Forum for Education Studies 2025, 3(2), 1925.
https://doi.org/10.59400/fes1925

Article

Learning recovery post-COVID-19 in Ohio's Appalachian communities: A multivariate causal-comparative investigation

Colleen Richardson[1], Cynthia J. Davenport[2], Karen H. Larwin[3,*]

[1] Teacher Education and Leadership, Youngstown State University, Youngstown, OH 44514, USA
[2] Student Services Department, Seneca Valley School District, Harmony, PA 16037, USA
[3] Education Leadership, Youngstown State University, Youngstown, OH 44514, USA
*** Corresponding author:** Karen H. Larwin, khlarwin@ysu.edu

CITATION

Richardson C, Davenport CJ, Larwin KH. Learning recovery post-COVID-19 in Ohio's Appalachian communities: A multivariate causal-comparative investigation. Forum for Education Studies. 2025; 3(2): 1925. https://doi.org/10.59400/fes1925

ARTICLE INFO

Received: 24 November 2024
Accepted: 20 January 2025
Available online: 3 April 2025

Abstract: This study investigates causal-comparative relationships between COVID-19 learning loss in reading and math for 3rd grade through 8th grade students and Appalachian status of schools across Ohio. This study further explored potential differences in learning recovery for Appalachian and non-Appalachian schools and potential factors that may impact recovery. Archival data was collected from the Ohio Department of Education and Workforce to support analysis of differences in average proficiency on Ohio State Testing results. The initial investigation occurred without adjustment or differentiation for socio-economic status, operationalized as eligibility for free or reduced-price lunch, and was then adjusted by this variable for enhanced analysis. The study analyzed additional information about Educational Services Center delivery models for interventions and staff support. The analysis revealed no significant difference in learning loss between Appalachian and non-Appalachian schools, although Appalachian schools demonstrated more negative decline on average over the study period. The study revealed statistically significant gains in reading in an Appalachian County with an Educational Service Center that utilizes a direct service delivery model for professional development and emphasizes targeted interventions. No significant gains were made in math from this same county. The analysis supports the need for future research into service model approaches and their potential impact on preventing learning loss and aiding in learning recovery.

Keywords: COVID-19; reading; mathematics; interventions; growth; county-wide supports

1. Introduction

The COVID-19 pandemic ushered in unprecedented disruptions to education worldwide, with significant repercussions for students' academic performance, particularly in the realms of mathematics and reading. Several studies and reports have documented the multifaceted impact of the pandemic on these critical subjects, shedding light on the challenges faced by students across various demographics. Ninety percent of the world's student population faced disruptions in education due to COVID-19-related school closures. The abrupt shift to virtual platforms and non-virtual alternatives has created challenges in providing equitable access to reading materials, especially for students in low-income households who may lack adequate digital resources [1].

Research conducted by the Organization for Economic Co-operation and Development indicates that the pandemic has exacerbated existing inequalities in educational outcomes, with disadvantaged students experiencing a more significant decline in reading proficiency compared to their more privileged counterparts [2]. The

limited availability of internet connectivity, reduced access to direct instruction, and diminished opportunities for interactive reading experiences have contributed to a concerning decline in literacy skills among students during the pandemic.

In the realm of mathematics, the impact of COVID-19 has been equally profound. A study published found that the closure of schools and the shift to remote learning resulted in a decrease in students' mathematical achievement, with a disproportionate impact on vulnerable populations [3]. The study highlighted the importance of in-person instruction and the challenges associated with adapting direct and collaborative approaches to an online format or worse yet, to worksheet packets for urban areas where internet connectivity was unavailable to families.

Overall, researchers have found that the impact of COVID-19 on learning is profound, however these negative impacts hit the most vulnerable groups the hardest [4–6]. The impact on students in Appalachia has been particularly pronounced. Appalachia, a region encompassing parts of thirteen states in the eastern United States, is known for its unique challenges, including economic disparities and limited access to resources. The pandemic has exacerbated these pre-existing issues, creating a perfect storm that has disproportionately affected students in poverty who were already suffering from widespread achievement gaps [7,8].

A study in collaboration with various education agencies delved into the specific challenges faced by students in the region during the pandemic [9]. The findings underscored the complex interplay of factors contributing to the negative impact on math and reading outcomes, with poverty emerging as a central determinant. The shift to remote learning exposed the digital divide in Appalachia, where at least 24% students lacked access to reliable internet connectivity and devices necessary for virtual education, significantly limiting students' ability to engage in online math and reading instruction [9]. Students in poverty were more likely to face these connectivity challenges, compounding the educational inequalities that existed before the pandemic.

A study highlighted the challenges faced by rural schools, including those in Appalachia, in adapting to online math instruction [10,11]. Teachers in rural areas often had less access to technology before COVID-19, and most lacked professional development opportunities to transition to virtual teaching effectively. For students in poverty, who may already face barriers to quality education, the sudden shift to online learning intensified the struggle to grasp complex mathematical concepts. Additionally, the absence of in-person instruction in math, a subject that often requires direct learning and immediate feedback, has left students in Appalachia, particularly those in poverty, without the necessary support. The report emphasized the importance of face-to-face interactions for effective math education, citing the challenges associated with virtual instruction in conveying abstract mathematical concepts [9]. This gap in understanding could have long-term consequences for students' mathematical proficiency.

Students in Appalachia faced similarly complex challenges in developing reading skills during the pandemic. The limited access to physical books and resources, a common issue in rural areas, was exacerbated by the closure of school libraries. A study highlighted the importance of school libraries in promoting reading skills, particularly for students in poor rural communities [12]. The closure of these vital

resources further hindered the development of reading proficiency, particularly for students in poverty who lack alternative access to books [13]. Likewise, COVID-19 disruptions negatively impacted the social and emotional aspects of reading education. Reading often involves group activities, shared reading experiences, and discussions that foster a love for literature. Research has emphasized the importance of social engagement in promoting reading skills [14]. Isolation caused by the pandemic has diminished students' motivation to read [15]. Students in poverty, who may already face social and emotional challenges, are particularly vulnerable to these negative consequences.

The negative impacts of COVID-19 on math and reading outcomes for students in Appalachia, especially those in poverty, can be attributed to a confluence of factors. The digital divide, economic disparities, limited access to resources, and the unique challenges of remote learning have collectively created a formidable barrier to educational success in the region. Efforts to address these challenges must be multifaceted, considering the specific needs of students in poverty and leveraging community resources to bridge the gaps.

To mitigate the impact on math and reading education, targeted interventions during and after the initial impact of COVID-19 were essential [16]. Future investments in broadband infrastructure can help address the digital divide, ensuring that all students have equitable access to online resources [17]. Professional development opportunities for educators in rural areas can enhance their ability to deliver effective virtual instruction, particularly in subjects like math that require specialized teaching methods. Additionally, community partnerships and initiatives to provide books and reading materials to students in need can contribute to fostering a positive reading culture [18]. Policy interventions are also crucial to address the root causes of educational disparities in Appalachia. Increased funding for schools in impoverished areas, targeted support for families facing financial hardships, and initiatives to promote community engagement in education can collectively contribute to creating a more equitable educational landscape. These interventions should be informed by a nuanced understanding of the challenges unique to Appalachia, considering the region's economic, cultural, and geographical factors.

Papadakis et al. [19] study how cloud and AR can reduce COVID-19-related educational disruptions in remote and poor areas like Appalachia. The essay discusses how different technologies work together to provide scalable, interactive, and immersive learning environments that solve interrupted quality education [19]. Augmented reality provides realistic, practical simulations to supplement cloud-based solutions that centralize and disseminate educational resources to distant areas without physical infrastructure. This method is essential for educational recovery, especially in rural places.

Cloud platforms make educational content available to all [19]. Rural areas with poor educational infrastructure need this. Appalachian towns can reduce economic inequality by reducing their reliance on textbooks and typical classroom settings. Gamified and visual storytelling in AR promotes student retention by 25%–30% [19].

Papadakis et al. [19] stresses the importance of educator professional development to optimize these technologies' benefits. Targeted training is needed in rural Appalachia, where 60% of teachers feel unable to use digital technologies [19].

These initiatives should teach educators how to use AR and cloud-based technologies and encourage the creation of culturally relevant content that connects with local communities [19]. AR apps based on Appalachian culture could boost academic performance and community pride [19].

2. Federal response

In response to the known impacts on literacy and mathematics, federal and state governments have taken significant steps, allocating billions of dollars to state education agencies (SEAs) through three pivotal stimulus packages: the Coronavirus Response and Relief Supplemental Appropriations Act (CRRSA); the Coronavirus Aid, Relief, and Economic Security (CARES) Act; and the American Rescue Plan Act (ARP), which made the largest contribution to the Elementary and Secondary School Emergency Relief (ESSER) Fund [20].

The Elementary and Secondary School Emergency Relief (ESSER) funds distributed over three relief packages, were utilized to disseminate nearly $200 billion in federal aid for schools, which Congress allocated in response to the COVID-19 pandemic and the significant disruptions to education it caused. The amount of financing allocated through Title I, the main program for elementary and secondary schools in the US Department of Education, is around 12 times more than the average level. This equates to nearly $3500 per student, while the average spending per student in the US is approximately $13,000. Each of the three stimulus programs distributed funding to SEAs utilizing the Title I, Part A (Title I) formula of the Elementary and Secondary Education Act [20]. This mechanism ensured that the school districts with the greatest disadvantages received larger amounts of funding, on average [20]. The funds were allocated with the purpose of providing financial support for operational needs, offering mental wellness services to students, and addressing the challenges faced in learning for the period of 2021–2022 and beyond [20].

2.1. ESSER I: Coronavirus aid relief, and economic security (CARES) act

Congress allocated $13.2 billion from the $30.75 billion Education Stabilization Fund, which was established under the Coronavirus Aid Relief, and Economic Security (CARES) Act, specifically for the Elementary and Secondary School Emergency Relief Fund (ESSER) Fund on 27 March 2020. The Department granted these funds to State educational agencies (SEAs) with the intention of providing emergency relief to local educational agencies (LEAs), including charter schools that function as LEAs. The objective is to address the ongoing impact of COVID-19 on elementary and secondary schools nationwide. The allocation of ESSER Fund awards to State Education Agencies (SEAs) is proportional to the amount of funds each state received under Part A of Title I of the Elementary and Secondary Education Act of 1965, as amended, in fiscal year 2019 (Elementary and Secondary School Emergency Relief Fund—Office of Elementary and Secondary Education) [21].

2.1.1. ESSER II: Coronavirus response and relief supplemental appropriations (CRRSA) act

On 27 December 2020, the Coronavirus Response and Relief Supplemental Appropriations (CRRSA) Act, 2021, was ratified. It gave the Elementary and Secondary School Emergency Relief (ESSER II) Fund an extra $54.3 billion. The allocation of ESSER II Fund awards to State Educational Agencies (SEAs) is based on the same proportion as the monies each state received under Part A of Title I of the Elementary and Secondary Education Act of 1965, as amended, in fiscal year 2020 (Elementary and Secondary School Emergency Relief Fund—Office of Elementary and Secondary Education) [21].

2.1.2. ESSER III: American rescue plan

The American Rescue Plan Elementary and Secondary School Emergency Relief (ARP ESSER) Fund, created under the American Rescue Plan (ARP) Act of 2021 (Public Law 117-2), which was enacted on 11 March 2021, provides approximately $122 billion to States and school districts (Elementary and Secondary School Emergency Relief Fund—Office of Elementary and Secondary Education) [21]. This initiative aims to assist in the secure resumption and uninterrupted functioning of schools while also addressing the widespread impact of the COVID-19 pandemic on children across the country. The ARP Act allocates funds for diverse purposes, including but not limited to $1.75 billion for non-public schools, $3 billion for special education, $850 million for the Outlying Areas, and additional funds for homeless children and youth, tribal educational organizations, Native Hawaiians, and Alaska Natives [22].

The primary goals of educational investments under ARP, to be allocated by September 2024 and implemented by January 2025, are to support the safe reopening and ongoing functioning of schools while addressing the impact of the COVID-19 pandemic on the nation's youth. Districts are obligated to prioritize efforts to mitigate the disproportionate effects of the COVID-19 pandemic on underrepresented student populations when allocating 20 percent of district funds for addressing learning setbacks [22].

2.2. State of Ohio

Ohio was granted a sum of $4,475,243,513 as part of the ARP Elementary and Secondary School Emergency Relief (ESSER) fund. The state received an initial payout of $2,981,378,065 on 24 March 2021, followed by an additional release of $1,493,865,448 on 15 July 2021[23]. Ohio's plan for ARP ESSER centers around major needs, given the initial statewide enrollment of 1,645,412 students for the 2020–2021 school year. These include offering assistance for the intellectual, social, and emotional requirements of students and educators, as well as investing in academic resources, connection, and enhancing different educational chances, regardless of whether they are in-person, remote, hybrid, or blended [23].

In 2021, the Ohio Department of Education (ODE) emphasized the need for schools and districts in the state to offer secure and complete in-person learning choices to all students who want to take part, prioritizing the safe reopening of schools and ensuring their continued safe operation. To achieve this, the state actively offers immunization to

children between the ages of 12 and 18 through different channels, including pediatricians, school partnerships, and summer food service program sites [23]. Schools have the authority to offer vaccination chances to children through designated providers throughout extended or summer learning periods and in the future school year [23].

In addition, ODE utilizes state-level data to identify and tackle patterns that relate to children who have been significantly impacted by the COVID-19 pandemic and develop long term plans to address their needs [23]. Every district is required to delineate its strategy for mitigating the effects of the pandemic on particular student demographics. ODE addresses the social, emotional, and mental health needs of students and educators by using trauma-informed and culturally responsive methods [23].

As students resume their academic pursuits during both the summer and the 2021–2022 academic year, ODE implements mental health support derived from data obtained from the Ohio Healthy Youth Environments Survey [23]. In addition, the ODE works together with the Governor's office, the Ohio Department of Medicaid, and programs from the Ohio Department of Mental Health and Addiction to strengthen school-based initiatives and enhance resources for the mental and physical well-being of children [23].

3. Methods

The current causal-comparative investigation initially examined school districts in five counties located in eastern Ohio that are considered in the Appalachian zone between the years of 2019 and 2023. Specifically, this investigation seeks to understand if the impacts of COVID-19 were similar across all counties and what if any differences existed. Data for this investigation was extract from the Ohio Department of Education and Workforce. All counties have urban, rural, and suburban communities, with a mix of socio-economic status. Each county has a dedicated Educational Service Center, that is supported with state funding. Each county has a career-technical or vocational education option available, as well as a mix of schools with and without open enrollment. According to the Fordham Institute, NE Ohio has a sizeable home-school population, public and private charter schools, and non-funded private schools [24]. There is a variety of each in the of the five counties. The data was extracted for 3rd grade through 8th grade. In Ohio, these students participate in annual state-mandated reading and mathematics testing.

Following the initial investigation, additional data was collected for non-Appalachian districts/counties (n = 171 school districts) to examine if there were differences in the recovery for the non-Appalachian schools relative to those identified as Appalachian. This data was examined specifically for third-grade student test scores from 2019 to 2023 from counties listing at least five school districts. Third grade is an important test grade since Ohio is a Third Grade Reading Guarantee state. Currently, sixteen states and the District of Columbia have some form of a third-grade reading guarantees in place [25].

4. Results

The initial analysis included 3rd through 8th grade change in average proficiency. The data, derived from available estimated test scores, were extracted and reported

without adjustment or differentiation for the 2019–2023 periods. Additionally, an analysis was conducted to examine the performance of school districts in the five surrounding Appalachian counties. **Table 1** provides the results based on the available data from these counties.

Table 1. Data by county: changes in average reading and math scores.

County	Number of Districts	Average Reading Difference 2019–2023	Average Math Difference 2019–2023
1	7	−0.26	−0.42
2	13	−0.26	−0.44
3	5	−0.14	−0.30
4	16	+0.12	−0.05
5	11	+0.08	−0.05

Note: the lower the average value, the better the performance of the county schools in reaching pre-pandemic reading levels. Average values were provided on the ODEW webpage and are weighted accordingly.

To further enhance the comparison across school districts, socio-economic factors were considered, particularly the percentage of students eligible for free or reduced-price lunch. A General Linear Model was used for this analysis in which the percentage of free and reduced lunches was introduced as a covariate. Generalized Linear Models (GLM) are used to model the relationship between a dependent variable and one or more independent variables, incorporating different distribution families and link functions. Introducing a covariate, such as socioeconomic status (SES), helps control for its potential confounding effects, allowing for a more accurate estimation of the relationship between the primary variables of interest.

Table 2 provides the reading and math differences in performance, when controlling for percent free/reduced lunch.

Table 2. Data by county: changes in average reading and math scores adjusted for average socio-economic status.

County	Number of Districts	Average Reading Difference 2019–2023	Average Math Difference 2019–2023
1	7	−0.14	−0.42
2	13	−0.16	−0.43
3	5	−0.12	−0.31
4	16	−0.03	−0.05
5	11	+0.11	−0.05

Note: Average values were provided on the ODEW webpage and are weighted accordingly.

When controlling for socio-economic status, as measured by free/reduced-price lunch percentages, County #5 served schools demonstrated significant gains in reading compared to other Appalachian counties. These differences across counties are statistically significant. In contrast, when adjusting for socio-economic factors in mathematics performance, no additional improvements were observed, relative to the analysis without the inclusion of percentage of students receiving free/reduced lunches.

Third grade guarantee

A Multivariate Linear Model was conducted that examined if there were differences by Appalachian designation and county, using third grade data only. A Multivariate Linear Model (MLM) can be used to simultaneously examine reading and math test results, allowing for the analysis of both outcomes across students from the Appalachian area and non-Appalachian regions. By including county as a factor in the model, MLM accounts for variations in performance that might be influenced by local educational and socioeconomic conditions. This approach enables the exploration of whether geographic region (Appalachian or not) and county-level factors have distinct impacts on both reading and math scores, while controlling for potential confounders.

Results indicate that the differences are not statistically significant across the county/Educational Service Centers or the Appalachian designation of the school district, $p > 0.05$, when examining change in third grade performance on reading and math state achievement tests between 2019 and 2023. However, while the differences between groups (Appalachian $M = -0.61$ and Non-Appalachian $M = -0.36$) in reading and between groups (Appalachian $M = -0.51$ and Non-Appalachian $M = -0.24$) in mathematics, reveal that the overall change is more negative on average for Appalachian schools. The one county (County #5) with the highest levels of recovery between the years 2019 to 2023 on the 3rd through 8th grade data also demonstrated the highest levels of recovery in math, and the third highest level of recovery in reading, when examining only third grade results.

5. Discussion

The analysis examined changes in average reading and math proficiency for 3rd to 8th graders from 2019–2023 across five Appalachian counties. Initial results showed variability in performance, with some counties recovering better than others. After adjusting for socio-economic factors, particularly free or reduced-price lunch eligibility, County #5 showed significant gains in reading, but no notable improvements were observed in math across counties. The second analysis examining only third grade data revealed no statistically significant differences between Appalachian and non-Appalachian schools, although Appalachian schools generally experienced greater declines. Noteworthy, for the second analysis, County #5 demonstrated the strongest recovery in both reading and math performance.

The analysis of student performance from 2019 to 2023 revealed an overall decline in both reading and math scores for students in grades 3 through 8, with mixed results across counties. While most counties experienced a decline in academic achievement, particularly those with higher percentages of students eligible for free or reduced-price lunch, County #5 demonstrated notable recovery, especially in reading. This suggests that socio-economic factors may have amplified the impact of the pandemic on academic outcomes. Adjusting for socio-economic status, County #5 continued to show improvement in reading, but this adjustment did not significantly influence math recovery, highlighting that socio-economic factors may have played a more substantial role in reading recovery than in math. Furthermore, a multivariate linear model examining third-grade performance revealed no statistically significant

differences based on Appalachian designation, though there was a trend indicating that Appalachian schools experienced greater declines in both reading and math. This could reflect unique challenges faced by Appalachian districts, such as resource constraints and socio-economic factors, which warrant further investigation. The findings suggest that while County #5's success in recovery may be attributed to effective interventions, broader strategies are needed to address the challenges faced by other districts, particularly those in Appalachian regions.

Data was requested from each of the five county ESCs to understand the differences in outcomes. After analyzing requested information from the multiple educational service centers across various counties, it was evident that the county with consistently better outcomes operated an educational service center that emphasized targeted interventions and professional development through direct service delivery. Although this approach necessitates significant investments in personnel, transportation, and strategic planning, the results, particularly in the county's post-COVID recovery rates, are outstanding. These findings suggest that focused, hands-on support can yield substantial improvements in educational outcomes, even in challenging circumstances.

The five counties analyzed shared common elements as outlined in the literature and received additional funding for local Educational Service Center support. The findings suggest that County #5's service delivery model may mitigate adverse outcomes. Prior research highlights the success of this model in training and empowering educators. Brock's [23] study demonstrated that targeted interventions under the Striving Readers grant led to substantial gains for at-risk high school students, whose reading levels entering high school were at the elementary grade level. This evidence underscores the potential of strategic service delivery in improving educational outcomes during challenging circumstances.

Limitations to these findings are consistent with all causal-comparative research. Causal-comparative research is valuable for exploring relationships between variables, but it has several limitations. First, it lacks randomization, meaning participating schools are not randomly assigned to groups, which increases the potential for bias and confounding variables that can distort causal conclusions. Additionally, since this research compares pre-existing groups, there may be uncontrolled variables influencing the results, complicating the determination of cause-and-effect relationships. Furthermore, without random group assignment, researchers cannot ensure comparability between groups, and pre-existing differences may affect the outcomes. Finally, causal-comparative studies often have limited external validity, as their findings may not generalize well to other populations or settings, particularly when the groups being compared are not representative of the broader population. These factors make it challenging to draw definitive causal conclusions.

Future research should focus on the long-term effects of the pandemic, further exploration of socio-economic factors, and identifying best practices for intervention. Specifically, case studies of successful districts, such as County #5, could provide valuable insights into effective recovery strategies, while a deeper understanding of regional challenges in Appalachian schools could help inform targeted interventions. Ultimately, these findings underscore the need for continued research to understand

the persistent learning gaps and develop strategies to support students, particularly those from lower socio-economic backgrounds, in their recovery.

6. Conclusion

The COVID-19 pandemic significantly disrupted children's education, leading to learning losses and widening disparities, particularly among vulnerable students [24,25]. Key barriers to digital inclusion for people with learning disabilities included cost, access, and environment [26]. To mitigate these impacts, research suggests implementing RAPID actions: Reach every child, assess learning levels, prioritize fundamentals, increase instruction efficiency, and develop psychosocial wellbeing [24]. Educators sought information on digital and distance learning, with video content use increasing dramatically [27]. Successful strategies included higher engagement, community mobilization, and inclusive remote learning approaches [28]. A nexus of interconnected support involving students, parents, and teachers was crucial for maintaining engagement, especially for low-income and immigrant students [29]. These findings emphasize the need for innovative curricula, community-focused pedagogy, and consistent support systems.

Author contributions: Conceptualization, CR, CJD and KHL; methodology, CR, CJD, and KHL; software, CR, CJD and KHL; validation, CR, CJD and KHL; formal analysis, CJD and KHL; investigation, CJD and CR; resources, CR, CJD and KHL; data curation, CR and CJD; writing—original draft preparation, CR and CJD; writing—review and editing, CR, CJD and KHL. All authors have read and agreed to the published version of the manuscript.

Institutional review board statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Institutional Review Board (or Ethics Committee) of Youngstown State University IRB (protocol code 2024-271 on 14 May 2024).

Informed consent statement: Not applicable.

Conflict of interest: The authors declare no conflict of interest.

References

1. UNESCO. Education: From COVID-19 school closures to recovery. Available online: https://www.unesco.org/en/covid-19/education-response (accessed on 2 October 2024).
2. OECD. Available online: https://web-archive.oecd.org/2023-12-15/580005-covid-19.htm (accessed on 2 October 2024).
3. Di Pietro G, Biagi F, Dinis Mota Da Costa P, et al. The likely impact of COVID-19 on education: reflections based on the existing literature and recent international datasets. Publications Office of the European Union; 2020.
4. Dorn E, Hancock B, Sarakatsannis J, & Viruleg E. COVID-19 and student learning in the United States: The hurt could last a lifetime. McKinsey & Company. 2020; 1: 1–9.
5. Gee KA, Asmundson V, Vang T. Educational impacts of the COVID-19 pandemic in the United States: Inequities by race, ethnicity, and socioeconomic status. Current Opinion in Psychology. 2023; 52: 101643. doi: 10.1016/j.copsyc.2023.101643
6. Wyse AE, Stickney EM, Butz D, et al. The Potential Impact of COVID-19 on Student Learning and How Schools Can Respond. Educational Measurement: Issues and Practice. 2020; 39(3): 60–64. doi: 10.1111/emip.12357

7. Haliwa I, Layman H, Coffman J, et al. Perceptions and Expectations of School-Based Professionals Surrounding School-Based Mindfulness Training in Appalachia During the COVID-19 Pandemic: A Qualitative Study. Frontiers in Public Health. 2022; 10. doi: 10.3389/fpubh.2022.816494
8. McFayden TC, Breaux R, Bertollo JR, et al. COVID-19 remote learning experiences of youth with neurodevelopmental disorders in rural Appalachia. Journal of Rural Mental Health. 2021; 45(2): 72–85. doi: 10.1037/rmh0000171
9. Stover K, Cowley K, Gaunt G, et al. Comparison of on-campus and virtual self-assessment outcomes for incoming Appalachian STEM undergraduates' first research experience. Online Learning. 2024; 28(1). doi: 10.24059/olj.v28i1.3834
10. Nicola T, Gable A, & Ash J. The response of rural districts to the COVID-19 pandemic. National Center for Rural Education Research Networks; 2020.
11. Pordell P, Ali H, Martinez GM, et al. COVID-19 Prevention Facilitators and Barriers among Specific Ethnic Minority Communities in Rural Ohio. Available online: https://www.medrxiv.org/content/10.1101/2021.10.21.21265302v1.full (accessed on 2 October 2024).
12. Karchmer-Klein R, Konishi H. A mixed-methods study of novice teachers' technology integration: Do they leverage their TPACK knowledge once entering the profession? Journal of Research on Technology in Education. 2021; 55(3): 490–506. doi: 10.1080/15391523.2021.1976328
13. Zucker TA, Oh Y, Conradi Smith K, et al. Low-Income Elementary Students Access to Books & Reading Motivation. Reading Psychology. 2022; 43(3–4): 250–276. doi: 10.1080/02702711.2022.2094040
14. Marchessault JK, Larwin KH. The Potential Impact of Structured Read-Aloud on Middle School Reading Achievement. International Journal of Evaluation and Research in Education (IJERE). 2014; 3(3). doi: 10.11591/ijere.v3i3.6463
15. Larsen L, Helland MS, Holt T. The impact of school closure and social isolation on children in vulnerable families during COVID-19: a focus on children's reactions. European Child & Adolescent Psychiatry. 2021; 31(8): 1–11. doi: 10.1007/s00787-021-01758-x
16. Reuge N, Jenkins R, Brossard M, et al. Education response to COVID 19 pandemic, a special issue proposed by UNICEF: Editorial review. International Journal of Educational Development. 2021; 87: 102485. doi: 10.1016/j.ijedudev.2021.102485
17. Karalis T. Planning and evaluation during educational disruption: Lessons learned from the COVID-19 pandemic for treatment of emergencies in education. European Journal of Education Studies. 2020; 7(4).
18. Darling-Hammond L, Schachner A, & Edgerton AK. Restarting and reinventing school: Learning in the time of COVID and beyond. Learning Policy Institute; 2020.
19. Papadakis S, Kiv A, Kravtsov H, et al. Unlocking the Power of Synergy: The Joint Force of Cloud Technologies and Augmented Reality in Education. In: Proceedings of the 10th Workshop on Cloud Technologies in Education (CTE 2021) and 5th International Workshop on Augmented Reality in Education (AREdu 2022); 23 May 2022; Kryvyi Rih, Ukraine.
20. ESSER. Elementary and Secondary School Emergency Relief (ESSER) Fund. Available online: https://www.ed.gov/grants-and-programs/formula-grants/response-formula-grants/covid-19-emergency-relief-grants/elementary-and-secondary-school-emergency-relief-fund (accessed on October 2024).
21. Educational Commission. 50-State Comparison: State K-3 Policies. Available online: https://www.ecs.org/50-state-comparison-state-k-3-policies-2023/#:~:text=16%20states%20and%20the%20District%20of%20Columbia%20require%20grade%20retention,determined%20at%20the%20local%20level (accessed on 2 October 2024).
22. Fordham. Available online: https://www.ohiobythenumbers.com/#school-options (accessed on 2 October 2024).
23. U.S. Department of Education. Elementary and Secondary School Emergency Relief (ESSER) Fund. U.S. Department of Education; 2021.
24. Brock M. Re-conceptualizing secondary literacy: Impacts of 21st-century literacy interventions on STEM high school student achievement [PhD thesis]. Youngstown State University; 2021.
25. Alejo A, Jenkins R, Yao H. Learning losses during the COVID-19 pandemic: Understanding and addressing increased learning disparities. Future in Educational Research. 2023; 2(1): 16–29. doi: 10.1002/fer3.21
26. Spiteri J, Deguara J, Muscat T, et al. The impact of COVID-19 on children's learning: a rapid review. Educational and Developmental Psychologist. 2022; 40(1): 5–17. doi: 10.1080/20590776.2021.2024759
27. Seale J. It's not all doom and gloom: What the pandemic has taught us about digitally inclusive practices that support people with learning disabilities to access and use technologies. British Journal of Learning Disabilities. 2022; 51(2): 218–228. doi: 10.1111/bld.12497

28. Cavanaugh C, DeWeese A. Understanding the professional learning and support needs of educators during the initial weeks of pandemic school closures through search terms and content use. Journal on Empowering Teaching Excellence. 2020; 28(2): 233–238.
29. Sims K. Lessons Learned from Education Initiatives Implemented During the First Wave of COVID-19: A Literature Review. Institute of Development Studies (IDS); 2021. doi: 10.19088/k4d.2021.134