, 2008). Deaf educational literacy policy is therefore a wicked problem characterized by inconsistent inputs, ambiguous processes, and insufficient outcomes.

Aesthetics against the wicked

Wicked challenges require nontraditional reasoning and collaborative problem-solving (Bills et al., 2020). Education policy debates are often trapped within logical positivist approaches that aim for efficient, definitive solutions to inscrutable problems (Rittel & Webber, 1973). For this reason, we set aside traditional top-down ideas and instead explored ambiguous, contingent processes; specifically, potentially ameliorative uses of *design* as a resource alongside deaf-positive pedagogical and curricular aesthetics (Raike et al., 2014). Aesthetics is integral (not incidental) to our framework. We take direction from the pragmatists, including Cherryholmes's (1999) pragmatic educational aesthetics. Pragmatism is geared toward conceiving consequences of practical decisions that enhance beneficence or reduce harm. For Cherryhomes, knowledge/power can be used for good or ill; furthermore, aesthetics modulates how knowledge and power are constructed, used, and shared in education. Pedagogic labor in this vein includes creating workable solutions where none exist in a bid to reduce injuries of omission (Cherryholmes, 1999). We set forth to evaluate consequences of design choices that might enhance (or detract) from educational experiences through a pragmatic approach to (deaf) education centered on aesthetic epistemologies. We began with the assumption that aesthetics and design affect deaf educational interactions, including inputs like teaching and curricular choices, intermediary processes (including emotional aspects) relative to the work of deaf students and teachers, and finally, their consequences for learning and teaching (Skyer, 2021).

Researcher positionality

We are bilingual deaf academics, fluent in American Sign Language (ASL) and English, experienced in pK-12 and higher education in Canada and the United States. We live and work in nested deaf communities at local, provincial/state, national and international levels. Our university work includes deaf and special education, teacher education, bimodal-bilingual pedagogy, arts-based research, and curriculum development. We are practicing artists. As artist-scholar-teacher-researchers, we are committed to exploring deaf aesthetics as a (often unacknowledged) form of power. We are critical pedagogy theorists and practioners who understand that Western/Northern societies are instituted on the injurious legacies of colonialism, racism, xenophobia, and ableism; furthermore, we commit to using our combined knowledge/power to combat all instances where we identify them.

Literature Review

We generated then tested a novel theoretical framework (Boote & Beile, 2005) in three stages. First, we synthesized empirical and theoretical studies about OER and ebooks in deaf education. We collected literature based on our supposition that e-book and OERs for deaf learners should have unique design-properties, including multilingualism, multimodality, and visual literacy to foster bimodal-bilingual language acquisition (Kuntze & Golos, 2021; Kuntze et al., 2014). Thereafter, we proposed our full framework to include seven relevant areas of research and three axioms (used to delimit scope) to a diverse global audience and asked for feedback using structured questions. After, we describe methods and findings that analyze the wicked problem of insufficient or partial frameworks for accessibility.

Our review analyzed seven interdependent areas of research relevant to e-books and OER. Within the larger goal of synthesizing unique principles about the situated needs of deaf bilinguals who primarily access education via sign language, visual discourse modes, and multimodality, the literature review yielded seven propositions:

1. In/accessibility exists in e-books and e-publication platforms for deaf learners (UNICEF, n.d.; Kourbetis & Gelastopoulou, 2017; VL2 Labs, 2021).
2. Bimodal bilingualism ameliorates Language Deprivation Syndrome (Cheng et al., 2019; S. Cheng et al., 2020; Gulati, 2019; Hall et al., 2019; Hall, 2020).
3. Deaf axiology amplifies the focus on aesthetic and ethical values in education (Boukouras & Kourbetis, 2014; Raike et al., 2014; Cherryholmes, 1999).
4. Universal Designs for Learning over-promise and under-deliver for deaf learners (Hamraie, 2017; Shakespeare, 2014).
5. Levels of Digital Accessibility are a rubric for identifying inequalities (McKeown & McKeown, 2019; Mohammed, 2021).
6. Multimodality, multimedia, and New Literacy change what is considered learning (Kress, 2010; Kuntze & Golos, 2021; Skyer, 2021; Kourbetis et al., 2016; Karipi & Kourbetis, 2021; Hladík and Gůra (2012).
7. Open Education Resources are promising but underdeveloped in deaf education (Andrade et al., 2011; Hockings et al., 2012).

We concluded with three theoretical considerations or guiding axioms:

1. UDL accessibility is relevant to deaf education but lacks specificity for deaf educational uses of e-books and OER.
2. Deaf aesthetics affects deaf pedagogy, curriculum, and learning, with a net-positive influence that can be explored in e-books and OER.
3. Finally, multimodality and visuality are important for deaf learners and their teachers and positively affect OER and e-book interactions.

The specific findings from our literature review were presented at the Webinars, and, due to limitations of scope, are excluded from present study; interested parties should locate our subsequent work based on this review (e.g., Weber and Skyer, 2023, *in preparation*).

METHODOLOGY

To uncover tentative, workable designs to better manage a wicked problem, we first synthesized the literature then presented it to attendees at an international conference about digital accessibility and disability: *Open and inclusive education: WUN and UNESCO Training & research networks*. This section of the paper examines the responses of the WUN/UNESCO participants (herein, "participants) to our two webinars about how OER might meet the situated needs of deaf bilingual-bimodal students. In all, 382 responses were gathered from attendees hailing from 20 nations. In the first webinar (October 13th, 2021), we presented our accessibility framework. In the second (October 20th, 2021), we provided samples of implementation using Pressbooks and 5HP. Accompanying the webinars were structured questions designed to elicit data about current infrastructure, attitudes, and aspirations. The questions explored current OER and those that could be developed to facilitate inclusive deaf education in multiple countries.

Participants

The first webinar had 201 participants and 181 attended the second webinar (N=382 responses). It is likely that groups overlapped, but we lack data to examine overlaps, a limitation we discuss later in this manuscript. Participants were scholars, teachers, students, educational administrators, or from non-profit sectors, representing 20 different nations. Across datasets, participants mainly worked in education (total N=330/382, or 86%). Analysis of participants by profession revealed that many are elementary or secondary classroom teachers (N=105 accounts for 27%). University students comprised another large group (N=89, or 23%).

Questions

Our questions (Appendix A demonstrates our precise wording) were intended to probe accessibility of translated material in sign language with the long view of facilitating multi-lingual language acquisition and multimodal interactions with deaf children and youth. Following the webinars, we posed questions and elicited tasks, asking participants to reflect on current problems and future needs (Barton, 2015). Some tasks consisted of arrangement/ordering. Generally, we asked them to externalize abstract principles, patterns or conceptual categories underlying decision-making (Barton, 2015).

Data Analysis and Interpretation

We used mixed methods and in addition to tabulating quantitative data, we addressed written comments using structured qualitative coding cycles: first descriptive coding and systematic coding (Saldaña, 2021; Strauss & Corbin, 1998), then magnitude coding (Saldaña, 2021). After, we explored initial themes using an Ecocycle model (Lipmanowicz & McCandless, 2013), in which interrelated qualitative and quantitative data was presented.

Coding

We first used descriptive coding to uncover basic ideas that we then re-coded to develop initial sub/themes (Saldaña, 2021). Further codebook analysis suggested meaningful patterns, so we used systematic coding, developed by Strauss and Corbin (1998), to examine these structures. This cycle identified categories like causal conditions, contextual conditions, and consequences (Strauss and Corbin, 1998). Finally, we employed magnitude coding to indicate the strength of a sub/theme within the dataset (Saldaña, 2021). The magnitude coding bridged quantitative and qualitative data. Our mixed methods data and multi-method coding is in line with our conceptual framework of *wicked problems,* where data consisted of multiple perspectives, shifting foci, and extraneous (but valuable comments) related to the posed questions. By mapping data on an ecocycle model, we moved from a focus on unwieldy problems to tentative solutions.

Ecocycle Model

To represent voluminous data, we elected to use an Ecocycle model based on the work of Lipmanowicz and McCandless (2013). This methodological maneuver is intended to facilitate clear analyses of multifaceted issues. In line with our conceptual framework, the Ecocycle defines a complex problem in a nexus of agents, policies, and networks with divergent personnel and values (Rittel & Webber, 1973). The model depicts a horizontal figure-eight shape with four main stages: Gestation, Birth, Maturity, and Creative Destruction (Lipmanowicz & McCandless, 2013). Two additional stages show stagnation, the Poverty Trap, and the Rigidity Trap.

We used this model to provide a snapshot of participant responses to our theoretical framework. In sum, the Ecocycle promotes an overall view of present systems and environments and facilitates conversations among groups of people in a quest to define problems and locate them within complex systems (Lipmanowicz and McCandless, 2013).

Meaning from Mixed Methods

We will report on two of the six questions between the two webinars: 1) the second question posed to the participants at the end of the first webinar. The question is divided into two parts. Part A gathers quantitative data based on the selection of items and Part B invites the participants to further expand upon the selection of items as solicited in part A, and 2) the qualitative data gleaned from the first question posed at the end of the second webinar. The data suggests that when participants are encouraged to reflect on their own experiences, they capably identify and explore problematic issues in OER e-book production and design for deaf students. While four clear summative themes emerged, it's important to note that responses were not uniform; the raw data suggests a complexity of responses according to levels of knowledge, present resources, and attitudes of diverse participants.

This novel presentation of data allows for the inclusion of inconsistencies, misunderstandings, misinterpretations of questions, varying levels of knowledge and expertise, and expressions of intentions and commitments. We believe that inclusion of that data yields a rich source attesting to the nature of wicked problems in that the data presentation veers away from measures of efficiency and straightforward solutions toward interactions in open systems and concerns with equity (Rittel & Webber, 1973). Below, Figure 1 depicts the treatment of data collected from participants of Webinars 1 and 2. This model aims to promote a different approach to wicked problems, suggesting data be represented in a nexus of agents, policies, and networks with divergent personnel and values (Rittel & Webber, 1973).

Figure 1
Wicked Problem Data Representation Model (Weber & Skyer, 2021)
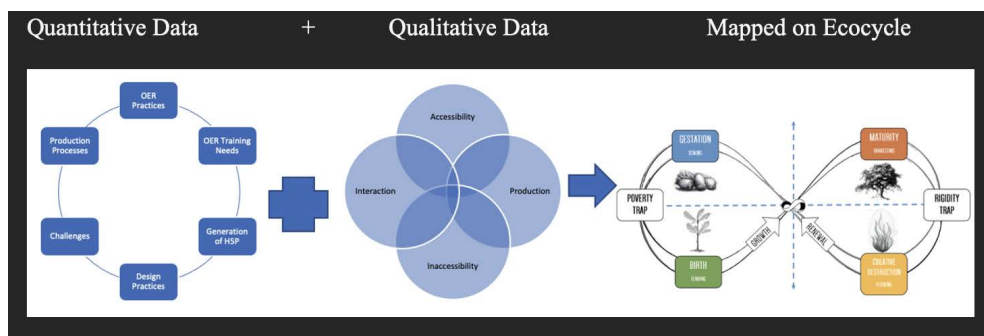
In our schematic, *Accessibility* corresponds to Gestation because ideally, theoretical standards should guide their actual development. The Gestation phase involves planning, goal development and establishing mechanisms for future

actions. The data from the two questions reported in this paper primarily address the Gestation period in the ecocycle.

In Birth, we placed the *Production* of accessible digital texts; ideally, as led by teams of deaf people (researchers, teachers, designers, students). In the Poverty Trap, highlight insufficient institutional networks, organizations, mechanisms to produce accessible texts. The Maturity phase concerns the *Interaction* of good digital texts on the part of deaf and hard of hearing learners, their teachers, and families. We placed *Inaccessibility* within the Rigidity Trap because many teachers and institutions, our evidence shows, simply follow along with the status quo, using inaccessible texts because accessible ones do not exist yet.

Data Presentation - Tabulated Results of Quantitative Data

The tabulated data is first presented separately from the ecocycle but is color coded to represent points on the ecocycle. Blue represents Gestation (correlated with Accessibility theme), white represents Poverty/Rigidity Traps (correlated with Inaccessibility theme), and represents ironically the flag of surrender, green represents Birth (correlated with Production theme), and brown represents Maturity (correlated with Interaction).

Findings

Quantitative Data (from Webinar 1, Question 2 A)

The second question employs an elicitation technique, known as a construction task (Barton, 2015) which allows the participant to identify the primary challenge inherent in the design and creation of e-books for deaf students. The prompt asked the participants to select one challenge that appeared the most pressing. The participants indicated that the most significant challenge was the provision of effective inclusive and equitable access to quality OER for deaf learners (60 responses). A second significant challenge was to support policy development pertaining to the production of ebooks for deaf learners (49 responses). When asked to amplify their selection of challenges, many participants indicated that design according to UDL remained a significant challenge (16 responses).

Table 1
Quantified Responses from Webinar 1, Question 2 A Related to Plotted Points on the Ecocycle (n=201)

Gestation	
Determining visual design frameworks that support accessibility	13

Support policy development	49
Effective inclusive and equitable access to quality OER for deaf learners	60
Poverty Trap	
Foster creation of sustainability models for OER that are deaf led	25
Promotion and facilitation of international cooperation among deaf organizations, deaf leaders and deaf academics along with hearing allies	21
Promoting deaf leadership in the production of accessible digital texts	21
Software capabilities	12
Totals	201

Qualitative Data (from Webinar 1, Question 2 B; Webinar 2, Question 1)

In Question 2 B (Webinar 1), the participants were asked to provide written responses to further elaborate on current challenges in providing OER for deaf learners. In Question 1 (Webinar 2), the participants were asked to provide written responses on current practices related to design of ebooks for deaf learners. The written responses were coded in three cycles: descriptive coding, thematic coding and magnitude coding. Then the coded themes were first arranged according to the points on the ecocycle: Gestation, Poverty Trap, Birth, and Maturity. A schema of the codebook developed for each question and assigned numerical values to reflect the number of times that the themes surfaced in the written responses is provided below.

Table 2
Ecocycle (quantitative and qualitative data coded according to magnitude)

	Ecocycle Stage - Gestation (Accessibility)	
2B - Webinar 1	Identification of Most Important Challenge (Written responses)	
	Design using UDL	16
1 - Webinar 2	Current practices concerning design principles of ebooks for deaf learners - Quantitative coding of subthemes	
	Beginning Initiatives	6
	Expression of Interest	17
	Sign Language Resources	14
	Teacher Training	1
	Technology Infrastructure	1
	Technology resources	26

	New Design Frameworks	33
	Multimodal pedagogy	16
	Plurilingualism	1
	Complexity thinking	4
	Theoretical understanding of inclusion	2
	Deaf Aesthetics	5

	Ecocycle Stage - Poverty Trap (Inaccessibility)	
2B - Webinar 1	Identification of Most Important Challenge (Written responses)	
	Invisibility of deaf people	64
	Need for policy	49
	Networks	37
	Sustainability	34
	access to OER	33
	New Design Framework	33
	Commitment	33
	Economic Resources	26
	Teacher training	25
	Technology Infrastructure	24
	Multimodal pedagogy	16
	Nothing	13
	Oppression of deaf people	10
	Deaf Aesthetics	5
	Complexity thinking	4
	Human Resources	3
	Planning	2
	Educational attainment	2
	Dissemination	2
	Blind people	2
	Theoretical understanding of inclusion	2
	Classroom accommodations	1
1 - Webinar 2	**Current practices concerning design principles of ebooks for deaf learners**	
	No action taken	94
	Invisibility of Deaf People	1
	Human Resources	2

	Invisibility of Deaf People	1
	Educational attainment of deaf people	1
	Classroom accommodations	3
	Ecocycle Stage - Birth (Production)	
2B - Webinar 1	Identification of Most Important Challenge (Written responses)	
Design	Design using UDL	16
1 - Webinar 2	Current practices concerning design principles of ebooks for deaf learners	
	Design using UDL	13
	Ecocycle Stage - Maturity (Interaction)	
1 - Webinar 2	Current practices concerning design principles of ebooks for deaf learners	
	Placement in Inclusive Classrooms	1

Finally, the coded data was merged with quantitative data. This allows for the presentation of all data gleaned through Question 2A and 2B at the end of Webinar 2 and Question 1 posed at the end of Webinar 2. On the ecocycle model, the numerical notations represent the magnitude in which the themes of accessibility (Gestation), inaccessibility (Poverty Trap), production (Birth) and interaction (Maturity and Creative Destruction) appeared.

Figure 2

Merged Quantitative and Qualitative (Coded) Data Related to Points on the Ecocycle
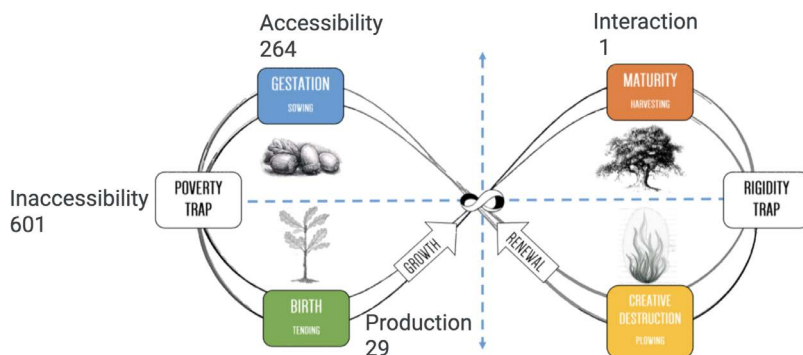
Discussion of Findings

Within the gestation phase, 33 participants in their written responses elicited in Question 1B (Seminar 1) stressed the need for new design frameworks (33), and for more technology resources (26). Additional comments included expressions of interest in working toward the production of ebooks, the importance of multimodal pedagogy (16), and deaf aesthetics (5). Some comments included a description of initiatives in support of deaf students in inclusive environments but not specific to ebooks. The challenge to the inefficacy of Universal Design Principles in meeting the needs of deaf students had many respondents remarking on the need for further theorizing on new design frameworks, multimodal pedagogy, plurilingualism, and inclusion. Overall, this gestation phase garnered strong responses (264) that affirmed the need for further reconceptualizing of design frameworks, planning, and policy development toward increasing sustainable and accessible production of ebooks for deaf learners.

Most of the numerical and coded responses (601) concerned potential poverty traps. With respect to Question 1A (Webinar 1) which asked for the identification of current OER practices, only 13 responses indicated that institutional networks, organizations, and mechanisms were in place to produce ebooks for deaf learners. In the second question, the participants identified the primary challenge as the fostering of creation of sustainability models for OER that are deaf led (25). International cooperation between deaf organizations, deaf leaders and deaf academics and hearing allies (21) along with the promotion of deaf leadership in the production of accessible digital texts were cited as secondary challenges (21). The written responses amplified

the lack of deaf leadership in their observations that deaf people were primarily invisible (64). The lack of policy (49), networks (37), sustainable models (34), access to OER (33), new design frameworks (33), commitment (33), economic resources (26), teacher training (25), and technology infrastructure (24) were enumerated as potential barriers to success production of ebooks for deaf learners. At the end of the second seminar, with respect to the first question, 94 written responses indicated that no action had been undertaken to develop design principles for deaf learners.

With respect to the Birth phase, the responses identifying current open education resource (Question 2A, Webinar 1) practices indicated that 6 participants were knowledgeable about active production efforts of accessible digital texts for deaf learners. In addition, 6 responses indicated that there were deaf led initiatives in the production of digital text and 7 responses indicated a partnership between deaf and hearing persons in the production of digital texts.

With respect to the Maturity phase, in the first webinar question (2A), thirty participants selected the item: active use of accessible digital texts as a current OER practice. The first question posed at the end of the second seminar asked the participants to provide written responses in response to the prompt: What are the current practices concerning design principles of ebooks for deaf learners within your organization, school, or institution? Placement in inclusive education classrooms was identified as a design principle.

DISCUSSION: OER and inclusion poses a wicked problem for deaf curriculum

Our literature review and novel presentation of data about deaf curriculum shows insufficient accessibility in OER and e-book design, multiple levels of understanding of presented material, differing interpretations of questions, and personal preoccupations or biases. This overriding wicked problem had four identifiable sub-themes. We describe these ideas herein, alternately analyzing data, citing the literature, describing problems, and suggesting possible resolutions. Overall, our central purpose remains: to facilitate difficult and complex conversations, involving multiple deaf and nondeaf partnerships, networks, and collaborations between deaf and nondeaf organizations, individuals, and institutions. The way we presented the data allows us to identify nodes of meaning across the four subthemes: accessibility, inaccessibility, production, and interaction pertaining to ebooks for deaf learners.

Accessibility and Inaccessibility: Rendering low incidence populations as invisible

Deaf learners, in nearly all contexts, are an extreme minority. One recent study analyzed 40 years of demographic data; it showed that in the United States deaf students are .17% of the school-aged population (Skyer, 2021). Deaf students are also

minoritized by deaf education. A critical stance raises a consequential question: *for whom are deaf education accessibility standards designed?* Overall, it appears that accessibility standards in deaf education are not designed to benefit marginalized deaf learners, but instead, to protect nondeaf institutions.

Within the coded written responses, we found that institutions or participants may conflate the situated needs of deaf learners (e.g., bimodal language), with other learning needs for other people with other disabilities (e.g., Braille). In doing so, the specific design needs of deaf students are rendered invisible. Shakespeare (2014) explains that universal disability accessibility sometimes produces irreconcilable contradictions. As an example, while blind or low vision individuals disprefer colorful or complex images, these same images may be assets for autistic or deaf students. The overapplication of UDL to OER in deaf education, may have a limited applicability and may even cause harm. Although it is clearly intended to incur positive results, our pragmatic stance shows that negative consequences remain possible.

Current accessibility standards are designed *for* but not *with* deaf end-users. Available OER and e-book technology lacks deaf-centric epistemic knowledge. To immediately increase benefits, existing software should undergo deaf-specific design audits; all new online materials for classroom-usage should also be designed specifically for deaf learners. Our literature review provides a structured rubric for this work. Designing new education resources should coincide with deaf leadership and full collaboration with deaf team members, including teachers, artists, researchers, and students, who can draw on their own embodied, biosocial experiences as deaf bimodal bilinguals (Skyer & Cochell, 2020). To aid this work, the following theories and methods should be considered. Deaf centricity (Rogers & Sutherland, 2014) denotes a positive stance in teaching and research oriented toward enhancing the unique traits of deaf agents, including (but not limited to) *abilities* using visuality, multimodality, ocularcentricity, Deaf Culture, sign languages, and bimodal bilingualism (Bauman & Murray, 2014; Skyer, 2021).

Production: Economic problems, epistemic solutions

We juxtapose quantitative and qualitative data in one theme with two parts: 1) developing sustainable curricular resources, 2) to resolve problems of scarce funding. Because of diverging values in research design and deaf education theory (Skyer, 2021), there is no current unified solution to this complex problem. However, our data suggests that deaf epistemology is a counteracting force against economic scarcity. Economic privation is a wicked, dispersed methodological problem (Rittel & Webber, 1973). A knowledge-based approach to a complex finance problem is not an obvious solution. Data from one participant clarifies the claim:

Creating these types of materials requires knowledge and cooperation from multiple sectors. It requires investment of time, effort, and money. Creating

sustainable models for deaf-led or deaf-led OER is complex in a world so focused on materialism and profitability ... inclusion of deaf people and people with all kinds of different abilities [is essential]. The support and management of organizations like UNICEF is essential.

Readers will note the following contrasts, 1) between "types of materials [that] require *knowledge*" and b) the fact that materials-development "requires [the] investment of time, effort, and *money*" (emphases added). Another participant bluntly added: "[I]institutions ... obey a market logic and therefore do not see the deaf user as a sustainable financial opportunity."

We are not economists. We are ethically-minded people who find it *deeply* problematic that deaf students ––*children*–– are depicted as mere investment opportunities. By interpreting this data, we see a power imbalance between deaf and nondeaf persons, and a tension between capitalist and educational ventures. Reducing educational strategy to financial cost-benefit analyses, precisely, renders this problem *wicked*. It seems prudent to use available funds wisely to maximize beneficial impacts. Data shows this can be done by privileging the self-defined needs of local communities, and triaging strategy based on potential benefits.

Data suggests that market-based solutions are both unsustainable and actively harmful. The coded data refines this potential solution: deaf epistemic forms of knowledge. One deaf respondent remarked at length about the dilemma between an economic status-quo and deaf-positive problem-solving:

Leadership is almost always held back by the environment that does not yet understand the situation, the idea [is] deeply rooted is the traditional paradigm, where it is considered that a person with a disability is practically useless, [in spite of being] professionals and trained professionals ... Promoting leadership so that the deaf can produce digital texts, not only involves technology, it implies that society [should] recognize that [any deaf person] can be a leader and not stop [their] attempts [to change the system].

This participant draws on his own deaf experiences and supports deaf epistemic knowledge and centralizes deaf educational self-determination (Cawthon & Garberoglio, 2017; O'Brien, 2017; Skyer, 2021). In this context, it's concerning that deaf students find themselves muddling through (so-called) solutions designed by nondeaf persons, where a principal criterion of value is economic, not educational. An alternate approach focuses deaf power and deaf epistemic cohesion by coordinating involvement (from local- to international-scale) between deaf students, deaf educators, and deaf social organizations, where knowledge is centered on the bounteous community-based methods of teaching and learning emanating from deaf experiential knowledge (Rogers & Sutherland, 2014: Skyer & Cochell, 2020).

Interaction: Design principles or translations as a simple solution?

Deaf-led design teams could articulate deaf epistemologies and deaf ontologies in positive ways, such through Deaf Gains in education (Bauman & Murray, 2014). While social scientists, designers, ergonomists, rehabilitation experts, architects, and policymakers have championed accessibility standards, major gaps remain about accessibility in regarding embodied knowledge of disability and deafness (Hamraie, 2017; Skyer, 2021). In the first question posed at the end of the second WUN seminar, most respondents (70/181) indicated that there were no current practices related to design principles to guide creation of e-books for deaf learners. However, within the coded data, respondents indicated practices that attempted to include deaf learners including the provision of sign language interpreters, captioning on videos, providing written transcripts and the presence of special education faculty to train teachers. Overall, the responses did not address design principles in this question. Rather, many written responses focus on the provision of translations in sign language and text. This may be cited as an influence of the UDL movement.

In 2017, the United Nations (UN) Convention on the Rights of Disabled Persons adopted UDL principles as a mandate. UNICEF (n.d.) employs UDL principles in research on Accessible Digital Textbooks with adaptive recommendations for deaf learners (Annex D, p. 72). UNICEF also emphasizes sign language translations; however, they fall short of explaining that without additional modifications, translation alone may be insufficient. Translation into sign language is a minimum first requirement for equity. To their credit, UNICEF recognizes, in part, the complex and politicized nature of translation: namely, that word-to-sign or sign-to-word equivalents may not exist. To mitigate problems, UNICEF promotes translation and sign glossaries (main concepts and provisional signs) created by bimodal and bilingual deaf signers who possess native or native-like proficiency in all modes of the local target languages. Translation is not a simple checkbox to tick. To illustrate, one might assume that sign language translations might guarantee accessibility to spoken and textual materials, but deaf epistemic knowledge suggests that this is far from the truth. Translations can mar or subvert intended messages.

As Rittell and Webber (1973) remark: "Whenever actions are effectively irreversible and whenever the half-lives of the consequences are long, every trial counts" (p. 163). For instance, many language-deprived children, upon being unable to function at the same level as their hearing peers, are often thrown into non-profit agencies and deaf communities, to provide sign language-based services at a much later stage of language acquisition long after the optimal period of language acquisition has passed. Where the primary systemic vehicles have failed, another set of wicked problems become activated as the language deprived child ages, thereby incurring problems within healthcare, social services, justice systems and advanced education and employment sectors. In this way, wicked problems far outrun the list

of available or enumerated solutions, particularly in relation to translating between languages.

Study Limitations

In reflecting on our data and methods after analysis, we have identified a few limitations that we wish to discuss. Mainly, we think the study was limited by the kinds of questions we asked and those we did not. Some questions posed did not allow for "Other" options and may have been too restrictive. If we were to repeat the study, we would include more choices of this kind to allow for customization. We regret that we did not include means to account for which participants engaged with which set of questions; we do not know if somebody who participated in webinar 1 also engaged with webinar 2. Lastly, we acknowledge that our sample was one of convenience; as such, it overrepresented nondeaf professionals and those working outside of deaf education. To account for this, we aim to repeat the study, conducted with a new sample that overrepresents deaf professionals in deaf education. Thereafter, we intend to compare the data sets.

CONCLUSIONS

By focusing on the available resources, deaf aesthetics, and the networks of institutions, multiple sectors and professionals, the nature of OER and inclusion proved itself to be a wicked problem. The WUN seminars focused on the deaf aesthetic needed to guide the creation and production of OER e-books for deaf learners. We attempted to determine the shifts in power, aesthetics, and knowledge within the present ecology of participants, institutions, available infrastructures, and practices after the participation in two WUN seminars. Wicked problems inherent in OER and inclusive education when applied to low incidence populations such as deaf students may be more easily managed through training on how to create H5P content using the deaf aesthetic as integral to accessibility for deaf students. In this sense, the creation of OER content allows for the problem to be managed in a "quixotic way," as one of our participants wrote, recognizing that traditional hierarchies and related modes of thinking may eventually be replaced by a nexus of actors at various levels of understanding, commitment, and communication. Nevertheless, deaf curriculum design is mired in larger policy debates about methods and philosophies and pedagogies and the value of developing accessible design frameworks for deaf people.

Deaf students across the world encounter only modest variations to these same basic problems. Language deprivation, while entirely preventable, is endemic (Hecht, 2020). Beginning in the 1990's, systemic and technological changes in health care (e.g., the erroneous assumption that cochlear implants and sign languages are incompatible), have exacerbated the language deprivation syndrome (LDS) crisis

(Hecht, 2020). Lack of knowledge about language deprivation is a contributing factor to the wicked problems in deaf education and becomes the "weak strut in the professional's support system [that] lies at the junction where goal-formulation, problem-definition and equity issues meet" (Rittel & Webber, 1973).

We suggest that data about deaf people and those who work with them may need to be remodeled in a way that captures the complexity inherent in identifying problems and ultimately managing wicked problems as opposed to being inundated with overly simplistic solutions that are often generated from an audiocentric or phonocentric perspective.

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APPENDIX A: QUESTIONS

Webinar 1

1. What open education practices are in place within your organization, school, or institution that serve the visual learning needs of deaf and hard of hearing children with respect to e-books or accessible digital texts. (Check all that apply).

   - Accessibility standards guide the use, production and dissemination of accessible digital texts for deaf and hard of hearing learners
   - Active use of accessible digital texts (e-books) by deaf and hard of hearing learners
   - Active production of accessible digital texts (e-books) for deaf and hard of hearing learners
   - Deaf led initiatives in the production of accessible digital texts (e-books)
   - Deaf and hearing led initiatives in the production of accessible digital texts (e-books)
   - Dissemination of accessible digital texts (e-books)
   - Institutional networks, organizations and mechanisms for the production of accessible digital texts (e-books)

2. A What do you consider to be the biggest challenge facing the development of e-books or accessible digital texts for the deaf and hard of hearing? (Please select only one challenge).

   - Software capabilities
   - Determining visual design frameworks that support accessibility
   - Supportive policy development
   - Effective, inclusive, and equitable access to quality OER for deaf learners
   - Foster the creation of sustainability models for OER that are deaf led
   - Promotion and facilitation of international cooperation among deaf organizations, deaf leaders and deaf academics along with hearing allies
   - Promoting deaf leadership in the production of accessible digital texts (e-books)

3. B Please expand on your answer here:

   _____

4. Please indicate in the order of importance, the necessary processes required to produce accessible digital texts (e-books) for deaf and hard of hearing learners:

- 1 - Development of software capabilities (such as Pressbooks and other applications)
- 2 - Establishment of local teams including deaf individuals who provide the sign language interpretations and consultation on visual pedagogy
- 3 - Establishment of accessibility standards that specifically meet the needs of deaf learners
- 4 - Development of local, state/provincial, national and international networks that support the development of accessible digital texts (e-books) for deaf learners

Webinar 2 Questions

Questions in Response to the Viewing of the October 20, 2021 Webinar: The use of Open Educational Access publishing platforms to create e-books for the deaf and hard of hearing.

1. What are the current practices concerning design principles of ebooks for deaf learners within your organization, school, or institution?

Open Education Resources

2. In this presentation, you were introduced to an ebook creation platform Pressbooks, and its contribution to the creation of Open Educational Resources (OER) through the support for H5P content generation. In your estimate, what is the potential for your institution or organization to create interactive H5P content that can be created, shared and reused for deaf learners. Select best answer below:

- Not likely
- Maybe
- Yes
- Definitely!

Training

3. Please indicate in the order of importance, your institution's training needs related to developing a visu-centric ebook (check all that apply).

    - Sign language learning
    - Comparative linguistics (sign language and spoken language)
    - Use of Pressbooks or a comparable e-book creation platform
    - How to establish a film studio (including technical specifications related to lighting and equipment
    - How to add captioning to videos
    - How to work with audio and video files
    - How to work with deaf people
    - How to work with translators (signed and spoken languages)
    - Promotion of design principles and development of policy related to ebooks within the education milieu
    - How to promote bimodal bilingual language acquisition in an online environment
    - How to establish an H5P repository for use in ebooks