Evaluating middle school students' understanding and emotional outlook on the COVID-19 pandemic

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Abstract

Background and Objectives:

The COVID-19 pandemic interrupted the education of nearly 94,000 students throughout Denver Public Schools (DPS), creating academic and mental health challenges. COVID Virtual Summer Camp (CVSC) was created to educate adolescents on topics pertinent to the pandemic and to assess its effects on students' understanding and emotional outlook.

Methods:

Eighty-five middle school students (63% females) were recruited. Two identical camps took place July 13th- 24th. Curriculum topics included microbiology, immunology, health disparities, recognizing and verifying credible sources, and mental health. Content was presented using short lectures, small group discussions, and Q&A sessions with medical and public health professionals. Participants completed pre- and post-camp surveys assessing their understanding of COVID-19 topics and emotions experienced in light of the pandemic. Participants described their emotions by choosing words, from a provided word bank, corresponding to positions on a pleasantness vs energy intensity scale.

Results:

Pre- and post-camp survey analysis showed a 55% increase ($p < 0.001$) in participants who felt confident discussing infectious diseases and a 48% increase ($p < 0.001$) in participants who reported knowing how infectious diseases spread. Pre- and post- CVSC, 62% and 68% of words chosen to describe emotions associated with the pandemic were in the unpleasant, high-energy quadrant, respectively.

Conclusions:

Our observations show the impact programs like CVSC may have on students' ability to understand and discuss topics pertinent to the pandemic while highlighting the challenge in addressing students' emotions associated with the pandemic. These observations may help guide future approaches to supporting students' academic success and mental health.

Introduction

The COVID-19 pandemic interrupted the education of nearly 94,000 students throughout Denver Public Schools (DPS) in the spring of 2020. Students were transferred to online curriculums to promote safety while remaining on track academically. This created challenges for students including unfamiliarity with virtual learning, decreased social interaction[1,2,3], and impaired access to mental health services[1,2]. Most students who engage in mental health counseling do so through their school[1,2]. The change to virtual education lessened the resources students depend on[1,2].

Consequences of these challenges are vast. Decreases in social interaction and sudden changes in learning style contributed to increasing levels of student anxiety as they continued their education from home[4]. Spending more time at home and the inability to engage in outdoor, social activities correlated with increased screen time[5]. Students were affected by the increased amount of information they accessed daily through online resources, including social media[6,7]. As the mechanisms of COVID-19 were not fully understood, information was confusing and contradicting, further contributing to increases in students' levels of anxiety[8].

Anxiety can be beneficial in the academic context but is harmful at its extremes[9]. Students may become overwhelmed with higher levels of anxiety, leading to decreased productivity[9]. When students become overwhelmed with anxious feelings, they disengage from activities, manifesting in impaired academic performance[9]. Such impairments may be short or long term, depending on the student's ability to recognize, label, and regulate their anxiety[10].

School systems across the US, including DPS, have provided students and families with COVID-19 resources aimed to describe symptoms and track reported cases. Though information was made available to students and families, mental health resources remained scarce[11].

The COVID-19 Virtual Summer Camp (CVSC) attempted to provide students with tools to navigate this situation. The curriculum taught skills to recognize and cope with the emotional consequences of quarantine and determine the veracity of information found on the internet. It also emphasized social determinants of health and vulnerable populations within the context of current events.

In this study, we evaluated students' self-reported understanding and confidence in discussing topics relevant to COVID-19 and the emotions associated with COVID-19 pre- and post-CVSC.

	Pre-CVSC Amount	Pre-CVSC (%)
Grade Level		
Sixth Grade	14	33
Seventh Grade	12	28
Eighth Grade	16	37
Sex		
Male	16	37
Female	27	63
Living Arrangement		
Apartment	2	5
House	40	93
Parents live in the same home	36	84
Parents live in separate homes	6	14
At least one parent has to leave home for work during quarantine	23	53
Access to learning technology		
Shared home computer	31	72
Personal computer	27	63
Cell phone	30	70
Tablet	25	58
Access to a physician		
Visited a physician in the past year	33	77
Ability to see a physician / nurse if needed	35	81
Ethnicity		
Caucasian	23	53
Hispanic / Latino	8	19
African American	4	9
Asian	6	14
Native American	2	5

Table 1. Characteristics of participants who completed the pre-CVSC survey (N=46).

Participants and Methods

Participants in the CVSC were recruited from students who completed sixth, seventh, or eighth grade (ages eleven to fourteen) in the (DPS) district the spring of 2020. DPS serves the entirety of metro Denver as well as surrounding suburbs. The demographic makeup of DPS middle schools is 53% Hispanic, 25.3% White, 13.4% Black, 3.9% Mixed Race, 3.1% Asian and 0.9% Native American[22].

A recruitment flyer was emailed to all DPS middle school science teachers through the listserv operated by the DPS science curriculum coordinator. This was done the first week of May, before the end of the semester but after all classes had transitioned to virtual learning. The recruitment flyer contained information for DPS science teachers, parents, and students with a link to a Google poll where those interested could share their contact information and reserve their spot in either of two identical camps. The program did not have a limit for participants. The flyer described the timeline, curriculum, and ten-dollar virtual gift-card incentive for completion of both surveys. The only requirements for participation were a functioning internet connection and Zoom compatible device. DPS had distributed Chrome Book laptops when transitioning to remote learning which we believe minimized the barrier to participation. The flyer emphasized that "those who do not yet consider themselves future scientists" were ideal participants. This was done to address the divide that can develop with discouraging science instruction experiences.

The curriculum for the camp was prepared by three first-year medical students (BS, EC, RM) at University of Colorado School of Medicine (CUSOM). The curriculum intended not to provide a list of facts about COVID-19, but rather to develop a skillset of informed inquiry. Presentations of twenty minutes or less followed by small group (5-10 students) discussions and problem-solving activities encouraged students to engage with the presented material. Programming was four hours per day, 9am to 1pm, with each camp lasting four days. Two camps were held, the first July 13th –16th (n=59) and the second July 21st -24th (n=26).

Following the development in medical education away from block-style learning and toward longitudinal integrated curriculums[12], content was presented as longitudinal threads reinforced each day. These threads included infectious pathogen biology, treatments, prevention, assessing suspect information on social media, social determinants of health, health disparities, nutrition, the immune system, and mental health in quarantine. By continuously reinforcing concepts in each topic every day, participants were allowed time after camp for concepts to solidify before being expanded on the next day.

As the participants' knowledge of each thread increased, opportunities to practice thinking critically were provided. Faculty from CUSOM were invited to field questions from the camp's participants. Participants from each camp were able to ask questions of six faculty throughout the four days of programming. These faculty included an emergency physician, an infectious disease specialist, a public health expert, a cardiologist, and a psychiatrist. Each faculty member corresponded to a particular thread in the curriculum. The emergency physician and infectious disease specialist answered questions regarding pathogens and treatment. The public health expert was able to elaborate on subjects related to health disparities. The cardiologist answered questions about nutrition's role in the immune system and the psychiatrist discussed the effects of COVID-19 on mental health.

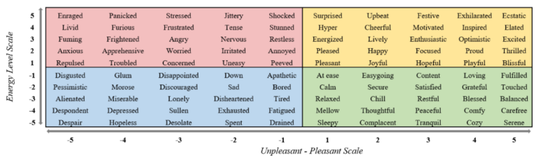
After sixteen hours of programming, small group problem solving, and asking questions of experts, the camp concluded with a discussion of how participants are now able to be "Science Ambassadors" to their communities.

A link to the second survey was provided the evening after the final day of camp. This email thanked the participants for their engagement with the material and for their questions. It also included the contact information for the three medical student instructors with insistence to reach out if any of the participants ever wanted to discuss content or a career in healthcare.

The surveys consisted of twelve multiple choice questions, four short answer questions, and a demographics question. Multiple choice questions included learning preferences, understanding of topics pertinent to COVID-19, and confidence level in discussing such topics, while free response questions probed attitudes and emotions towards the pandemic. Descriptive statistics were used to summarize the cohort's demographic characteristics (Table 1) .

For short answer questions, students picked a set number of words from a word bank of emotional descriptors (Figure 1) to elaborate on their feelings about the COVID-19 pandemic in one question and finishing their school year online in another. These questions intended to elicit qualitative responses from the participants. To analyze these responses, the emotional descriptor words were distributed across two spectrums: pleasantness and energy level[23]. Each emotional descriptor had a position on both spectrums (Figure 1). For example, both *hopeful* and *enthusiastic* are at a similar position on the pleasantness spectrum. However, *enthusiastic* is higher on the energy-level spectrum than *hopeful*[23]. By overlaying these two spectrums as axes, each emotional descriptor corresponds to a specific position in one of four quadrants. The quadrants are high-energy pleasant, low-energy pleasant, high-energy unpleasant, low-energy unpleasant (Figure 1).

Three reviewers independently identified the words chosen by the participants in the answers to free response questions. For words that were not identified on the RULER Mood Meter (RMM) , reviewers identified synonyms that accurately represented the words. For example, the word "afraid" was not on the RMM but was identified by the reviewers to be synonymous with the word "frightened," which was established on the RMM[13].



Results

The two camps combined included 85 participants. 46 participants completed the pre-camp survey and 36 completed the post-camp survey (54% initial participation with 78% retention) . Of the pre-camp survey responses, 63% were female, 54% Caucasian, 19% Hispanic/Latino, 14% Asian, 9% Black/ African American, and 5% Native American. Participants who had just completed 6th, 7th, and 8th grades were 33%, 28%, and 37% respectively (Table 1).

An increase in the number of participants who reported understanding topics pertinent to COVID-19 and feeling confident in discussing them was observed. A 55% increase (37% in pre-camp to 92% post) of students reported knowing the causes of contagious diseases and how such diseases spread (Table 2). Additionally, the number of students that felt confident in their ability discussing infectious disease increased by 48% (from 33% pre-camp to 81% post-camp) (Table 2).

	Pre-CVSC (N=43)			Post-CVSC (N=36)			P value*
	"I feel confident"	*"I feel like I know some things but not a lot"*	*"I don't feel confident at all"*	*"I feel confident"*	*"I feel like I know some things but not a lot"*	*"I don't feel confident at all"*	
Do you feel confident talking about how contagious disease spread?	14	27	2	29	7	0	<.001
	"Yes"	*"A little bit"*	*"No"*	*"Yes"*	*"A little bit"*	*"No"*	
Do you know what causes contagious diseases and how diseases are spread between people?	16	25	2	33	3	0	<.001

*Chi-squared test comparing Pre-CVSC and Post-CVSC responses

Table 2. Survey responses to questions assessing "confidence in talking about how contagious disease spread" and "knowing what cases contagious disease and how diseases are spread".

Some examples of the qualitative responses to the survey question, "Using at least five words from the list above, please describe how you feel about the COVID-19 / 'Coronavirus' pandemic?" are shown in Table 3. This question evaluated the students' attitudes, emotions, and feelings towards the COVID-19 pandemic. A total of 195 words were identified in the pre-camp survey and 163 in the post-camp survey (Table 4).

"Terrified, Nervous, Anxious, Distraught, Confused, Concerned, Enraged. Sometimes I feel enraged about the virus because I feel that some are being selfish and not looking out for each other by not taking careful procedures. I feel that they think it will not effect them, which while it may be true, they can be transmitters and effect others."

"Honestly, I'm fed up with it because I'm bored and don't know what to do anymore at home, at first I was nervous about my family getting sick but thankfully we are all good. I was also excited that I didn't have to wake up early anymore for school. I'm also a bit frustrated because there are many people who don't want to wear masks, which can the number of people with the virus. I hope that this can all end soon so we can go back to normal and be relaxed without nothing to worry about."

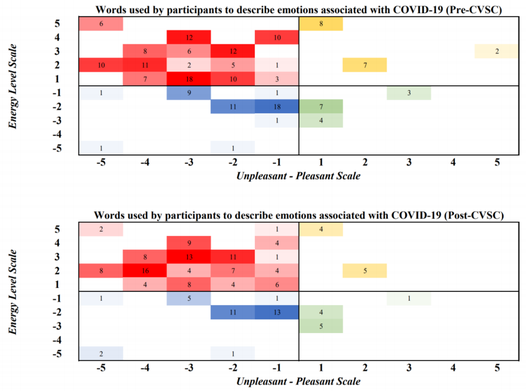
"I feel enraged about the hysteria that came from apathy towards virus prevention. I am concerned about the future of humanity if we continue this bitter behavior."

"I feel nervous about this pandemic, my worries are that if one of my family members is going to have this pandemic they could probably pass it on to people and it's going to be sad and hurtful for many families losing any family member. Something else I feel about this pandemic is that I feel really bored staying at home But something I am excited about this pandemic is that I get to stay home and sleep a lot but I'm interested learning about this pandemic."

Table 3. Response examples to the question "Please describe how you feel about COVID-19 / 'Corona virus' pandemic". Examples of words identified for analysis are underlined.

A theme expressed in the short-answer responses was a concern for the safety of family. While *nervous* and *anxious* were used to describe concern for personal safety, *frustrated* and *enraged* were used to describe feelings towards those not concerned with public safety. An example given by one student stated, "Sometimes I feel *enraged* about the virus because I feel that some are being selfish and not looking out for each other by not taking careful procedures" (Table 3). While explaining how some people don't seem to care about the virus, another student went on to say, "I am *concerned* about the future of humanity if we continue this bitter behavior" (Table 3).

Most responses in both surveys were observed to be on the unpleasant side, with a greater association with high energy (Figure 2). Of the words used by the participants in the pre- and post-camp surveys, 62% and 68%, respectively, were allocated to the unpleasant / higher energy quadrant (Figure 2). No significant shift was observed (Table 4).



Fi ith COVID-19, pre and post CVSC. Words were selected from the word bank to describe emotions associated with the COVID-19 pandemic.

	Pre-CVSC (N=195)				Post-CVSC (N=163)				P value*
	Unpleasant, High-Energy	*Pleasant, High-Energy*	*Unpleasant, Low-Energy*	*Pleasant, Low-Energy*	*Unpleasant, High-Energy*	*Pleasant, High-Energy*	*Unpleasant, Low-Energy*	*Pleasant, Low-Energy*	
Please describe how you feel about the COVID-19 / 'Corona virus' pandemic	121	17	43	14	110	9	34	10	.60

*Chi-squared test comparing Pre-CVSC and Post-CVSC responses

Table 4. Survey responses to the question assessing emotions associated with the COVID-19 pandemic.

Conclusions

This study indicates that while CVSC was efficient in teaching young adolescents about biologic, public health, and mental health topics related to COVID-19, it was not an effective mechanism for immediate improvement of emotional states. This supports the literature[10,14, 20] describing the several other factors influencing mental health besides lack of reliable information. We also saw a slight increase in the number of emotional words chosen in the high-intensity unpleasant quadrant of the RMM. While this difference was insignificant, it raises the question of whether providing these adolescents with more information regarding the pandemic's effects could have a marginally negative effect on emotional outlook.

Future studies would follow up with students to explore how their mental health has changed in months following the camp. Follow up material would question students' retention of camp material, mental health, and their use of the emotional regulation methods presented to provide an understanding of whether these tools are helpful when given time to implement. Future work would also aim to develop additional programs to address mental health effects of COVID-19. Finally, we would hope to see the study replicated in other school districts. Comparing this study with the results of similar programs that have been conducted would be of substantial benefit in understanding the emotional landscape navigated by adolescents during the COVID-19 pandemic.

References

1. Lee, J., 2020. Mental health effects of school closures during COVID-19. The Lancet Child & Adolescent Health, 4(6), p.421.
2. Clemens, V., Deschamps, P., Fegert, J., Anagnostopoulos, D., Bailey, S., Doyle, M., Eliez, S., Hansen, A., Hebebrand, J., Hillegers, M., Jacobs, B., Karwautz, A., Kiss, E., Kotsis, K., Kumperscak, H., Pejovic-Milovancevic, M., Christensen, A., Raynaud, J., Westerinen, H. and Visnapuu-Bernadt, P., 2020. Potential effects of "social" distancing measures and school lockdown on child and adolescent mental health. European Child & Adolescent Psychiatry, 29(6), pp.739-742.
3. Loades, M., Chatburn, E., Higson-Sweeney, N., Reynolds, S., Shafran, R., Brigden, A., Linney, C., McManus, M., Borwick, C. and Crawley, E., 2020. Rapid Systematic Review: The Impact of Social Isolation and Loneliness on the Mental Health of Children and Adolescents in the Context of COVID-19. Journal of the American Academy of Child & Adolescent Psychiatry,.
4. Fegert, J., Vitiello, B., Plener, P. and Clemens, V., 2020. Challenges and burden of the Coronavirus 2019 (COVID-19) pandemic for child and adolescent mental health: a narrative review to highlight clinical and research needs in the acute phase and the long return to normality. Child and Adolescent Psychiatry and Mental Health, 14(1).
5. Nagata, J., Abdel Magid, H. and Pettee Gabriel, K., 2020. Screen Time for Children and Adolescents During the Coronavirus Disease 2019 Pandemic. Obesity, 28(9), pp.1582-1583.
6. Wai WONG, C., TSAI, A., Jonas, J., Ohno-Matsui, K., CHEN, J., ANG, M. and Wei TING, D., 2020. Digital Screen Time During COVID-19 Pandemic: Risk for a Further Myopia Boom?. American Journal of Ophthalmology,.
7. Gao, J., Zheng, P., Jia, Y., Chen, H., Mao, Y., Chen, S., Wang, Y., Fu, H. and Dai, J., 2020. Mental Health Problems and Social Media Exposure During COVID-19 Outbreak. SSRN Electronic Journal,.
8. Liu, C. and Liu, Y., 2020. Media Exposure and Anxiety during COVID-19: The Mediation Effect of Media Vicarious Traumatization. International Journal of Environmental Research and Public Health, 17(13), p.4720.
9. Eysenck, M., Derakshan, N., Santos, R. and Calvo, M., 2007. Anxiety and cognitive performance: Attentional control theory. Emotion, 7(2), pp.336-353.
10. Singh, S., Roy, D., Sinha, K., Parveen, S., Sharma, G. and Joshi, G., 2020. Impact of COVID-19 and lockdown on mental health of children and adolescents: A narrative review with recommendations. Psychiatry Research, 293, p.113429.
11. Liang, L., Ren, H., Cao, R., Hu, Y., Qin, Z., Li, C. and Mei, S., 2020. The Effect of COVID-19 on Youth Mental Health. Psychiatric Quarterly, 91(3), pp.841-852.
12. Muller, J.H., Jain, S., Loeser, H. and Irby, D.M. (2008), Lessons learned about integrating a medical school curriculum: perceptions of students, faculty and curriculum leaders. Medical Education, 42: 778-785. https://doi-org.proxy.hsl.ucdenver.edu/10.1111/j.1365-2923.2008.03110.x
13. Hoffmann, J., Brackett, M., Bailey, C. and Willner, C., 2020. Teaching emotion regulation in schools: Translating research into practice with the RULER approach to social and emotional learning. Emotion, 20(1), pp.105-109.
14. Golberstein, E., Gonzales, G. and Meara, E., 2019. How do economic downturns affect the mental health of children? Evidence from the National Health Interview Survey. Health Economics, 28(8), pp.955-970.
15. Jo W, Lee J, Park J, Kim Y. Online Information Exchange and Anxiety Spread in the Early Stage of the Novel Coronavirus (COVID-19) Outbreak in South Korea: Structural Topic Model and Network Analysis. Journal of Medical Internet Research. 2020;22(6):e19455. doi:10.2196/19455
16. Reardon, R., Beyer, I., Carpenter, K., Irwin, M., Kester, K., Laird, J., Moore, C., Shah, P. and Conrad, R., 2020. Medical Student Development of K-12 Educational Resources During the COVID-19 Pandemic. Academic Pediatrics, 20(6), pp.763-764.
17. Imran N, Zeshan M, Pervaiz Z. Mental health considerations for children & adolescents in COVID-19 Pandemic. Pak J Med Sci. 2020;36(COVID19-S4):S67-S72. doi:10.12669/pjms.36.COVID19-S4.2759
18. Boudreau E. Supporting Teenagers in a Pandemic. Harvard Graduate School of Education. https://www.gse.harvard.edu/news/uk/20/08/supporting-teenagers-pandemic. Published August 27, 2020.
19. Adolescent's Wellbeing During COVID-19: Parental Resources |CDC. Centers for Disease Control and Prevention. https://www.cdc.gov/coronavirus/2019-ncov/daily-life-coping/parental-resource-kit/adolescence.html. Published August 20, 2020.
20. Chen B, Sun J, Feng Y. How Have COVID-19 Isolation Policies Affected Young People's Mental Health? - Evidence From Chinese College Students. Front Psychol. 2020;11:1529. Published 2020 Jun 24. doi:10.3389/fpsyg.2020.01529
21. Rideout, V., and Robb, M. B. (2019). The Common Sense census: Media use by tweens and teens, 2019. San Francisco, CA: Common Sense Media
22. Dpsk12.org. 2020. Facts & Figures | Denver Public Schools. [online] Available at: <https://www.dpsk12.org/about/facts-figures/#1568924309877-49b63c08-21ef> [Accessed 17 December 2020].
23. Nathanson, L., Rivers, S., Flynn, L. and Brackett, M., 2016. Creating Emotionally Intelligent Schools With RULER. Emotion Review, 8(4), pp.305-310.
24. Brackett, M., Bailey, C., Hoffmann, J. and Simmons, D., 2019. RULER: A Theory-Driven, Systemic Approach to Social, Emotional, and Academic Learning. Educational Psychologist, 54(3), pp.144-161.

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