

Protecting While Connecting for Teaching and Learning

White Paper: The Best Selection of PPE in Reopening Classrooms

Abstract

This white paper is based on the analysis and review of more than forty peer reviewed quantitative and qualitative studies on Personal Protective Equipment (PPE), social emotional needs of students, and suggested practices for preventing the spread of COVID 19. With school districts forming task forces and developing plans for school reopenings, we prepared this document to facilitate the discussion of best safe practices while meeting student needs. As education experts, we synthesized recommendations for practical use of available PPE options in classrooms as a decision making guide in how to return to classrooms safely. This paper is a synopsis of emerging academic research and literature related to the successes and challenges of reducing the spread of COVID 19 with consideration of the social emotional well being of PreK-12 stakeholders. Our team utilized clinical research data and classroom expertise to make the recommendation for use of face shields alone, or in combination with face masks for the specialized needs of the school community.

Discussion

- Teachers struggle to keep a culture of known best classroom practices while living with the threat of COVID 19³².
 - *“Students in special education, English learners, and those with identified gaps need to be at school receiving services, resources, and facetime to support all needs.”* (Principal Lorena Rubio, Orange Unified)³².
 - Homemade masks are not considered PPE since their capability to protect the wearer is unknown, yet they are the only CDC preventative equipment measure recommended ⁹.
 - Current data suggests the primary source of transmission of COVID 19 is in respiratory drops from coughing, sneezing and talking spread to eyes, nose, and mouths³⁹.
 - Health experts do not expect a vaccine or known standard of treatment or prevention by return to school in fall 2020.
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Consider our Stakeholders...

Preschool Aged Child

Pre-school closure: Jackson is the child of a frontline worker and a parent who works from home. He loves going to daycare each day where he plays with friends and spends time with the teachers he loves. Jackson is learning to write his name and will surprise his parents with his efforts on his Mother's Day project going home soon.

Post-school closures: With the closure of daycares, Jackson is excited to be home with his parents and video conferencing with his teachers. While his computer skills are improving, his fine motor skills practice in holding a pencil and writing his name are no longer a part of his routine. He misses his teachers and daily hugs and his parents are starting to notice basic skills and emotional deterioration. Jackson's appropriate developmental learning is slowing and he is no longer his happy self; his parents are concerned and don't know what to do. They are at a loss for how to support him in a quarantined environment with lack of social interaction. Jackson desperately needs to return to daycare for his academic, emotional, and social wellbeing.

PPE Recommendation: Face shield with frequent handwashing and distancing as much possible for a preschooler.

Elementary Teacher

Pre-school closure: Elena is a dedicated 2nd grade teacher who is a recent cancer survivor. While undergoing treatment this past school year, her time with her students in collaborative circles reading books and sharing ideas brought her joy and inspiration. She is the welcoming face of the school with her big smile and warm nature. Families and students are drawn to her for support and well being with her ability to connect deeply with them.

Post-school closures: With obstacles in technology and the rapid switch to online platforms Elena is losing confidence in her ability to support and help students in a meaningful manner. Her greatest concern is her students with special needs. Jorge, who was struggling prior to the closure had just turned a corner and was making progress. Distance learning has created a lack of appropriate structure to meet his Individualized Education Program goals. Additionally, the loss of comradery in community and staff that inspired her to persevere through cancer treatments is waning and presents a threat to her health. Elena desperately wants to return to her students in fall.

PPE Recommendation: Face shield in combination with face mask when necessary along with frequent handwashing and distancing as much as possible.

Student

Pre-school closure: Aman is in a dual working home and normally begins his day at the YMCA an hour before school starts. His parents are working long hours and rely on him to stay current with homework and school requirements. At home, he is the older child who cares for his siblings and manages to keep up with his assignments. .

Post-school closures: Closure of schools and community centers means Aman does not have a stable connection to the internet. He spends most of his day caring for his younger siblings and supporting their needs with one computer between them. His parents are under immense stress working while struggling to maintain a safe home. Too busy, his parents are completely absent from all school interactions. Aman's social and emotional needs are at their highest levels without intervention or support. Aman desperately needs to return to school in the fall.

PPE Recommendation: Face shield with frequent handwashing and distancing as much possible.

Administrator

Pre-school closure: Dr. Martinez is a leader who lives and breathes her work with her school. A passionate TITLE I school principal who advocates for equity and access for her students daily. She has created a system of support and process for her unique family needs in her community. Parents trust her with the deep relationships she has built with each group in her diverse environment.

Post-school closures: With the abrupt school closures, she has not been able to connect with 30% of her families. Lack of technology is leading to loss of academic progress. Absence of intervention support and counseling along with the social emotional wellbeing and food insecurities of her families are keeping her awake at night. Enrollment is at its lowest projection for the upcoming school year and she is heavy with concern for loss of teachers and support staff when they are needed the most. Her district is still developing potential plans and she has not been informed of a chosen action plan. Elena desperately needs to return to her school this fall to support her families and staff.

PPE Recommendation: Face shield in combination with face mask when necessary along with frequent handwashing and distancing as much as possible.

The stakeholders described serve as representatives of a growing percentage of teachers and students who may not thrive in a solely distance learning format. Because school districts need to meet the needs of all learners, hybrid models of in person and distance learning are being recommended by state officials³². Parents and community members have expressed concern in reopening schools with a potential spike and heightened curve in infection and death rate as a consequence. When considering *how*

to protect those returning to classrooms, Personal Protective Equipment (PPE) is at the forefront of the discussion.

Introduction/Background

On March 11, 2020 the COVID 19 outbreak was labeled a pandemic spreading easily in communities with little known of the clinical blueprint¹¹. Widely understood was the spread of COVID 19 in respiratory droplets from coughs, sneezes, or by talking transmitted to the nose, mouth, or eyes¹¹. With the United States in the acceleration phase of the pandemic, schools closed immediately moving to distance learning for all students. While state, community, and school leaders wait for a vaccine or medications to control the spread of the virus, they are now faced with the dilemma of reopening schools while protecting the safety of all stakeholders.

The recommendations for safely reopening schools in the fall have been varied and left up to individual school districts to develop an appropriate plan that meets the needs of specific infrastructure and communities. Teachers have expressed the need to maintain a culture of best collaborative learning practices to support the academic and social-emotional needs of students^{13,32}. Members of school staff have also shared concerns in schools becoming hubs for transmission out to the larger community³².

At the center of all concerns is how best to protect students, staff, and the community while still providing effective means of learning³². Recommendations for Personal Protective Equipment (PPE) have ranged from simple to complex. Educational leaders have been asked to consider best safe practices for the unique needs of classroom social interactions. This paper serves to evaluate what PPE is available that can effectively protect students and teachers while maintaining best practices for student learning.

Table 1. PPE Protection Comparison of Characteristics

Characteristics		Face Mask (Medical) *CDC does not recommend it for public use.	Face Mask (Cloth)	Face Shield	Safety Goggles/ Glasses
Considered Personal Protection Equipment (PPE) ^{4,9,10,38}		✓	✗	✓	✓
Does Not Impact Medical Supply ²⁶		✗	✓	✓	✗
Provides a Barrier	Eyes ^{10,17,18,19,28}	✗	✗	✓	✓
	Nose ^{10,17,18,19,28}	✓	✓	✓	✗
	Mouth ^{10,17,18,19,28}	✓	✓	✓	✗
Comfort	Dermal facial heating ^{17,27,28}	Mild to Mod.	Mild to High	Mild	Mild
	Allow corrective lens usage ^{17,28}	✓	✓	✓	✓ Some Styles
	When concurrently worn with corrective eyewear ^{17,28}	✗ Fogging	✗ Fogging	✓	✓ Some Styles
	Fits properly over facial hair ^{17,28}	✗	✗	✓	✓
	Bulkiness ²⁶	✓	✓	✗	✗
Breathing	Measured breathing resistance ^{27,28,40}	Mild to Moderate	Mild to High (fabric dependent)	None	None
Protection	Creates a seal around nose & mouth ^{10,25}	✗	✗	✗	✗
	Used for source control (for infected person) ^{7, 5,12, 18,24, 34,38}	✓	✓	Unknown	Unknown
	Blockage of large droplets coming into: Eyes ^{17,30,34} Nose/Mouth ^{18,19,24,26,36}	0% 66%-75%	0% 4%-66%	Unknown 68%-96%	Unknown 0%
	Used for wearer protection (for healthy person) ^{5,12,38,28}	✓	✗	✓	✓
	Non-permeable material ^{10,17}	✗	✗	✓	✓
Durability	Length until disposal ^{19,24,26,28}	Single-use	Each wash compromises the integrity	Until damaged	Until damaged

Characteristics		Face Mask (Medical) *CDC does not recommend it for public use.	Face Mask (Cloth)	Face Shield	Safety Goggles/ Glasses
Communication	Facial non-verbal communication (e.g. smile, frown) ^{1,2,17,28}	✘	✘	✓	✓
	Clear voice ^{17,28}	✘	✘	✓	✓
	Ability to read lips ^{1,2,17}	✘	✘	✓	✓
Disinfection	How to clean ^{17,28,38}	Disposable	Machine Wash Daily	Alcohol Wipe /Soap & Water	Alcohol Wipe /Soap & Water

Cloth Masks

Cloth masks have become the primary recommendation for the public with little known of their ability to protect against COVID 19⁹. In an effort to reduce the strain on medical supplies to Health Care Providers (HCP), the California Department of Health stressed the importance of counties suggesting use of alternative face coverings to those of medical grade materials⁴¹. While the Center for Disease Control (CDC) recognized homemade cloth masks are not considered PPE⁸, the CDC has stated cloth face coverings made from household items or common materials are acceptable forms of protection⁹. The CDC warned caution be used when considering cloth masks for HCP and should be advised as a last resort⁸. Studies have shown particle penetration, moisture retention, corrective lens fogging, frequent cleaning, fit, and self contamination as risks in using cloth masks ^{19,22, 24,28,31,36}.

A 2019 study found fabric variations a concern in filtration, fit, and reusability after washing²⁴. Average fabric pore sizes ranged from 80 to 500 micrometers with COVID 19 spores averaging 0.12 micrometers²⁴. Efficiency in filtering ranged from 63%-84% and dropped by 20% after being washed four times²⁴. Fit of cloth masks are a concern in gaps between face and mask and stretched material widening pore size depending on the material used for the masks²⁴. Children in particular have been found less protected by face masks with a smaller face making it difficult for a tight fit³⁶. A factor to consider for adults in fit is facial hair impeding the effectiveness of the face mask¹⁷. Face mask wearers who wear corrective lenses or safety glasses in conjunction have reported fogging and irritation²⁸. With that said, several agencies and health organizations have recommended a combination of face masks and face shields to effectively reduce risk^{7,41}.

With classroom use of cloth masks under consideration as recommended by the CDC⁹, it is important to note, “there remains no evidence to guide a recommendation for child masking” (Children’s Hospital of Philadelphia, 2020). In addition to safety risk and spread of COVID 19 within and outside of schools, the culture of establishing and maintaining relationships in a collaborative setting is negatively impacted. Building relationships with teachers and each other are critical for academic and social-emotional growth in students³⁷. Students’ ability to make social connections and infer meaning are largely linked to facial expressions which cloth masks inhibit^{3,6}.

Face Shields

Face shields may be the best option for use in classrooms without obstructing the mouth while still protecting the entire face¹⁰. Although face shields have been recommended in combination with face masks by the CDC⁷, several studies have concluded face shields are an effective method in PPE⁷. In fact, the Infectious Diseases Society of America have included face shields as a method to maintain physical distancing in steps toward reopening communities¹⁴. Although face shields can be bulky, they provide a barrier for the entire face including eyes, nose, and mouth and extend from the top of the head to below the chin^{10,18}. Face shields have been referred to as a better alternative to face masks due to the eye protection³⁴. Medical masks were found to have mild to moderate breathing resistance, cloth masks ranged mild to high depending on material while no or limited breathing resistance was found in face shields^{15,17,27,28}.

Fit, extent of face coverage, reusability, facial visibility and protection associated with face shields make them an attractive option for classroom use. A study conducted aerosol simulations with influenza to test face shield effectiveness with airborne pathogens and found 96% reduction in inhalation of a simulated cough⁷. As stated by physicians, based on studies of droplet spread associated with Influenza, face shields hold promise as a better option to face masks in preventing spread of COVID 19¹⁸. Research suggests face shields offer advantages in reusability and fit while providing the added barrier of preventing face touching²⁶. Variety of materials used in creating face shields can lead to clarity issues and glare¹⁸. With higher quality plastics used in the development of the shields, clarity in visible communication is also a benefit in classroom social interactions⁴.

Facial visibility for teachers allows for context and emotion-perception in important interactions between students, educators, school staff and administration. Studies have found those connections made socially and emotionally directly impact student achievement³. The use of face shields without face masks allows full facial visibility

critical to the needs of students who have autistic spectrum disorder, are hard of hearing, or deaf²⁹. As noted by educators, the classroom is naturally a non-socially distancing environment with close interactions difficult to avoid leading to a constant need for personal protection^{25,32}. Educators and community members have expressed returning to classrooms in the fall imperative for student academic development and social emotional wellness³². Taking this into account, research and established studies point to face shields as a viable option to meet the specific needs of schools^{12,18,32}.

Safety Glasses/Goggles

While the CDC does not suggest goggles as an additional precaution to the public for prevention of contracting COVID, it is widely known the virus is spread by airborne droplets to nose, mouth and eyes^{9,39}. Guidelines for wearing goggles as a barrier for HCPs are provided by the CDC and suggest they should fit tightly with indirect vents and anti-fog coatings¹⁰. Glasses and safety goggles as stand alones are not an acceptable method of protection, but goggles have been studied in combination with medical grade N95 masks. The option of wearing goggles/safety glasses and masks in conjunction in the classroom environment does not seem a viable option given findings of studies conducted on both components.

A study conducted to test for safe use of N95 masks in combination with safety glasses found the practice did not prevent contamination of the eye mucous and found the use of full face shields far superior³⁰. Conclusive studies related to cloth face masks and their discrepancy in materials and poor efficiency in filtering particles impedes the consideration of the combination of components^{21,24}. While goggles/safety glasses alone do not protect the user, use of masks combined with goggles/safety glasses are not a practical or safe solution for classroom interactions.

Face shields make sense for the classroom

Districts are currently forming task forces now to prepare safety plans and protocols for school reopenings. As educational leaders, school districts, and policy makers plan for the reopening of schools, the time for careful consideration of what PPE will best meet the needs of student learning while providing the greatest level of protection is now³². Face shields could offer solutions for face touching, wearer compliance in young children, asthma, or other related breathing issues and the expectation of full day use which are also considerations unique to the classroom. Many companies are in the position to focus efforts on manufacturing high quality PPE face shields in time for fall opening of schools without impacting the demand for greatly needed medical grade PPE for healthcare providers. If school districts establish plans now for the distribution of

PPE face shields, students, teachers, and staff will have a critical piece of personal safety equipment to return to schools in fall. Without a vaccine or known treatment for COVID 19, a system of good classroom hygiene, frequent handwashing and use of a face shield is a responsible approach to safely reopening schools.

Conclusion/Recommendations for the Classroom

Teachers, parents and community members have expressed concern for protective measures when schools reopen. How will they utilize PPE in a safe manner and can a classroom culture of best practice still exist? As educators, and experts in classroom practice, we sought to analyze recommendations made by leading health organizations and analyze studies related to those recommendations to assess what could be a solution for PPE in the classroom. Also taken into consideration was the supply impact of medical grade PPE, therefore evaluating PPE options that do not pose a threat to the supply chain.

Among all preventative measures for spreading COVID 19, frequent hand washing and social distancing remains essential. Nevertheless, PPE is a component of daily life in living with COVID and will be a necessity in protecting those entering a school. With a market for PPE created for adults and the medical profession, we are faced with a new challenge of how best to protect the unique needs of our children and teachers so they may return to the classroom. Looking to other nations who were hit first with the pandemic that are now starting to implement reopening plans provide models to consider. The Temasek Foundation with its partners in Singapore are funding a face shield program that will provide reusable shields to over 650,000 students and 42,000 teachers and staff²⁰.

Although cloth masks have been the primary recommendation to the public to prevent spread of the virus, studies suggest filtering issues, poor fit, lack of facial visibility for instruction/communication as an ineffective method for classroom use alone. Although goggles or safety glasses offer an additional layer of protection, research has shown the combination is less effective than full face coverage. All research and literature taken together point to high quality plastic PPE face shields as offering the greatest protection while still allowing much needed face to face collaboration in the classroom.

It should be noted the efficiency of any one prevention alone is not a guarantee for safety. Despite the extensive research done on PPE most suitable for schools, there is still information emerging daily. Additionally, keeping in mind our stakeholders we met at the start of this paper, those with pre-existing conditions, or special circumstances should adhere to the best use of PPE for their individual needs and follow medical

professionals' advice. The use of a combined face mask and face shield is also a protective measure that decreases the likelihood of droplet transmission to both the wearer and the environment. It is found for the purpose of sustaining a culture of collaboration, best classroom practices with facial visibility while still protecting users lends itself to the use of face shields. A system of good classroom hygiene with frequent handwashing, surface cleaning, and the use of reusable face shields is the optimal model for the safest return¹³. The research compiled here is an effort to focus on the collaborative goal of common safety for all of our school members while updating and communicating best practices as new knowledge is gathered and learned.

About the Authors

TL NGSS Consulting is an independent education consulting group with extensive experience in various classroom settings including as classroom science teachers, professional development providers, and classroom lab safety trainers. They have partnered with public and private school organizations to support teachers in implementing best classroom practices safely and effectively. With repeated teacher requests for support in how to mitigate the transition safely back to the classroom, educational experts, Dr. Argento and Dr. Stillittano sought to research and evaluate available literature and data to guide decisions in appropriate measures. This review of literature was funded by Racing Optics® in an effort to understand best fit PPE for the educational setting.

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