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Exploring the Effects of Masks on Student Engagement in ECE and ESE: A Literature Review of Related Research

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Abstract

During the advancement of COVID-19, safety protocols (including facial masks) were incorporated into public settings. The Centers for Disease Control and Prevention (CDC), due to safety regulations, recommend wearing face masks when in close contact with other people in public environments, such as in a classroom, where social distancing is difficult. Understanding these CDC recommendations is still critical when looking for effective and safe alternative forms of masking for particular industries. Many industries smoothly transitioned to daily use of traditional cloth masks, but other industries (such as education) serving clients with high communicational needs and communication-centered services sought masking alternatives. This study examines related research to explore the question of whether wearing masks may have any impacts on student engagement, particularly with regards to Early Childhood Education (ECE) or in the Education of Students with Exceptionalities (ESE). Research found that masks have a significant impact on factors of engagement (i.e., physical, behavioral, intellectual, social, emotional; The Glossary of Education Reform, 2016) and suggests transparent masks paired with Remote Microphones as a viable alternative to traditional masking. Future recommendations are provided in hopes of impacting the use of face masks with young students for both safety and for engagement. Future research should focus on ECE or ESE classrooms using observable language and literacy acquisition skills and visual cues related to the Categories of Engagement defined by The Glossary of Education Reform (2016).

Key words: ECE, COVID-19, ESE, exceptional needs, face masks, transparent face masks, student engagement, language, and literacy acquisition skills

Introduction

Since Spring 2020, people around the world have modified their lives and routines quickly to include COVID-19 safety protocols. These protocols, though needed, have caused the typical routines and habits of some people to become a struggle. For example, "stay-at-home mandates," remote work and instruction, and eventually in-person instruction with required face masks. Suddenly, children were not able to see facial expressions, including nonverbal contextual clues, such as the movement of lips and emotional expressions which are the core elements to be addressed during the teaching/learning process--especially when educating individuals with disabilities.

Children with Specific Language Impairment (SLI) struggle with phonological perception that impacts literacy (McDowell, 2018). Students with SLD need access to the visual cue of their teacher's lips during the pronunciation of words (Ehri, 2020). The addition of visual language cues is a greater priority for those with SLD who need additional context clues to equate meaning and understanding to a literacy lesson. This access to these additional visual language-based context clues can be blocked by the use of a traditional mask.

Children also need human engagement to develop effective language skills and to better learn and retain information. Adults may be inconvenienced by using masks in an educational or public setting, but children rely on the social and emotional components of language for the acquisition of proper language and literacy skills (Feldman, 2019). The social and emotional components of language are far more difficult to access for children with conditions related to social and emotional comprehension, such as children with Autism Spectrum Disorder (ASD). Diagnoses such as ASD impact their language and literacy acquisition even without the

additional barrier of face masks due to its impact on their perception of emotions (Matteson, 2014).

Other people to consider when looking at the impact of masks are children and adults with hearing and language disabilities. They can experience visual barriers with traditional masks due to their dependence on nonverbal communication, such as facial cues (Atcherson, et al., 2020). For educators, wearing a mask during instruction may potentially make it more difficult for children with exceptionalities to engage with lessons that include aspects of literacy. Relation to a high impact on engagement to literacy or literacy incorporated lessons could be linked to the added barriers of masks affecting the student's visual access to their teacher's mouth and lips articulating proper phonetic pronunciation of words (Ehri, 2020). The following thesis explores how wearing masks in an educational setting has the potential to impact engagement in students, especially those students younger than 8 years old and those who have underlying diagnoses that impact the learning and engagement with literacy and communication-based lessons

The following sections will give a thorough background of how COVID-19 impacted educational settings and people with disabilities. Following this *engagement* will be defined, given examples in connection to language and literacy-based skills, and shown how these skills are affected by the use of a variety of different mask types.

The Impact of COVID-19

The influence of COVID-19 has been extensive for a variety of industries, but education has been fully reformed by it. Education has been impacted far more than other industry due to the complex needs of its clientele, that being children (Asri et al., 2021). The social, emotional,

and communication needs of developing children are crucial to consider for children under the age of 13. These factors are important to include in every lesson taught because a human's brain learns through the use of social interaction and communication (Hiver et al., 2021). Without effective school interaction and communication children may struggle to grasp academic concepts being presented to them. Due to these needs for early childhood through elementary educational learning, COVID-19 safety protocols were less effectively implemented in the educational system with greater negative impact on its client base (the children). Research, such as Tremmel's 2020 research, documented this impact across alternative demographics in education who are the most at risk of academic struggle. Young children, English as a Second Language (ESOL) students, academically at-risk children from low income areas, and children with developmental delays, such as children with exceptional needs, are most affected. The demographic with the potential to be most strongly impacted by safety protocols, and therefore important to research, is comprised of those select individuals with exceptional needs complex enough to be placed in specialized Exceptional Student Education (ESE) programs (Asri et al., 2021). The impact of COVID-19, as stated, is all encompassing and by collecting documentation of its effects on education and different demographics of people we can then create a basis of proof that can help back up change for competent implementation of health and safety protocols in the education system in the near future.

Influence of COVID-19 on General and Exceptional Education

COVID-19 has impacted every element of education, from classes being instructed virtually, to in-class instruction needing to be split with virtual modes, and this has caused stress on teachers and students and impacted their competence. Many of these elements were explored

by Pressley (2021) as 329 teachers in the United States were asked to complete the survey related to their engagement and efficiency during the 2020–2021 school year. This 2020-2021 survey was named "*Teacher Sense of Self-Efficacy Scale (TSES*)" and was administered during COVID-19 to see the impact it had on instruction due to all the new alternate methods of instruction created in school districts around the country. The TSES scale that this study used is a method by Tschannen-Moran and Hoy (2001) that measures the efficacy of a teachers' instruction and engagement. The constructs indicated questionnaires that showed the teacher's opinions on their own abilities in teaching. The results suggested that the highest instructional self-efficacy was for in-person instruction at 6.22. Hybrid instruction had a mean self-efficacy report of 5.91, and the lowest average was the fully online instruction with 5.32 (Pressley, 2021). The study shows some of the impact that virtual instruction has on teacher's confidence in implementing effective instruction. Many elements probably played a role in this, such as technical issues, high absentees, and the difficulty of holding student engagement through the barrier of a screen in virtual instruction. In addition, specific subjects may be more difficult to teach with various COVID-19 restrictions (Tremmel et al., 2020).

COVID-19 also greatly influenced the procedures in a variety of environments, including rural locations with limited resources, and many places had to adapt to serve all their students effectively, including students with exceptionalities in ESE programs. A study conducted by Tremmel and colleagues in 2020 explored the impact COVID-19 has had on underprivileged ESE programs and compiled statistics and recommendations for advancing students to the next grade level. Schools in rural impoverished areas scored lower than the national average when compared to scores of National Assessment of Educational Progress (NAEP, 2019), leading to the supposition that statewide mandated remote learning would have a greater impact. With

limited resources, students and educators have impacted the general performance past expectation. A rapid survey conducted by Gross and Opalka was conducted online within the first half of the school year in 2020. These results showed that 27% of rural schools had expectations that the teachers would provide instruction to students, while in urban areas schools reported over 50% had expectations. Within rural areas other people and programs had to pitch in. Commerce Independent School District (CISD) is one example. CISD is part of the Tri County Shared Services Arrangement (SSA) in Hunt County, Texas and provides exceptional education services to 12.50% of students, which exceeds the state average of 9.60%. Many of these services are for students from disadvantaged backgrounds, as 65.8% are disadvantaged, as compared with the state average of 60.60%. COVID-19 has also added to the growing poverty rates due to the financial impact that COVID-19 had on industries. Many of these industries during this time chose to cut costs by letting go of work staff, leaving many unemployed and without a source of income (Tremmel et al., 2020).

The mobility rate with students moving from school to school is occurring more often and more rapidly, as well, with CISD mobility rates at 16.10% , according to Texas Education Agency (2019). Considering these statistics, it is apparent how important it is to consider a significant percentage of the population when implementing COVID-19 safety regulations in school districts with a high percentage of low-income students and students receiving exceptional needs services. Factors and services that need to be considered when implementing safety protocols are professional development for teachers needing to provide virtual classes and providing students with exceptional services (such as therapy and day programs). Many of these services may require training on how to get involved in resource allocation and how to

collaborate with all funding programs to meet the community's needs, including accessibility to technology (Tremmel et al., 2020).

Impact of COVID-19 on Individuals with Exceptionalities

The inclusion of individuals with exceptionalities should be considered in all settings and it is important to see how exactly COVID-19 has impacted people with exceptionalities in general. In many countries due to the COVID-19 lockdowns, there was an increased use of virtual communication software, social distancing, and the use of face coverings. These methods and safety and health procedures kept people safe but also impacted our ability to connect, communicate, speak, and hear, especially for individuals with hearing impairments and other varied disabilities. During 2020, a rapid online survey was conducted to collect responses from individuals with these exceptionalities and their personal feelings towards how these procedures impacted their day-to-day lives when communicating with others (Naylor et al., 2020).

The study surveyed 129 adults with an audiometric hearing loss in Glasgow, Scotland. The online survey was composed of a 24-item questionnaire that covered a variety of topics related to COVID-19 safety procedures and asked individuals to respond to each question with Agree, Disagree, or Neutral. The answers were broken up into two groups: a "Worse hearing group" and "Better hearing group." The results showed how many people with exceptionalities had struggled with COVID-19 safety procedures, and that they did affect people's hearing and ability to communicate (Naylor et al., 2020).

For descriptive statistics on questions related to face masks specifically, this survey found that for the "Worse hearing group," 92.9% agreed that understanding people wearing face masks is harder because the speech is muffled, while in the "Better hearing group," 85.5% agreed. For

the "Worse hearing group," 80.7% agreed to "Understanding people wearing face masks is

harder because I can not see their mouth moving" and 67.8% agreed in the "Better hearing

group." The results also showed that people's behaviors had changed in both groups

post-lockdown with video calls being used more and people with better hearing opting out of

using hearing aids due to mask use. When it came to the emotions expressed by the two groups,

there was an increase in anxiety related to verbal communication and having access to audiology

services. It was also shown that people spent more time, on average, thinking about their hearing

loss while COVID-19 safety procedures were enforced. Results also showed that most people

from both groups wanted essential workers to be provided access to transparent face masks

(Naylor et al., 2020).

More research still needs to be done on the effects of masks on engagement in different

environments with different communities. But a further understanding of what engagement is in

practice is first needed before knowing how to address how it may be influenced by factors of

masking.

Defining Engagement

There are many factors to consider when developing an effective learning environment

for students to stay engaged. Engagement is important in education but difficult to understand

without understanding what elements go into defining it. For a classroom environment, however,

The Glossary of Education Reform (2016), created by Great Schools Partnership, has worked on

defining engagement by breaking it down into separate constructs called the Categories of

Engagement, shown in Table 1.

Table 1

Table indexing Engagement Categories

Engagement Categories:	Definition:	Examples:
Intellectual	Student's interest and desire to interact and problem solve within the coursework. Accuracy and dedication to pursuing accuracy during instruction.	Appropriately answering the questions in an effective way that shows their understanding of the material. Answering verbal questions, having questions of their own related to the topic, making time to focus on studying the material.
Emotional	Students react with positive emotions in a way that facilitates learning instead of distracting with negative behaviors.	Smiling, laughing when appropriate, providing positive verbal and non-verbal reactions to the topic.
Social	Social interaction and collaboration with other students and teachers related to the lesson.	Positive collaboration with instructors and peers using positive and productive conversations that facilitate instruction instead of distracting from it.
Behavioral	The use of consistent cues, routines, and reactions that foster behaviors more conducive to learning.	Students' willingness to participate in a classroom's set schedule, routine, rules, directions, expectations and procedures, such as sitting in a designated location in a seat.
Physical	Participation in active physical movements, reactions, or routines to bring awareness to the lesson.	Eye contact with instructor or assignment, raising hand, dancing, playing, performing written assignments, manipulating related tools, objects, scissors, paper, calculators, etc.

(*The Glossary of Education Reform,* 2016).

These are all positive examples of the categories of engagement. However, engagement is not just simply positively represented or not represented. Sometimes it is negatively represented within an environment. Diversity in engagement within a classroom could be linked to a set of environmental factors that can have a negative impact on a student's ability to engage

behaviorally, emotionally, and socially (Hiver et al., 2021). Furthermore, with this new

post-pandemic world we live in, it is important to understand that students, and especially

students with exceptionalities, may harbor a lot of stress from their lives which they can bring

into the classroom by demonstrating *negative engagement.* Examples of negative engagement for

the Categories of Engagement can be seen in Table 2.

Table 2

Table indexing Examples of Negative Engagement

Engagements:	Negative Examples:
Physical	- Infrequent, un-prolonged eye-contact - Eye-contact and body positioned away from the instructor or lesson - Not physically participating in lessons - Not writing and following along
Emotional	- Disruptive emotional outbursts: of laughter, crying, whining, sighing loudly - Inappropriate facial reactions: frowns or pouting, making faces
Social	- Disruptive negative verbal reactions - Talking out of turn - Talking to other people besides the instructor when unprompted - Talking off topic - Asking questions unrelated to the lesson
Behavioral	- Disruptive and distractible non-verbal behaviors - Finger fidgeting, rocking, arm flapping, putting things in mouth, picking skin, biting hands, etc. - Not following routine and not using positive behaviors when expected, aka raising hand, etc.
Intellectual	- Shown by lack of comprehension of the lesson - Lack of dedication and focus on problem solving within the lesson - Lack of accuracy and dedication to pursuing accuracy

Note: Answers will be looked at but engagement with questions will be the primary focus for

testing Intellectual Engagement (The Glossary of Education Reform, 2016).

When looking at the categories of engagement, it is important to understand the cues within the context of one's own classroom environment and the importance of conducting lessons that inspire a variety of engagement types. However, not all engagement types hold equal representation within classroom lessons. Behavioral Engagement, Emotional Engagement and Social Engagement are more inclusive and present in ECE and ESE classrooms than the other categories because of the learning characteristics of children (Green et al., 2021).

Masks Impact on Behavioral, Emotional, and Social Engagement in the Classroom

Some of the more salient categories of engagement for educators to consider are Behavioral Engagement, Emotional Engagement, and Social Engagement because children have a biological and neurological need to be exposed to an environment filled with effective behavioral, social, and emotional interactions (*The Glossary of Education Reform*, 2016). A young child's capacity to engage socially, emotionally and behaviorally is heavily based on what they have or can observe when interacting with the adults around them in their environment. Within a socially supportive environment children can start to form important social skills that will lead to competent engagement in future academics. Reading another's face is an important social skill for engaging with others because reading another's face helps the person to regulate their own behavior (Green et al., 2021).

The reading of another's face and being aware of another's emotions helps a child to form an appropriate social response based on another's emotional clues. From there the child forms patterns of appropriate social skills performed as a task, some of which can be deemed specific behaviors (Gresham, 2000).

Because of the needed social skills used in the forming of behaviors, such as reading

emotions on another's face, Behavioral Engagement is an intersecting issue that correlates with

Emotional Engagement and Social Engagement elements, all of which are learned through

proper exposure to other people. To explain further, a child will only feel motivated to

Behaviorally Engage in classroom routines if they are also motivated to be Socially and

Emotionally Engaged (Gresham, 2000).

How does a teacher promote Social and Emotional Engagement in a classroom setting?

A teacher can inspire their student to be Socially Engaged with positive verbal interactions and

motivate their student to be Emotionally Engaged with positive facial expressions. These forms

of motivation are why access to the instructor's face, mouth, and voice is so important when

implementing engaging lessons. Traditional face masks can directly impact a child's ability to

learn in their environment and by extension affects their willingness and ability to engage in

appropriate behaviors. Interacting with a teacher whose face is obscured is creating

miscommunication and misunderstanding among students on what their behavioral expectations

truly are. Masks add a layer of misunderstanding to an environment that already has a plethora of

distractions that impacts students' engagement skills (see Table 3).

Table 3

Table indexing Engagement Skills and each related Engagement Category

Engagement Skill:	Engagement Categories:
Comprehension	*Behavioral, Emotional, Intellectual, Physical, Social*

Lipreading	Intellectual, Physical
Perception of Emotions	Behavioral, Emotional, Social

(*The Glossary of Education Reform*, 2016).

One factor to consider is that of added distractions, such as environmental noise. Environmental noise can be a significant distraction due to its impact on auditory perception. Prior to the implementation of masks, students were able to fill in the blanks for their missing auditory information by observing their teacher's mouth and pronunciation. However, now with masks covering up those visual cues, students struggle even more in a disruptive classroom environment (Nobrega, 2020). These layers of distractions can cause a rise in stress in both the learner and the instructor and can inhibit a person's emotional wellbeing and motivation to engage. Schools also have additional regulations placed on the environment related to student and teacher goals and expectations, many of which correlate directly with Behavioral Engagement. Currently, ECE and ESE teachers are expected to teach several content areas behind a mask, while giving instruction that is both educational and stimulating (McCollow, 2019). These regulations can cause stress among students and teachers during the enforcement of safety mask protocols and can interrupt a person's routine and extension of a student's ability to behaviorally engage and may even ignite Negative Behavioral Engagement (*The Glossary of Education Reform*, 2016).

The stress of noise and interruptions on routine does lead to an emotional and social impact on both the student and the instructor and an impact on Emotional and Social Engagement among students (Hiver et al., 2021). When looking at identifying whether a student is Emotionally and Socially engaged with a lesson, it is first important to be able to understand

the difference between the two types of engagement. Separating the categories of Emotional and Social Engagement from each other seems tedious but is very much needed in the education system when trying to prove if a student is engaged (*The Glossary of Education Reform*, 2016).

When looking for Emotional Engagement in a person, a teacher should start with looking for external identifiers and cues of emotions. Seeing as emotions are strictly internal factors, a teacher could look at any external visual or audible cues of a person's inner emotions and base any deductions off this (McCollow, 2019). These cues can be simple to identify if the student's face is not obscured by a mask. Identifying some of these cues includes looking at the person's audible emotional reactions unrelated to speech, such as sighing out loud; or a teacher can look at visual emotional reactions, such as facial expressions like frowning, and any emotional expressions unrelated to non-verbal communication, such as raising hands.

Children need to be studied in relation to their own feelings of disconnection, as they may experience the most struggle with facial masks. This disconnect around a masked face may be due to the idea that children are still learning how to conduct themselves socially and emotionally in different settings, mainly in school and academic environments (de Brito Lima et al., 2021). Children are still learning things like focus, self-control, self-motivation, comprehension, facial recognition, and social cues along with how, when, and in what ways they should react in different social settings (McCollow, 2019). These cues are not accessible to students when their instructors are wearing traditional cloth masks. Masks cover the instructor's mouth so that a student cannot perceive specific facial cues and features of the mouth related to the instructor's expression of emotion.

When looking to identify Social Engagement in students, teachers should look to primary language and communication-based interactions that show "positive" social interactions among

student and teacher and student and classmates in relation to any academic lesson. When looking at Social Engagement it is clear a student's own interactions with a lesson can be directly influenced by any emotional disruptions or behavioral disruptions. All types of engagement are connected to each other but also individually hold importance when being represented in a classroom setting. A facial mask can affect social interaction as facial masks can inhibit speech, audibility, and the visual cues of speech, such as perception of emotions and lipreading. These are directly related to Social Engagement and interaction but also overlap with Physical Engagement due to the manual manipulation of one's face and voice. Behavioral Engagement relates to routine, Emotional Engagement relates to a person's internal emotions, and Social Engagement relates to communication with other people. All three engagement categories play large roles in the development of children and their capacity to learn in a classroom environment.

Masks' Impact on Children's Perception of Emotions

All these styles of engagement are impacted by the use of masks in the classroom and can directly impact a student's ability to engage with the content being taught to them. The following sections will describe the specific skill set of *perception of emotions*, and its link to language and literacy acquisition which relate to Behavior Engagement, Emotional Engagement and Social Engagement.

When a typically developing child reaches age five, they are able to identify and name a range of emotions with close to as much accuracy as their adult counterparts (Green et al., 2021). Masks have the potential to inhibit this ability in children from infancy. Newborns who have not had enough exposure to adult faces may be at a deficit for impacting the infant's ability to learn facial processing and learn the proper patterns and behaviors needed to focus on another's face (Green et al., 2021). Because of the importance that exposure to faces plays in child

development, children should also be exposed to faces in their academic environment to develop academic skills.

An experiment conducted by Ruba and Pollak (2020) focused on the impact cloth masks may have on children's ability to identify emotions. For Ruba and Pollak's experiment, the researchers collected data from a range of school-aged children, ages 7 to 13 years old. A group of children were asked to infer emotions from images of faces covered up by sunglasses, face masks and faces not covered by anything. Children were then expected to identify what emotion each person was expressing. Each photo was meant to express one of three emotions: fear, sadness, or anger. The purpose of this study was to see if children's facial recognition of emotions were significantly impacted by face coverings. Ruba and Pollak's experiment had results that did show children were more accurate at identifying emotions on faces with no coverings ($M = .34$, $SD = .47$) compared to when the faces wore a mask, ($M = .24$, $SD = .43$), or compared to faces with shades alone, ($M = .24$, $SD = .43$). When testing emotional perception for faces with masks or shades, accuracy is shown to progressively increase as the age of the child being tested increased: $F (1, 78) = 5.85$, $p = .018$, $\eta p2 = .07$. This accuracy also showed when comparing improvements of individual children's accuracy across trials. Older children showed enhanced accuracy over time, more so than younger participants shown as Age x Trial, $F (6, 474) = 2.40$, $p = .027$, $\eta p2 = .03$. From the results, older children showed that they do have higher accuracy at emotional perception. Because of this, it can be inferred that adults also have a higher accuracy when compared to children, which varies by age range (Ruba & Pollak 2020).

Ruba and Pollak's experiment provided evidence to support the notion that masking influenced emotional identification in children, leaving room to explore transparent masks as an alternative to lessen this effect. This data sheds light on how a mask impacts children's

perception of emotions and their impact is present within all environments including the

classroom. This impact of the perception of emotions can cause Emotional, Social, and

Behavioral Engagement to drop within a given lesson. Lipreading has a high physical demand on

student engagement that can be linked to the categories of engagement when identified within a

classroom setting.

The following section will explain the impact of masks on lipreading and correlate this

skill set with Physical Engagement and Intellectual Engagement.

Masks Impact on Engagement Skills in Lipreading

To learn literacy and language, a child needs to focus on more than just sound, but also

how to properly pronounce these sounds with their own oral motor movements (Alcock, 2006).

Oral motor movement is the functional movement of the different parts of the mouth, such as the

tongue, jaw, cheeks, and lips, all of which play a large role in speech and other processes

(Pedroza, 2015). Lipreading is the ability to pick up visual information from a speaker's mouth

and is useful in that watching a speaker's facial movements improves perception of speech.

Lipreading could be a large contributing factor in obtaining necessary oral motor skills related to

pronouncing certain words or understanding spoken language; these factors are concealed by

traditional masks (Heikkilä, 2017).

Lipreading is an important component for children developing language and other skills

in relation to academic progress. A study by Heikkilä in 2017 was conducted on the relation of

lipreading ability to language skills and other academic skills through a series of standardized

tests. These tests were conducted first on 42 Typically Developing (TD) school-aged students

and 20 school-aged students with Specific Language Impairment (SLI) and later with adults

(with no underlying disabilities), after which the groups' results were compared.

This test measured word-level lipreading performance in Finnish-speaking, school-aged children. For the test, a silent video clip of a Finnish-speaking woman producing utterances of a word was shown on a computer. After the clip, four pictures were displayed on screen with one picture out of the four matching the word. The participants would point to the image that matched what they perceived to have lipread. The test was similar to a lipreading test developed by Kyle and Tye-Murray (2014) for English-speaking children.

Once researchers collected the lipreading scores, the scores were then compared to one another from several other different standardized cognitive and linguistics tests. These standardized tests included: (a.) The Phonological Processing test, which looked at phonological skills by observing the use of phonological processing to perceive word structures. (b) Word Segment Recognition. (c) The Phonological Segmentation Test, which tests for awareness of syllables and phonemes. (d) Digit Span was conducted by asking participants to listen to a list of numbers read and then orally repeat the list by memory. Other tests included were (e) Repetition of Sentences, (f) Comprehension of Instructions, (g) Boston Naming Test, (h) Word Generation test, (i) Oromotor Sequences, (j) Imitating Hand Positions, (k) Visual Attention test, and (l) Raven's Progressive Matrices.

From these tests, average scores were collected from group TD and average scores were collected from group SLI. These scores showed that on average TD, when compared to SLI, scored higher on all standardized tests. Digit Span (TD=12.0; SLI=7.7) (count of numbers for a span of time), Phonological Processing (TD=38.7 SLI=31.3), Comprehension of Instructions (TD=26.5; SLI=20.3), Repetition of Sentences (TD=25.1 SLI=15.3), Word Generation (TD=39.1; SLI= 26.0), Oromotor Sequences (TD=58.6; SLI=34.9), and Visual Attention (TD=12.2; SLI=5.0) TD were also found to have higher lipreading scores than those with SLI

(Heikkilä, 2017). When comparing adults scores later, results showed that on average adults had

the highest scores on the lipreading test and the other standardized tests when compared to both

the TD and the SLI groups. When looking at which test would correlate to lipreading,

researchers compared TD and SLI lipreading scores with the scores of the other standardized

tests conducted. The strongest correlation was found between lipreading, and Repetition of

Nonsense Words and Phonological Processing, which represented 33% of the variation in ability

of lipreading. The conclusion was that effective phonological skills are associated with

lipreading ability in both TD and SLI children.

Lipreading correlated with short-term memory capacity (Digit Span) and verbal motor

skills (Oromotor Sequences). Results across the board found the SLI children struggled more

than their TD peers with visual speech processing and lipreading, which could affect their

face-to-face conversations. These results show how some elements, such as the mouth, can play

a big role in students comprehending language and school lessons, especially in students with

SLI.

Masks' Impact on Engagement Skills in Literacy

Instructors wearing cloth facial masks in the classroom after the impact of COVID-19

could play an even bigger role than we think when it comes to student engagement and overall

comprehension of any lesson that involves lipreading, especially language and literacy. This

shows students rely on reading lips as one route to obtaining information. With masks, this visual

information is not accessible to students. When instructing subjects such as literacy, a teacher

should consider how masks obscure lipreading, and impede a student's observation of the

correlated oral-motor movements with their respective phonemes (smallest unit of sound). Once

effective pronunciation and students' discrimination of a sound is established, an instructor can move on to connecting them to corresponding decoding and spelling skills (Ehri, 2020).

The importance of lipreading and emotional perception are both key skills in language and literacy acquisition, but the third skill, comprehension, is also needed from the student when trying to learn. Comprehension, by comparison, is more difficult to acquire for those students with specific diagnoses. The following section will explain the effect masks have on the acquisition of comprehension skills alongside other literacy-based acquisition skills and their correlation to all the Categories of Engagement (Hiver et al., 2021).

Within the instruction of literacy, teachers should start with the basics when teaching individuals in the early stages of language development. These sorts of individuals include ESOL students, ECE students, and students who are at high risk of being academically behind and students with communication-impacting disabilities (Hiver et al., 2021).

Exploration of how COVID-19 has influenced literacy instruction, both during and post-school closure, was explored by Chamberlain and colleagues in a study published in November 2020. Chamberlain's article showed how COVID-19 influenced literacy instruction and affected the roles of students and teachers in instruction and gave explicit examples of this impact.

Within the Starpoint School laboratory school, located at Texas Christian University (TCU) in Fort Worth, Texas, one teacher from Starpoint relayed that those teachers had to "rethink" how to effectively support students, not just in academics, but also in how they needed to look at a child as a whole person. Teachers explored new routines and how literacy and writing could be a tool to ease anxiety and inspire creative expressions. The creative and emotionally sensitive approach to literacy is especially important for a school such as Starpoint,

as they are a school dedicated to personalized instruction for students with exceptionalities related to reading disabilities and learning disabilities. They serve students ages 6 to 11, and the staff is trained in reading instruction and in understanding specific exceptionalities, such as attention-deficit hyperactivity disorder (ADHD), dyslexia, and other related learning disabilities and intellectual disabilities. Despite the highly competent staff, the pandemic added another layer when it came to literacy instruction. Before virtual classes were launched, a lot of collaboration occurred between the teachers at Starpoint and a school called KinderFrogs, that serves students with Down Syndrome (Chamberlain et al., 2020).

Many creative methods were developed during the 2020 pandemic that impacted student's literacy skills and social skills. One such example shown was how students would take turns developing and presenting morning announcements, often creating videos where they shared the weather, facts of the day, and quotes (Chamberlain et al., 2020). Literacy is an important subject to explore for these reasons, as it influences so many aspects of our world and in how we connect (Hiver et al., 2021). Other examples showed how students would find comfort in listening to their teachers read stories while also developing listening comprehension skills. Writing projects were developed to help students engage and feel comfortable in doing so. Students would create virtual journals on what they read, incorporating pictures and their own words. Both words and pictures helped them understand what they were reading, and the virtual journal was an effective tool that also allowed students to express emotions.

What can be taken away from this study is the adaptability of students and teachers to make meaning and how literacy can serve as a tool to socially connect despite separation. Though people were fully capable of adapting, students still went out of their way to connect in a social way with their schooling (Chamberlain et al., 2020). With all of these results considered it

still shows that virtual learning is only a tool, not a replacement, for face-to-face education, as

students need Social Engagement to truly learn. Social Engagement is needed even in online

learning platforms, and that extends to traditional in-person instruction. Without effective Social

Engagement students are not going to be fully academically engaged, especially students with

language related disabilities (The Glossary of Education Reform, 2016). This study also shows

how literacy growth goes hand in hand with social skills and social-emotional development, and

writing is another powerful component to communication. The study goes on to mention how,

when conducting in-person instruction in the future, face masks will be required for students and

teachers, bringing another challenge to socializing, communicating, and comprehension (Hiver et

al., 2021).

Face Mask Alternatives

Face coverings and their possible effects on reading lips in the deaf community and their

possible impact on social interaction have been talked about, with some transparent face

coverings coming out as alternatives (Atcherson, et al., 2020). Transparent face coverings could

include a variety of facial coverings, including shields and masks. Transparent masks are a

modification of the traditional face mask, defined by the Center for Devices and Radiological

Health in 2020, as a mask that covers the person's nose and mouth; they function the same way

but are instead made of transparent materials, such as plastic. Face masks are for public use and

not considered medical equipment, so the user should still investigate the mask's ability to block

fluids and the ability to filter air (Center for Devices and Radiological Health, 2020). Because of

the concerns with engagement, transparent face masks and shields have been made and

introduced into the educational realm (see Figure 1).

Figure 1

Figure 1 gives visual representations of 3 types of transparent face wear, including two masks and a shield .

(a.) Plastic face shield and cloth mask.	*(b.) Windowed mask.*	*(c.) ClearMask*
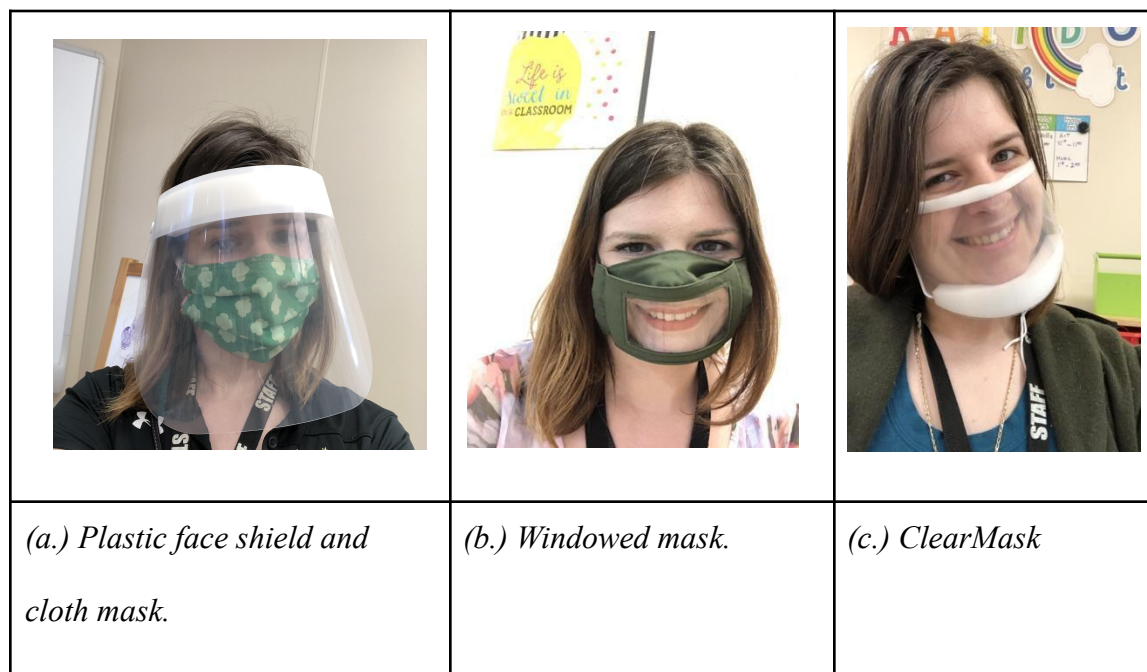
Note: Images taken by (Frahm, A, 2021) lead researcher.

These include plastic face shields for the entire face or just around the mouth *(a.)*. Face shields can be worn at a distance, but it is recommended by CDC to wear a shield with a cloth mask for environments where people are closer than six feet apart. Other transparent masks are closer to cloth face masks, such as windowed masks *(b),* with fabric covering most of the nose, cheeks, and chin with a small transparent plastic portion in the middle revealing the mouth. Other transparent masks include fully transparent face masks *(c)* that only cover the nose, mouth, and chin area much like the cloth masks, but are made of different transparent plastics and materials.

Despite some transparent face masks becoming available to consumers, transparent face masks remain in limited supply, with only a few on the market (Atcherson, 2020). Some of these

transparent or clear masks, however, may need to be paired with Remote Microphones (RM) to offset the impediment of sound that many clear plastics have been shown to have. Remote Microphones are shown to reduce factors such as possible effects on sound production and amplitude. RM are wireless systems created to amplify sound and help listeners better hear and understand speech in different environments. Some RMs are used with hearing aids or ear buds, while others are used with speakers and are called "sound field systems."

A 2020 study conducted through The Moorg Center for Deaf Education by Rudge, Sonneveldt, and Brooks explored the impact that different masks paired with RM have on children's auditory comprehension of vocabulary. Rudge, Sonneveldt, and Brook's experiment observed 15 adults with "normal" hearing in a classroom and observed their hearing perceptions by asking the participants to close their eyes. The study used a combination of different masks and face coverings with and without an RM, including a baseline group that used no face coverings and no microphones. The purpose of this study was to provide data on face coverings paired with RMs and their effects on speech perception in real life settings, along with providing data on how incorporating RM can affect sound quality impaired by masks (Rudge et al., 2020).

Findings for Rudge's experiment showed the baseline had an error rate of 2%. Face shields alone showed a significant increase in speech perception after being used with RM from .05% to 0.48%. Cloth masks alone also showed an increase when paired with RM, from RM .05% to 0.58%. The two conditions that showed the highest error rate were cloth mask alone and ClearMask™ with RM, and both were different from the baseline ($p = .37$, Cohen $d = 0.72$; $p = .15$, Cohen $d = 1.05$, respectively). The study found that ClearMask™ with RM had the highest error rate of 5%. The error rate was speculated to be due to the masks muffling the speech signal. The lowest error rate was the face shield with RM at 1.6% due to less obstruction of the face.

When comparing error rates between the different masks and conditions, it was found that windowed with RM and cloth with RM showed the smallest difference in final error rates between the two with only a 0.07 % difference. These results show that the norm in most classrooms using "traditional cloth masks with no RM pairing" can be effectively supplemented with the transparent alternatives such as a face shield with RM, or a windowed mask with RM. The use of RM in the classroom can aid in the impediment of sound that masks cause; and the transparent mask alternatives used in the classroom will aid in access to any visual cues and language and literacy acquisition skills that traditional masks cover up (Hiver et al., 2021). The discussion following this experiment pointed out that with this particular group of tests, the participants all mentioned needing to "work harder to listen." (p. 5).

Even though this research showed no large statistical effect on student hearing perception, this does not mean there is not any underlying effect on language comprehension. Furthermore, one should remember that this study involved adults and denotes that these final statistics are only fully conclusive for the demographic of adults used for this experiment. Understanding the limitation of the experiment's demographic leads me to speculate that other groups and populations may be more at risk of being significantly impacted by masks, especially young children and students with exceptionalities in more demanding and distracting environments, such as classrooms (Rudge, et al., 2020).

In particular, children with less developed auditory systems and focus or individuals with exceptionalities, especially individuals with communication disorders related to speech articulation, hearing, and auditory processing delays are all more at risk for being significantly impacted (Hiver et al., 2021). The understanding that these children are at more risk of being negatively impacted is also the consensus in the field of speech therapy as many professionals in

that field chose to use translucent face coverings when working with their clients starting at the beginning of the 2020 COVID-19 pandemic and after (Hiver et al., 2021). The following section reviews the research literature in regard to the benefits of transparent masks.

The Benefits of Transparent Masks

When the visual cues of communication are eliminated, intelligibility of speech can decrease to as low as 20% (Bankaitis, 2022). The impact masks have on language and literacy acquisition skills, such as the perception of emotions, lipreading, and comprehension is also significant (Hiver et al., 2021). Because of masks' impact on intelligibility, perception of emotions, lipreading, and comprehension speech pathology has been one of the industries that implemented the use of transparent face masks while working with clients (Bankaitis, 2022). When teaching speech, therapists should offer both audio and visual cues, as it has been shown to aid clients in breaking up the parts of speech. The use of transparent masks during speech therapy allows the client to learn how to properly augment their tongue, teeth, lips, and mouth in more precise ways, which helps with effective articulation in speech (Bankaitis, 2022).

The following section provides the synthesis of this literature review in terms of implications for ESE teachers using masks.

Implications of Transparent Masks and RM for ESE Teachers

As previously noted, the use of transparent masks have shown to work during speech therapy sessions. Therefore, it can be assumed that using transparent masks in an exceptional needs classroom could also show similar benefits. Transparent masks, such as a face shield or windowed face masks paired with RM, implemented by an ESE instructor could break down any communication-related barriers related to the wearing of traditional cloth face masks. These barriers relate to the covering of the mouth affecting non vocal communication skills, like

lipreading and interpreting emotions, and in extension comprehension. The other barrier caused

by face masks includes impediment of vocal speech output. With the use of transparent face

shields or windowed face masks paired with RMs these communication barriers are lessened,

which gives way to students feeling more confident and competent when trying to engage with

their classroom lessons (Rudge, et al., 2020).

Any classroom lessons related to language building skills, such as literacy, should be a

high priority when deciding when to implement transparent masks. The reason for prioritizing

literature is due to how conventional literacy is taught in schools. This teaching method involves

a stepped process involving connecting graphemes to phonemes and creation of sequenced

graphemes that form morphemes and then words (Ehri, 2020). Children may need to see the

pronunciation of a word when first learning how to pronounce new vocabulary. The individuals

who would benefit the most from the implementation of transparent face masks are those who

either are still learning literacy, communication, and engagement skills, such as young children,

or individuals who already struggle with literacy, communication, and engagement, such as

children with SLDs, ASD, or other exceptionalities that relate to language skills (Feldman,

2019).

The following section includes recommendations to further the research in this field of

facial coverings and ESE.

Recommendations for Future Research

Conducting research in the future on the topics of masks and engagement would be

highly beneficial, especially in relation to ESE programs or with ECE programs. When

developing future research related to traditional and transparent masks' impact on student

engagement, one might consider researching and measuring the engagement of children with

specific language disorders. Future researchers should consider all safety measures and health

risk factors of the population being studied. Research could implement transparent mask

alternatives safely in research by having certified ESE instructors conduct a language and

literacy lesson while standing the CDC's recommended 6 feet apart from participating students.

Lessons would be conducted with 4 different conditions including with instructors wearing two

different mask types with and without being paired with RM. Conditions shown below (see Table

4).

Table 4

Table indexing possible research conditions related to face mask and RM pairing in a classroom.

Conditions:	Instructor wears:	RM Pairing:
Condition 1: (mean norm) Cloth with no RM	Traditional cloth face mask	NO
Condition 2: Cloth with RM	Traditional cloth face mask	YES
Condition 3: Windowed with RM	Windowed face mask	YES
Condition 4: Windowed with no RM	Windowed face mask	NO

Future research might consider the teacher or researcher recording these conditions and

documenting behavior using a checklist of observable criteria exemplifying engagement based

on Categories of Engagement from The *Glossary of Education Reform*. For more specificity in

the data a study could take record of positive and negative examples of any engagement cues

shown in observation, including language and literacy acquisition skills like perception of

emotions, lipreading, and comprehension. See the Example shown in Table 3. This suggestion

for research would provide more solid, conclusive data on the effects masks have on ESE student

engagement (*The Glossary of Education Reform*, 2016).

Future research has such potential to further explore face masks across various

disciplines, developmental and age levels, and demographics, such as ESOL, and of course with

students with exceptionalities (Hiver et al., 2021). The pandemic that began with COVID-19

brought many changes and modifications to the field and opened a great deal of space to explore

best practices within different environments, health factors, and young learners impacted by

traditional or transparent face masks. I hope to pursue future research involving masks' impact

on language and engagement during my Masters Degree in Communication Sciences and

Disorders. The following example checklist may provide needed focus on important engagement

factors (see Figure 2):

Figure 2

Figure 2 shows an example of an engagement category checklist, including a section for The

Categories of Engagement, sections to put negative and positive examples, and sections for

participant demographics and needed background information.

Instructor:			
Date:		*Reading level:*	
	ID#:	*Init:*	
Group:	*Age:*	*Sex:*	*Exceptionality(s):*
	Examples:		

Engagements:	Negative	Positive
Physical		
Emotional		
Social		
Behavioral		
Intellectual		

(*The Glossary of Education Reform*, 2016).

Final Concluding Remarks

The expectations for researching this topic were fully impacted and influenced by the circumstances of the new post-quarantine world that I, and everyone else in America, was navigating. I, too, struggled with the impacts of COVID-19 and masking on my research.

At the beginning of my research journey, I was signed up to assist a professor in her early childhood research. However, this research never got off the ground, as within the first month, all of America and much of the world went into quarantine to fight the spread of COVID-19. The complete halt of this research opportunity was devastating to me. Yet, I pushed through these feelings and sent out email after email to professors in the field of education and in related fields such as psychology and communication science and disorders. Eventually, I landed another position in a survey-based research group run by my current chair, Dr. Judit Szente. Survey-based research at the time was almost exclusively the only research being developed and published. She was gracious enough to let me participate, but I soon realized I truly wanted to develop my own research. When I was developing my thesis, many schools were back to working in person and enforcing the use of facial masks to protect against the viral spread of COVID-19.

Around 2021, I was already wearing traditional face masks, as I was well aware of the dangerous spread of the virus. Later, however, I noticed some impact on engagement from my Students with Exceptionalities. Around that time in 2021, the vaccines were coming out, and I had my second dose along with most of the staff and students in the school. With the added safety protocol of vaccines and masks, I felt safe enough to start exploring different types of transparent masks within the classroom.

From there, I began my research for my thesis, with some expectations going in to collect my own data. I expected there to be limited research related to masks' impact on people's

emotional and social interactions and more research related to the impact masks had on the spread of viruses and the impediment of sound. These assumptions were formulated based on my awareness of current research at the time being slowed by the pandemic, like so many industries were and still are in 2022. While these assumptions were correct to a degree, I found more research in relation to virus spread and impediment of sound related to masking. Though I assumed masks did have some impediment on vocal sound output, I was not expecting the various mask types affecting sound so differently.

Thanks to my research journey, I learned a great deal, such as the information gleaned from Rudge, Sonneveldt, and Brooks (2020) article. I now have a more thorough knowledge of how the different types of masks affect sound. Furthermore, the use of remote microphones was not considered prior to researching the topic of transparent masks. Finding the effectiveness of pairing RM with a transparent mask to take away the factors of sound degradation had an impactful influence on how my thesis was formed.

When looking at the statistics, I noted the differences between each mask and RM condition, and then noted the most ideal pairing, that being a windowed mask paired with an RM. The most valuable research I amassed, however, was that of various survey-based research studies centering around collected testimonials from educators, from people with exceptionalities and their personal experiences with COVID-19, and from the research about the pandemic and masks. So few considerations were given to those students with exceptionalities who may communicate differently and who may see the world differently, inspiring me to push for my thesis's focus: the need to use transparent face masks and RM when teaching children with exceptionalities in a classroom (Rudge, et al., 2020).

To summarize, some research shows young children, starting at birth, rely on being able to see the faces of adults around them when learning (Pedroza, 2015). The research accumulated helped me form a strong rationale for the use of transparent masks in classroom settings. I know now from learning about perception of emotions, lipreading, comprehension, and other visual cues that students likely miss out on a great deal when traditional masks are used. Certainly, the use of transparent masks are needed when teaching young children learning how to engage in the classroom.

Exploring topics for my thesis allowed me to become more aware of how children with exceptionalities learn, which will help me as an educator to better understand how to engage children more effectively in classroom settings. I can now also confidently integrate windowed face masks with RM in my own future classroom when serving those children with and without exceptionalities. With my new knowledge, I will be able to facilitate the many kinds of student engagement, starting with the human connection and feeling like others want to understand. If I can help a child feel like I understand them and want to understand, then perhaps I can encourage students to understand and engage with the learning process in a classroom.

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