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Deaf students' linguistic access in online education: The case of Trinidad

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ABSTRACT

Comparatively little research on linguistic access in deaf education has occurred in the Caribbean when compared to the rest of the world. During the COVID-19 pandemic, many Caribbean countries attempted large-scale e-learning for the first time. This study investigates how an emergent system of e-learning that started during crisis conditions affects the linguistic access of deaf students in Trinidad and Tobago. The framework for investigation encompasses the learning management system, course materials and language and communication involved in e-learning. A phenomenological method of inquiry is employed to understand the processes of receiving and providing online deaf education in terms of those who experience it. Data are triangulated from deaf primary and secondary school students, their teachers, interpreters and parents. Deaf learners encountered unique modality-specific barriers since e-learning in the country was not prepared to convey the full range of communication available in sign language. Challenges also stemmed from institutional support issues, existing social inequalities and the unique sociolinguistic history of the local deaf community. These conditions have implications for deaf students' language learning and academic success. These are important considerations of e-learning or blended learning practices for deaf learners that deserve further empirical scrutiny.

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Introduction

Deaf students' access to education is a most critical matter for discussion. Surveying the United States, Gaberoglio et al. underscore that in comparison to their hearing peers, deaf students obtain lower academic qualifications and are largely excluded from tertiary education (2017). In the Global South, schools have especially struggled to meet the needs of deaf learners (World Federation of the Deaf [WFD], 2021). Braithwaite asserts that "in the Caribbean there has been a failure of the education system to prepare deaf students for

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successful entry into higher education and the number of deaf professionals and academics remains low” (2015, p. 19).

Deaf education in Trinidad and Tobago is an understudied area. The country’s Language and Language Education Policy even comments that “[a]t no time in the history of education in the country has there been sufficient information on deafness and Deaf Education” (Robertson, 2010, p. 37). A major additional complexity arose in March 2020 when the World Health Organization declared the COVID-19 outbreak an international pandemic. To prevent the virus from spreading, the school was no longer conducted face-to-face, and Trinidad and Tobago attempted nationwide e-learning for the first time (Kalloo et al., 2020). During this time of crisis, “[d]eaf people face greater and unique vulnerabilities ... particularly concerning equitable access to information and education” (WFD, 2020a, p. 1). Access for deaf people means overcoming linguistic barriers, and this is only achieved when all spoken or written information is provided in sign language (Haualand & Allen, 2019). Without access to language and education, deaf people’s lives can be catastrophically affected.

Research on e-learning for deaf students is relatively new and originates outside the Caribbean. Slike et al. (2008) detail the management of remote learning platforms for deaf learners. Curl and Jamieson (2011) compare deaf students’ learning outcomes in face-to-face versus online classes and McKeown and McKeown (2019) explore accessibility in online courses. However, the novelty of Trinidad and Tobago’s e-learning situation means that no similar studies exist for the country. This study is concerned with how the conditions of an emergent system of online education during the COVID-19 pandemic affected the linguistic access of deaf students in Trinidad and Tobago.

Background

Deaf education in Trinidad and Tobago

Trinidad and Tobago has no deaf preschools or highschools. The only designated schools for deaf students are the following three primary schools: Cascade School for the Deaf; Audrey Jeffers’ School for the Deaf; and the Tobago School for the Deaf, Speech and Language Impaired. According to Hall et al. (2019), approximately 5% of deaf children have deaf parents to provide them with an accessible first language at home. Most deaf Trinbagonians have hearing parents and no access to a native signing model. As a consequence, deaf Trinbagonians suffer educational delays and must learn a sign language from the ground up at primary school (Braithwaite, 2015; Lamb-Sterling, 2012).

While TTSL (Trinidad and Tobago Sign Language) is a distinct, indigenous signed language, teachers heavily rely on ASL (American Sign Language) and use SEE (Signing Exact English) to support comprehension and production

of written English. Consequently, the first language of most deaf students has become a variety nearly identical to ASL “albeit [...] with some recognizably Trinbagonian features” (Braithwaite, 2018, p. 33).

Deaf secondary school students are mainstreamed alongside hearing peers, and interpreters are employed to translate the spoken/written language of the classroom (Braithwaite et al., 2011). However, according to the president of the Deaf Empowerment and Advancement Foundation (DEAF) in Trinidad, often there are too few interpreters to work with deaf students (cited in Gittens, 2020). Braithwaite (2015) explains that English and other spoken/written languages are non-native and inaccessible to most deaf people in the Caribbean, yet their academic and career fulfillment is predicated on their command of English in education and beyond. He further quoted a deaf Trinidadian who said mainstream teachers “follow a hearing culture approach” and are not sensitive to the needs of deaf students (2015, p. 23).

Deaf education in the pandemic

It is clear that major problems already existed in deaf education before the pandemic. Therefore, a sudden, unprecedented shift to distance learning signalled new challenges. Leacock and Warrican examined how Caribbean education systems responded to COVID-19 and highlighted, inter alia, the following points: curricula were not designed for e-learning; online resources were not relevant to the Caribbean; teachers and students were struggling to adapt; and means for supervision and support were uncertain (2020).

According to the WFD, online learning materials may not be designed for deaf learners, families may lack good internet, and access to linguistic and visual input may be limited online (2020b; 2021). Additionally, without early linguistic support, deaf students can struggle to decode English text (Braithwaite, 2015; Johnson et al., 1989; Supalla & Cripps, 2008). E-learning may encourage strategies that appear inclusive on the surface, like providing fully captioned videos and written transcripts of lessons, but in reality, the complexity of the written language may be inaccessible to the students (McKeown & McKeown, 2019).

Reyes and Moll, writing on bilingual hearing students, explain that these students parsed the language of the classroom in terms of the language used at home (2008), but the pandemic has forced deaf students to learn from homes where families seldom know a signed language (WFD, 2020b). Deaf children also draw on their sign language knowledge to develop reading skills (Johnson et al., 1989; Supalla & Cripps, 2008), and e-learning can remove them from the sign-rich environment of the deaf school.

Branson and Miller (2004) provide a comprehensive case study of how a learning environment dominated by spoken/written language impairs deaf students’ competence in both sign language and the language of wider

communication. They concluded that only among students “from linguistic environments where the use of natural sign language is strong, the potential for ongoing linguistic and cognitive competence through sign language remains” (p. 31). Insofar as e-learning limits the use of fully accessible signed language, deaf students are at risk of language deprivation, a condition where insufficient linguistic access results in delayed or underdeveloped language and communicative abilities (Hall et al., 2019; WFD, 2021).

Conceptual framework

This paper approaches access through the model developed by McKeown and McKeown (2019) who identify three accessibility levels for deaf students online. Level 1 is the learning management system (LMS) that encompasses technological considerations like internet stability and the presence or absence of deaf-friendly features such as closed captions, clear video, etc. Instructors also need ample support to ensure they employ accessibility elements, for example, interpreters need proper lighting and must reduce visual noise in the form of their background and clothing (Krusser, 2017; Slike et al., 2008).

Level 2 is course material. Deaf learners need materials specially designed for their needs with distinct visual reinforcement and legible, unambiguous language (McKeown & McKeown, 2019). Deaf learners also benefit from self-study facilitated by videos in their native sign language (Krusser, 2017; Slike et al., 2008; Vinoth & Nirmala, 2016).

Level 3 is language and communication and involves more than just text alternatives to aural content. Written content must consider the literacy and comprehension challenges of deaf learners (McKeown & McKeown, 2019) and sign language, considered deaf people’s natural first language, should be the primary language of instruction (Cummins, 2007; Haualand & Allen, 2019; Plaza-Pust, 2020; Robertson, 2010).

Methodology

Since this work concerns a minority community, a phenomenological approach was used to allow participants to articulate their needs in their own terms. Interviews were used to gain insight into the lived experiences of receiving and providing online deaf education through participants own perspectives.

Ethical considerations

Accuracy and realism are crucial to representing the experiences and issues that affect deaf people (Benedict & Sass-Lehrer, 2007). Due to this, the researcher, possessing limited signing abilities, enlisted the help of a professional interpreter who is a CODA (child of a deaf adult) to help with interviews. This

was to facilitate faithful communication between the researcher and deaf participants since CODAs are presumed to have native-like signing abilities.

Consent forms were sent to school administrators asking for permission for students and staff to participate. Consent was then directly sought from participants and, for deaf students under 18 years old, parental consent was obtained. For deaf participants, sign language was used to obtain consent and inform them of the purpose of the interview.

Any material pertaining to participants that is presented in this paper was done so with their explicit consent. All information identifying participants was omitted from this study and they have acknowledged that they cannot be identified via this paper. Both participant consent and interview recordings were placed in an encrypted digital archive only accessible to the researcher. Ethical approval was confirmed within the University of the West Indies, St. Augustine campus.

As Braithwaite (2014, p.14) writes, “[f]or a researcher who is new to a Deaf community, and who has limited connections to that community, choosing to speak out on their behalf might rightly be perceived as arrogant and patronizing”. The researcher, therefore, engaged in meetings with teachers and interpreters from educational institutions where deaf students are taught, the deaf community and the Deaf Empowerment and Advancement Foundation so stakeholders could decide how the research is used.

Data collection

In order to reliably represent issues surrounding deaf people, Parks advises that researchers include perspectives from both people who are deaf and “people who do not identify as culturally deaf themselves but are still stakeholders in the community” (2019, p. 160). Data were thus triangulated from among deaf students as well as their teachers, interpreters, and parents. Sampling was purposive in nature, but also a form of snowballing as some participants were referred to by other participants (Table 1).

Interviews were conducted during 30–50-minute sessions in closed settings to enable inter-subject reliability. Questions corresponded to McKeown and McKeown’s operationalisation of access (2019) but were semi-structured

Table 1. showing composition of interviewee sample.

Stakeholder group	Number of participants
Deaf highschool students	2
Deaf primary school students	2
Parents of deaf students	3
Highschool interpreters	2
Hearing primary school teachers of deaf students	3
Deaf primary school teachers of deaf students	1
Total	13

because questions needed to vary according to the different stakeholder groups and so participants could construct access in their own terms.

Data analysis

Recordings of the interviews were transcribed for analysis and significant statements were grouped and coded in relation to the main themes of LMS, course material and language and communication. While these themes guided the research, they did not restrict the investigation. Parks explains that deaf people address their needs through “a variety of pragmatic stances as they pursue greater social access” (2019, p. 164), so frequent and salient codes that did not align with a preconceived theme were developed into new themes. Only experiences widely expressed were included in the findings.

Findings

Data from 13 interviews revealed various points related to McKeown and McKeown’s three categories of LMS, course materials and language and communication (2019) as well as two categories not accounted for in their model: institutional support and social variation. This section will address these findings in the form of a composite description including quotes from interviews as support.

Access and the LMS

Trinidad and Tobago’s Ministry of Education has its own school learning management system and provides schools with free access to the full version of Microsoft Teams. However, all participants used either Zoom or Google Meetings which they found more familiar and easier to operate. Those on Zoom only had the free version, which limits sessions to forty minutes. If classes ran longer, they would need to restart Zoom.

Zoom and Google Meetings also have a whiteboard feature where multiple users can write or draw simultaneously. While a traditional whiteboard is used almost exclusively by the teacher to present written information, the virtual whiteboard helped preserve some interactivity online as teachers and interpreters described using it for practicing short sentences and mathematics where they could circle or underline student errors and make corrections in real time.

Camera trouble

Sign language naturally entails rapid hand-movements prone to blurring if the frame rate is low. Fingerspelling especially, which is used extensively in education due to the prevalence of English, was frequently imperceptible.

Interpreters would often repeat themselves and sign slowly to avoid blurring, widening the time gap between what was said and what was interpreted. They found it stressful to rely more on memory and truncating interpretation for time could lead to less complete translations.

All teachers and interpreters were accustomed to signing offline where space could be used freely, but the online signing was restricted to the camera frame. Constant self-monitoring was needed to ensure signs were always produced in full view of the camera as students missed information when signs accidentally occurred off-camera and went undetected.

Lack of technical support for instructors

Teachers and interpreters were not sufficiently versed in the technology to provide access for deaf students. It was common for them to have no knowledge about software features like side-by-side video and multi-pinning, so screen sharing would prevent the person who was screen sharing from being seen. This meant that if a teacher or interpreter screenshared, the student could not see their signing.

Out of the 13 participants, a total of 10 participants (3 teachers, 2 interpreters, 4 students and 1 parent) used multiple devices to compensate for teachers' and interpreters' inadequate technical knowledge. One device would have a video-call with the class content and a separate device with a separate video-call would have the teacher or interpreter signing. Of the three participants who used only one device, one was a teacher who knew how to fulfill these functions on a single device. The remaining two participants were a student who had a smartphone only and a parent who only had a tablet for their deaf child to use. If screen sharing was used, they could not see the teacher or interpreter's sign language.

Modality limitations

Space and movement provide crucial information when communicating concepts in sign language. To illustrate how accessibly explaining a concept for deaf students can require construction of that concept in real space, one teacher described how she would teach the concept of perimeter to her math class:

[In physical classes] I can take them outside, walk around the car park, talk about perimeter, walk around the classroom, talk about perimeter. Online, I just use a video, I can't really do much reinforcing. (personal communication, February 21, 2021a)

Teaching in sign language also requires teaching of sign language and deaf learners benefit from tactile support. When signing new words errors can occur in any of the parameters of handshape, location, movement, orientation or non-manual components. In a face-to-face setting, educators can hold a student's

hand, guiding them through the sign proprioceptively or freely change body positions to demonstrate a sign from a different angle. Online corrective feedback required greater mental maneuvering. As one participant put it: “sign language is a 3D language and we using a 2D platform” (personal communication. February 20, 2021a).

Similarly, physical contact can be important for getting students’ attention. A pat on the shoulder or flicker of the room lights is a typical alternative to calling out to a deaf student as one would to a hearing student. However, these options are impossible online. As one teacher explained, “if that child decides, I am not going to look at Miss, I’m going to look somewhere else. Well guess what, there’s no way of reaching that child” (personal communication. February 21, 2021b). If students became distracted teachers or interpreters would either need to wait for them to refocus on their own or call their parents on the phone. Students would miss content if their teacher or interpreter kept signing without noticing they were distracted.

Detection of errors

Teachers and interpreters felt that in a face-to-face setting errors in written language are more detectable because they can check in students’ books while students are working. However, online these errors were almost always detected after the student had submitted their work. Teachers and interpreters felt that this made it harder to establish meaningful connections between the corrections and the content than if corrections were made during the lesson.

Course materials

Since the curriculum is designed with hearing students in mind, both primary and secondary schools lack course materials specially made for deaf learners. As a result, deaf students are expected to use English textbooks and take written English assessments. All participants reported that online pictures and videos were being used much more than before to reinforce linguistic concepts than before the pandemic. One teacher recalled having to teach a comprehension passage about the archer fish which catches insects above the surface by launching a jet of water at them. She found this conceptually difficult to convey in sign language and illustrated the use of videos as follows:

Me trying to explain this fish to this child, I couldn’t do it, I had to show the video ... once I showed the video, the child was able to get the gist of what the paragraph was about. (personal communication, February 21, 2021a)

Deaf students benefit from visual reinforcement much more than hearing students. Teachers and interpreters could not always find lesson-specific sign language videos, so they used general videos supplemented with their own sign language input. A point raised by all participants was that teachers and

interpreters were now filming themselves explaining content in sign language, thus essentially creating their own sign language course material. For the first time, students could study with sign language resources that corresponded exactly to class topics. Before the pandemic they relied on remembering what their teacher signed and connecting it to written notes.

Language and communication

The language of instruction

The lack of curricular materials designed for deaf learners corresponds with a general shortage of TTSL material. Participants explained that at the primary school level teaching is mainly conducted in ASL with TTSL typically used for reference to elements of local culture. Teachers or interpreters seeking sign language resources on the internet found ASL materials most abundant. They felt this was leading to an increase in ASL use over TTSL.

It is not uncommon for deaf children of hearing parents to sometimes struggle to make inferences from input received in sign language. Teachers and interpreters, therefore, emphasised that knowledge of sign language alone is not sufficient for accessible communication. Rather, instructors must also be competent visual-kinetic communicators as the following quote from a teacher demonstrates:

If I'm signing and I find that he is not understanding what I'm signing, I would add other features ... if it's something that could be contrasted, like you're describing something that's huge or something like that ... You'd say, no, it's not small, not tiny, it's really, really big. (personal communication, February 21, 2021b)

Similarly, another teacher highlighted the importance of extra-linguistic components by saying: "I try to direct [the students'] attention to how my body is moving or how my facial expression is because it's not just about the hand movement" (personal communication, February 20, 2021b).

At the secondary level, deaf education typically sees a single deaf student with an interpreter. This lends itself to a need for greater linguistic accommodating as one interpreter illustrates:

[My student] was like strong ASL ... and I had a mixture of TTSL and ASL, so it's not like he didn't understand me completely ... I was working with the student for a while so ... when you know somebody for a while they know your signs, and you know their signs ... he will show me, alright well this is how you sign this, and then I show him this is how we sign this or whatever and I try to use mostly his signs so he could be comfortable. (personal communication, February 20, 2021a)

Students and their teachers or interpreters may be proficient in different languages, but time and rapport may permit access to each other's language. This interpreter recognized that access required using the language in which the student was most proficient. Another interpreter demonstrated an

awareness of the challenges presented by English. He explained that while he saw SEE as useful for teaching written English, it was ill-suited for natural communication. He added: “English is a different language ... I wouldn’t explain in exact English, I would explain in Deaf” (personal communication, February 20, 2021c). Nevertheless, one student who worked with several interpreters reported that one of them “used a mixture of signing [the] Deaf way and English like exact English”¹ (personal communication, February 28, 2021).

The language of the home

Since e-learning has caused students to spend more time at home, it was necessary to investigate how students’ home language situation was affecting them. Interviews with four students and three parents revealed that in all seven households with a deaf child in this study, the child was the only deaf person. Only two out of seven had a family member proficient in sign language. Most families took no formal sign language lessons, instead making ad hoc use of online ASL dictionaries and YouTube videos. They were aware of sign language training offered by deaf primary schools but said that they found it difficult to include in their work-life balance. One student explained: “I’m the only deaf person [at home] ... My dad used to take sign language classes. He taught the entire family, but now they kind of don’t sign anymore” (personal communication, February 28, 2021). Instead, families frequently relied on writing notes, home signs, gesturing, and spoken language (in which case the child was expected to lip read). However, parents felt that they were able to pick up sign language communication strategies whenever they needed to be present for the classes of their primary school children to help them pay attention or operate the device.

Before the pandemic students spent roughly six hours a day at school. In contrast, online school was conducted in sessions punctuated throughout the day that totalled around three to four hours of instruction time. In physical primary school students had spontaneous interactions with peers during class and break, but now, as one student put it, “[they] see the teacher in the online class, but then afterwards, when the class is over, there’s not much” (personal communication, February 27, 2021). He went on to explain that normally he lived at the school dorms surrounded by deaf people, but at home, there was nobody else who was deaf around. Students were displaced from a setting with frequent access to natural language use and incidental language learning.

Deaf high school students are in a similar situation. They are expected to have stronger language abilities than primary school students, but lack continual, formal sign language lessons in the way that hearing students have access to English/language arts as part of the curriculum. Furthermore, the highschool that students attend is determined by a combination of geographic location and primary school performance, so few deaf students attend highschool

¹Quotes from deaf participants are based on interpretation.

together. Thus, in face-to-face classrooms mainstreaming already had a tendency to isolate deaf students from sign-rich environments. During online learning, their interactions that could lead to bidirectional learning with both deaf and hearing peers were reduced.

Institutional support

While teachers and interpreters are responsible for adapting the mainstream curriculum in linguistically accessible ways, the insufficient technological preparedness and lack of materials designed for deaf learners reflected a lack of institutional support. Teachers from one school explained that they received workshops on how to operate Zoom, but these workshops never delved into accessibility guidelines. Teachers and interpreters from other schools had no formal workshops whatsoever and had to learn what they could from colleagues.

Additionally, teachers lamented that most students arrive at primary school with little language ability due to a lack of deaf preschools or preschool level resources for hearing parents of deaf children. They felt access would be more achievable if a support system existed to provide accessible language during the critical period of early language learning.

In the mainstream highschool context interpreters are often the only professionals with knowledge about the linguistic needs of deaf students. However, their responsibility is only to interpret, relegating them to the periphery of core decisions on education delivery. One interpreter recounted the dichotomy he observed between mainstream schools that deaf students had attended in the past and those that had deaf students for the first time. In the former, teachers cooperated with the interpreter by providing transcripts of lessons to make interpretation easier, using multiple-choice assessments to minimize the burden of written English, and even setting up a remedial English class for the deaf students. However, in the latter schools, teachers would read from their personal notes as opposed to slides or a textbook available to the student and interpreter. These teachers would also refuse to spotlight the interpreter in case it distracted the hearing students and would ask the interpreter to sign “less distractingly” (personal communication, February 20, 2021c).

Social variables

Online schooling introduced new challenges related to variations in individuals' life situations. This was most evident in technology-related variables:

Access to devices

Most participants used two devices, one for class content and one for their teacher or interpreter. However, some students only had one device and did not know how to access all the necessary video feeds without two devices.

Levels of computer literacy

The above challenge was largely tied to participants not knowing how to use the LMS. Only one teacher knew how to utilise the accessibility features of Zoom and Google Meetings. In some cases, students knew more than their teachers or interpreters as one interpreter explained: “originally I was writing on a book and showing the book [through the webcam] and [the student] was like, you know, you could screen share” (personal communication. February 20, 2021a).

Appropriateness of device

While most participants used some combination of a laptop and smartphone or tablet for classes, teachers and interpreters reported that several of their students had to attend all classes using a smartphone only. This made it especially difficult to get the requisite visual input on a small screen.

Device quality

Household income may determine if individuals have fully functioning devices with high-definition cameras for optimal sign language visibility. One teacher and two interpreters reported having old laptops that would frequently crash. If a student encounters technical difficulties it affects the student only, but when this happens to an instructor, it affects all their students.

Internet access

It is no surprise that participants sometimes experienced internet problems during online school. However, certain conditions make this issue particularly salient. Bandwidth or internet speed depends on what people can afford. Moreover, some participants’ geographic location inhibited stable internet access. One parent described their location as a “hole” where internet signal is seldom strong (personal communication, March 3, 2021) and a teacher and interpreter both lived in rural areas where an internet disruption could last several hours. One interpreter described his experience as follows:

Internet connection these days is not really stable ... so information is being missed and you have to repeat over and over again ... sometimes it will make me cancel my session for the day. (personal communication. February 20, 2021a)

Discussion

Linguistic access in e-learning lies at the centre of an intricate system of conditions originating on and offline. Findings of this study corresponded to the three accessibility barriers discussed in McKeown and McKeown (2019): LMS, course materials and language and communication. However, two additional barriers presented themselves: institutional support and social variation.

In terms of the LMS, the presence or absence of deaf-friendly accessibility features, internet access and video quality all played a role in students' access to education. However, findings also evoke Pacey who argues that people often "focus on the tangible, technical aspect of any practical problem, and then think that the extraordinary capabilities of modern technology ought to lead to an appropriate 'fix'" (2000, p. 10). In the abrupt setup of nationwide e-learning under crisis conditions, the Ministry of Education appeared to be focused on continuing schooling remotely and not on accessibly delivering education to all students. Educators were not trained to operate the LMS to teach deaf students and there was a failure to consider modality-specific challenges the LMS presented. Deaf learners rely on space, movement, and tactile strategies as well as visual information. These were restricted online, meaning that e-learning did not convey the full range of communication available in sign language. This needs to be considered since it is reasonable to believe e-learning or blended learning practices may be continued in the future.

Furthermore, according to Jurgenson, online activity is "always deeply embedded in (or augmented by) offline social structures" (2011, p. 3). The lack of course material designed for deaf learners is symptomatic of an overarching lack of institutional support. It may not originate online but its presence is certainly felt online. The education system provides sign language trained primary school teachers and interpreters for mainstream secondary schools, but teachers and interpreters were left to improvise their own material in the form of personally recorded videos, or pictures and videos found online that often only tangentially connected with course content. This could stunt deaf learners' academic development since sign language is necessary for literacy skills (Johnson et al., 1989; Supalla & Cripps, 2008). Furthermore, in mainstream high schools, some hearing teachers did not cooperate with interpreters and considered signing a distraction to the hearing students. This reflects what a deaf Trinidadian described as "a Hearing culture approach" (Braithwaite, 2015, p. 23). Provision of educational personnel is but a token gesture unless these personnel are adequately supported to fulfil their tasks.

Additionally, there was an overall shortage of TTSL materials and teaching was already conducted in ASL before e-learning commenced. During e-learning, with the preponderance of ASL resources available online, educators gravitated further to ASL. Hauland and Allen (2019) assert that sign languages, like spoken languages, are conveyors of national cultures and heritages. They include the use of a national sign language as essential to preserving and respecting national deaf cultures. This is neglected insofar as e-learning (and education in general) contributes to the erosion of TTSL.

Another pertinent problem is that e-learning forced students to learn at home where their hearing families struggled to provide a fully accessible language context. The typical bilingual student uses skills learnt in the L1

to contextualize information encountered in the L2 (Cummins, 2007; Plaza-Pust, 2020). Deaf children born of hearing parents are then not the typical bilingual student since they may lack early L1 development. Most deaf children in Trinidad and Tobago experience language socialisation for the first time at deaf primary schools (Braithwaite, 2015, p. 23). Thus, e-learning in its current state may further contribute to language deprivation in primary school students since it minimises students' exposure to natural sign language learning.

Finally, new challenges arose related to owning a device, the quality and appropriateness of the device one can afford, internet service and level of computer literacy. These directly impacted access to information and education, and stemmed from variations between individuals' life situations, disadvantaging the most socially vulnerable students.

Limitations

Due to the researcher's limited sign language abilities, there was a great reliance on hearing stakeholders as sources of data. The perspectives of deaf students, while included in this study, were outnumbered by those of hearing primary school teachers, interpreters, and parents. Future iterations of this study should strive to include more deaf students as well as deaf leaders since the latter are deaf adults who have gone through the education system and who are directly interested in deaf welfare. Additionally, including classroom observations can help overcome the possibility of interviewees providing socially acceptable responses.

Conclusion and recommendations

This study revealed how the conditions of e-learning during the COVID-19 pandemic affected the linguistic access of deaf students in Trinidad and Tobago. Certain learning conditions arose in the new online setting, but others persisted from the offline period. Technology presented challenges in the form of internet stability, video quality and the language modality the technology was made to transmit. Others challenges pertained to the limited knowledge operators had of the LMS. There was an existing lack of course material that was somewhat improved by technology in that educators made greater use of improvised material that was either found online or personally created. However, these materials were informal and non-standard. The language used by teachers and interpreters changed little save for a possible tendency to use more ASL materials that were easily found online. However, by keeping deaf students away from their signing peers and reducing contact with teachers, e-learning produces a context where natural language socialisation can be reduced. This is situated in a wider context

where institutional support is low and social inequalities can determine access to technological resources needed for e-learning.

Possible solutions recommended by the researcher include but are not limited to the following:

- Providing all deaf students and their teachers and interpreters with standard educational technology (e.g., devices with large screens, high-quality webcams, and compatibility with e-learning software with accessibility features). This is an achievable goal for the government of Trinidad and Tobago since the two deaf primary schools in Trinidad enroll a total of 54 students and 24 teachers (personal communication, April 18, 2021; February 21, 2021a). This number is not expected to inflate dramatically if Tobago is included.
- Training educators in the accessibility features of the LMS through workshops.
- Creating pre-school level resources designed to provide deaf children with earlier exposure to the accessible language.
- Creation of culturally relevant TTSL materials.
- Enhanced support for sign language learning among hearing families with deaf children.
- Finally, the transition to online schooling has thus far been treated as a necessity and not an opportunity. The trials of inadequate institutional support are perhaps felt most at mainstream highschools where deaf students must contend with a lack of materials, communicative isolation, and a broader hearing culture approach. It is possible for e-learning to provide opportunities to explore the following initiatives:
 - Hosting remote workshops about deaf culture for hearing teachers across the country.
 - Bringing together deaf students from different high schools for remote all-deaf high school classes. Regional contact could also be facilitated since similar conditions exist across the Caribbean.
 - Creating special education material that assists educators of deaf students with teaching the mainstream curriculum; for example, sign language video translations of textbooks.

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