





How Did COVID-19 Affect Education and What Can Be Learned Moving Forward?

A Systematic Meta-Review of Systematic Reviews and Meta-Analyses

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Abstract: The COVID-19 pandemic drastically impacted the educational sector on a global front. A plethora of research has been conducted to better understand the effects that the pandemic had on education as a whole, including investigations into different topics (e.g., school closures, e-teaching and learning, mental and physical health), populations (e.g., students, teachers), and levels of education (e.g., school, higher education). To summarize the available literature on education during the pandemic both qualitatively and quantitatively, many systematic reviews and meta-analyses have begun to emerge. With the present systematic meta-review, we aimed to synthesize and combine this existing database to derive broader and more comprehensive insights that can aid educational stakeholders. We summarize and evaluate 43 systematic reviews, four meta-analyses, and eight combined systematic reviews and meta-analyses published until November 2022 to provide a comprehensive narrative of how this crisis affected education and what can be learned moving forward.

Keywords: COVID-19, corona, education, meta, review

Education around the world has faced unprecedented challenges as a result of the COVID-19 pandemic. While there have been many epidemics in human history, including the plague, bird flu, and the Spanish flu, the impact of the COVID-19 pandemic has emerged as being unique in terms of its vast disruptions to society and education. According to the United Nations (2020), it has drastically shaken the socioeconomic order of the world and impacted 63 million teachers and approximately 1.6 billion students at all educational levels in more than 190 nations across all continents. School children around the world have missed an estimated two trillion hours – and counting – of in-person instruction (United Nations Children’s Fund et al., 2022). As such, the resulting loss of learning prospects for young people is expected to amount to substantial costs for the global economy in the long run (Psacharopoulos et al., 2021).

The first phase of reaction to the COVID-19 pandemic was characterized by global lockdowns, health concerns,

and general uncertainty. Many countries experienced national closures that involved full shutdowns of educational institutions, ranging from preprimary schools to higher education institutions for extended periods of time. Classroom instruction was stopped, examinations were canceled or postponed, entrance exams and admission processes were delayed, universities were locked, and higher education students were asked to leave their dorms. The number of international students dropped drastically, and significant effects on the intellectual, emotional, and multicultural presence of education were observed (Tilak & Kumar, 2022).

Many believed that educational institutions would quickly reopen after being abruptly closed at the beginning of 2020. However, it soon became clear that schools and universities would not be reopening nor regular classes returning anytime soon, leading to a second response phase consisting of emergency remote teaching/learning. This instantaneous transition from

on-campus to online learning was an *ad hoc* provision of online education that brought with it considerable changes in teaching and learning strategies for both teachers and students (Pelikan et al., 2021; Turnbull et al., 2021). Online teaching and learning characterized by digital tools, webinars, and online platforms became the new normal, leaving teachers and students with much to adjust to – especially given the abrupt transition and lack of information about when regular educational conditions would resume (Truzoli et al., 2021). Following these events as well as strict rules to control the spread of the virus and the eventual development and wide distribution of vaccines, education institutions cautiously started to reopen.

By the end of 2022, educational institutions in many countries resumed in-person operation and aspects of teaching and learning reverted to their prepandemic forms. Stimuli packages were coordinated, and educators began tackling the learning losses and costs brought forth by the pandemic. However, this remains a slow process. Education was not a priority in the COVID-19 stimulus packages offered by most governments (accounting for only 2.9% of the total; see UNESCO et al., 2020), and the COVID-19 pandemic has left a lasting impact on the educational sector – the effects of which will be visible for years to come. It has challenged educational systems with dramatic cuts to established practices and the imposition of new requirements. Consequently, the vast differences in how individual students, teachers, and parents, as well as different educational institutions and systems managed to cope with this unprecedented crisis are still being understood. By understanding and analyzing these differences, we can not only identify vulnerabilities in prepandemic educational practices and areas for growth but also use these insights to develop educational policies that can more effectively manage and mitigate future crises.

Given this background, considerable effort has been put forth by researchers across all stages of the pandemic to build a knowledge base of individual studies that can shed light on the impact of the COVID-19 pandemic on education. Indeed, the number of COVID-19-related research articles has skyrocketed since the beginning of 2020, with pandemic-related works having grown to represent a large proportion of all published articles (Brainard, 2022). According to the Web of Science database, more than 8,000 works have been published between 2020 and 2022 containing the keywords COVID and school, university, or education in their title alone. This surge of research was encouraged by many journals having waived their publication fees regarding COVID-19-related topics and expedited their publication processes (Palayew et al., 2020). While fast-paced delivery of research output was undoubtedly important to share new evidence in a timely

manner, it may have also come at a cost in terms of quality (e.g., reduced objectivity, less rigorous peer review processes to support speed of knowledge dissemination, etc.). Aside from this, the sheer number of publications made it challenging to keep up with research on this topic (Brainard, 2022). As such, to draw conclusions from the vast amount of unique research works that have assessed COVID-19-related educational experiences and to subject them to quality control, many meta-analyses and systematic literature reviews have emerged. These reviews were conducted at different stages of the pandemic and, given the wealth of research on COVID-19 and education, often attended to rather specific and overlapping issues, necessitating a comprehensive overview.

We address this with the present work in the form of a systematic review that combines the information from existing meta-analyses and systematic reviews. Such a review is important in terms of bringing the separate findings together in a single place to be compared, thereby facilitating more extensive conclusions about the current research status of how education was impacted by COVID-19, as well as future directions.

The Present Systematic Review

We conducted a systematic meta-review of systematic reviews and meta-analyses that investigated the impact of COVID-19 on education. This includes findings of both individual and educational factors that operated as protective or risk factors for different populations (e.g., students, teachers) within different levels of education (e.g., primary school, higher education), as well as reviews more generally assessing teaching and learning, school closures, and interventions to support educational populations with the ramifications of the pandemic. As such, this meta study should provide a comprehensive overview to better understand how COVID-19 impacted education, expose gaps in current research, assess quality, and ultimately provide researchers, practitioners, and policy-makers with an overview of key outcomes and future directions.

Method

Literature Search and Eligibility Criteria

A search of systematic reviews and meta-analyses conducted between January 2020 and November 2022 was independently carried out by two co-authors using Scopus as well as the first 250 results from Google Scholar. Reference lists of the retrieved reviews were also scanned. We

searched for reviews and meta-analyses that *systematically*¹ assessed COVID-19-related educational experiences in students and educators at primary, secondary, and tertiary levels. Our search term read as follows: “TITLE-ABS-KEY ((corona OR covid OR “cov-19” OR pandemic) AND (school* OR university OR college OR instructor OR pupils OR teacher OR teaching OR learner OR learning OR educat* OR undergraduate OR faculty) AND (meta-analysis OR review)) AND PUBYEAR AFT 2019”.

Search filters were set to include peer-reviewed articles, book chapters, conference proceedings, and preprints published in English. Moreover, works were excluded if they were retracted or only review protocols, focused on a highly specific population (e.g., dentistry students in Austria) aside from those labeled as being at-risk (e.g., students with special educational needs), focused on a specific type of education (e.g., medical education, nursing education), or examined a mixed sample (e.g., the sample included a general population and did not explicitly investigate students or teachers).

Literature Screening Process

We used ASReview (van de Schoot et al., 2021), a machine learning application, to enhance our title and abstract screening during the literature screening process. In AS-Review, the researcher interacts with an active learning model to screen abstracts. Starting with a preselection of training articles by the reviewers, the algorithm iteratively changes its relevancy predictions for the remaining abstracts based on the researcher’s choices (relevant vs. irrelevant), thus aiding the selection process by grouping the records based on their relevance. Although it is possible to stop the screening process after a certain limit, we screened all abstracts to avoid false-negative decisions. Thus, ASReview was primarily used in the present study as a tool to reduce screening time. In comparison to a conventional screening method, this AI-assisted and open-source technology affords a more effective and error-free screening process (van de Schoot et al., 2021). We used the default Naïve Bayes classifier, term frequency-inverse document frequency (TF-IDF), and feature extraction and certainty-based sampling.

Quality Rating

To gauge the quality of the included reports, two raters coded each of the reports with regard to quality criteria

based on the AMSTAR 2 instrument (Shea et al., 2017). We chose AMSTAR 2 because it is a widely used and confirmed instrument incorporating both systematic reviews and meta-analyses. Given that this instrument was originally developed with regard to healthcare interventions, we selected and slightly modified the items to align with the scope of the present investigation. As AMSTAR 2 is not intended to generate an overall score, we present the quality criteria for each item (good inter-rater reliability: $\kappa = .84$). To provide a full overview of the covered research, we considered all works, irrespective of their quality, but used the ratings to assess overall confidence in the results of the review when interpreting their findings.

Data Availability

We present a full table of the reviewed studies and summaries of their findings (Table 1) as well as an overview of the quality criteria of these reports (Table 2), a PRISMA flow diagram detailing the reports identified and included in our review (Figure 1), and the covered literature database as supplementary materials and in the Open Science Framework (OSF) at <https://osf.io/9gudy/> (Daumiller et al., 2023).

Results and Discussion

Descriptive Information

As shown in Figure 1, our literature search identified 5,806 records. After the removal of duplicates and retracted articles, we screened the abstracts of 5,589 records and subsequently retrieved the full texts of 174 records. For two records, we were not able to retrieve a full text. After reading the full texts, a further 117 reports were excluded: Of these, 65 were not systematic reviews or meta-analyses, nine did not focus on COVID-19 and education, two were not in English, 38 pertained to a particular population or study program (e.g., dentistry students in Austria), and three addressed a general sample and not students or educators specifically.

Table 1 depicts an overview of all remaining 55 reports included in the systematic review. Most of them were systematic literature reviews ($n = 43$), followed by meta-analyses ($n = 4$) or combined systematic reviews and meta-analyses ($n = 8$). Using thematic synthesis (Thomas & Harden, 2008), we identified seven major themes that

¹ To operationalize *systematic*, we refer to the formulation of a research question and the identification of relevant individual studies (e.g., using specific search terms in literature databases), as well as the summarizing of those studies using explicit methodology (see Khan et al., 2003).

these works addressed. Through the same process, we highlighted relevant subfields, including recommendations for practice and future research. While partly overlapping, they placed a key focus on different aspects related to how COVID-19 affected education: well-being of students ($n = 14$), well-being of educators ($n = 6$), school closures and other school measures ($n = 7$), e-teaching and learning ($n = 15$), interventions ($n = 3$), individual factors ($n = 5$), as well as at-risk groups ($n = 5$). While most reports were clearly classifiable into one of these categories, some addressed multiple aims and were thereby independently grouped by two of the authors into the most relevant category based on the predominant topic of the paper. Only one discrepancy arose, which was resolved through discussion between the authors. In terms of scope and addressed works, some reports were quite similar; however, the majority were different from each other and contributed unique insights.

Table 2 provides an overview of the quality criteria of the reports. These ratings show that the quality of the works was mixed, with more than two thirds not fulfilling basic criteria, such as the provision of review questions, search strategy, and inclusion/exclusion criteria (which are also fundamental PRISMA criteria). Many also did not ensure sufficient reliability with regard to study inclusion and data extraction.

Next, we summarize the results and recommendations derived from the individual reports across the seven identified themes (for further details and specific references, see Table 1).

Well-Being of Students: Mental and Physical Health Problems

Students were uniquely affected by the COVID-19 pandemic due to drastic educational and lifestyle shifts related to physical isolation and the abrupt transition to virtual learning. Fourteen of the reviews retrieved from our literature search focused on examining mental health problems ($n = 12$) and physical health concerns ($n = 2$) in student populations.

Mental Health

Although the majority of the reviews ($n = 10$) focused on mental health in higher education students, some ($n = 3$) concentrated on mixed samples of school and higher education students, and only one review explicitly investigated school students. Regardless of school level, students reportedly faced a host of challenges during the pandemic, including reduction of face-to-face communication and

physical activity (Deng et al., 2021; Xiang et al., 2020), disruption of social environments due to school and campus closures (Liyanage et al., 2022; Wang et al., 2022), as well as changes in career outlook and academic progress (Ebrahim et al., 2022; Zhu et al., 2021). These challenges carried the potential to exacerbate mental health problems, as elaborated below.

Prevalence of Mental Health Problems. Across the assessed reviews, the pooled prevalence estimates² of anxiety and depression in students ranged from 28% to 41% and 23% to 39%, respectively. Comparatively, a large-scale study assessing 13,984 college students' mental health across eight countries prior to the pandemic reported 12-month prevalence rates of anxiety and depression to be 16.7% and 18.5% (Auerbach et al., 2018). Moreover, the prevalence estimates of stress and fear symptoms of students during the pandemic were 31% and 33% (Fang et al., 2022). From a longitudinal perspective, Buizza and colleagues (2022) concluded that most studies in their review (12 of 17 studies) found an increase in anxiety symptoms, depression, mood disorders, or personality disorders when comparing students before and during the pandemic. Paralleling this, increases in distress, loneliness, alcohol use, as well as issues with externalization and attention were also observed.

Differences in Subgroups of Students. Several reviews found differential effects of the pandemic for certain groups of students. This included higher rates of anxiety in females compared to males, higher anxiety and depression in sexual and gender minorities compared to their nonminority counterparts (Buizza et al., 2022), higher mental health problems in students living in rural compared to urban areas (Elharake et al., 2022), as well as in the United States compared to Asian or European countries (Chang et al., 2021). Moreover, a higher prevalence of mental health problems was documented in students with financially poorer backgrounds and in those who lived alone compared to those who were financially stable and lived with others (Deng et al., 2021; Elharake et al., 2022; Jehi et al., 2022). Importantly, prevalence rates also differed depending on the assessment tools used and the country investigated (see Deng et al., 2021; Fang et al., 2022).

Physical Health

The pandemic additionally impacted students' physical health as a result of increased screen time, less physical activity, as well as unhealthy behaviors and sleep problems linked to psychological distress (Cortés-Albornoz et al.,

² Reported are the pooled estimates based on the prevalence rates of mental health problems reported in the individual studies assessed in the different systematic literature reviews and meta-analyses.

2022; Valenzuela et al., 2022). Specifically, Cortés-Albornoz and colleagues (2022) documented that most studies in their review (19 of 21 studies) found visual health in school students to worsen during the COVID-19 pandemic, while Valenzuela and colleagues (2022) found undergraduate students to have experienced sleep problems and, interestingly, also increased sleep duration. Regarding the latter point, the authors noted that increased sleep duration may not necessarily be beneficial, as it can negatively impact time spent on school work, social relationships, and mental health.

Summary of Recommendations and Future Directions

Several recommendations for supporting students' well-being throughout crises such as the COVID-19 pandemic were suggested throughout the reports. First, the offering of widespread access to mental health screenings and counseling services via internet and telephone was considered an important support measure. This was especially the case due to students not having been able to leave their residences and clinics being physically closed at certain phases of the pandemic. Within this, interventions centered around mindfulness, meditation, time management, relaxation, and physical exercise were often mentioned as promising methods for improving student health. Similarly, the promotion of healthy behaviors such as regular exercise, healthy diets, sufficient sleep, practicing social media hygiene, and avoiding alcohol or drug use were frequently suggested as ways to protect student well-being. As variations in findings depending on the assessed country were also evident, future research should acknowledge country differences when considering responses to the pandemic and associated student well-being.

Adding to this, teachers were also reported to have played important roles in student well-being through connecting students to appropriate mental health resources offered by educational institutions, creating stability in students' lives through well-structured courses, and offering accommodations in extenuating circumstances (see also Kiltz et al., 2020). Ensuring that students had timely access to accurate and easily understandable information about the COVID-19 pandemic in relation to their studies was considered essential for reducing fear and anxiety levels.

Well-Being of Educators: Less Studied but Similarly Affected

The pandemic also had an unprecedented impact on educators and their well-being. Considerably fewer reviews identified in our search focused on educators compared to students. Six reviews summarized the impact that pandemic-related changes had on different

aspects of mental health in school and higher education teachers.

Mental Health

The rapid transition from established and familiar face-to-face teaching methods to online teaching threatened the well-being of school and higher education teachers (Daumiller et al., 2021). Specifically, this abrupt change came at a cost in terms of time and skill resources needed to convert learning materials to online contexts in a high-quality manner and was marked by confusion, poor work-life balance, lack of confidence and support, as well as concerns about students' academic progress and welfare (Ozamiz-Etxebarria et al., 2021; Susilaningsih et al., 2021; Zheng et al., 2022). In turn, high prevalence rates of mental health problems were observed in teachers during the pandemic, as elaborated on below.

Prevalence of Mental Health Problems. In the reviews identified in our search, the pooled prevalence of anxiety, depression, and stress among teachers during the pandemic ranged between 10%–49.4%, 16%–59.9%, and 12.6%–62.6%, respectively. Moreover, in their review containing longitudinal studies that compared experiences of teachers before and during the pandemic, Westphal and colleagues (2022) noted that some studies reported a decrease in feelings of accomplishment and an increase in depersonalization and emotional exhaustion.

Differences Between Subgroups of Teachers. Like with students, some groups of teachers appear to have struggled with their well-being more than others during the pandemic. This included teachers who were younger, female, had chronic health issues, and dealt with higher workloads (Ma et al., 2022; Silva et al., 2021). Moreover, while teachers in schools experienced higher prevalence rates of depression and anxiety, those in universities were comparatively less investigated but were also found to experience high levels of stress (Ozamiz-Etxebarria et al., 2021; Schwab et al., 2022).

Summary of Recommendations and Future Directions

Aside from teacher well-being being important in and of itself (Hascher & Waber, 2021), ensuring that teachers are feeling well and healthy is considered a critical step in fostering high-quality education for students. The most prominently reported suggestion aimed at supporting teachers' mental health in times of crises was to offer professional development opportunities geared at enabling teachers to optimally handle pandemic-related changes. Next, ensuring that teachers were provided with adequate materials and resources was considered a key factor (see e.g., Ozamiz-Etxebarria et al., 2021). This included the provision of sufficient IT support, technological software, and comfortable workspaces, as well as

up-to-date information and resources to best plan their teaching and accommodate their students. Lastly, the provision of mental health resources to help teachers deal with the emotional and psychological ramifications of the pandemic, including stress management strategies such as physical exercise and breathing techniques, were highlighted as protective factors for their well-being.

School Closures and Other School Measures: Intended and Unintended Effects

We found seven systematic literature reviews that engaged with school closures and other school measures. Most of this research focused on primary and secondary schools, while higher education institutions were less frequently examined.

Effects of School Closures

In terms of school closures, multiple problems were identified, including:

Restrictions of Students' Right to Education. A basic concern was that students' rights to education were restricted (Lorente et al., 2020). This issue is fundamental, as every human being has the right to a high-quality education (Robeyns, 2006).

Learning Losses. Despite the integration of remote learning, the results indicated learning losses similar to summer losses encountered by students with no teaching at all during the summer break ($d = -0.005$ SD to -0.05 SD per week; see Kuhfield & Tarasawa, 2020). These numbers are also mirrored by a recent meta-analysis reporting a pooled effect size of, $d = -0.14$ (Betthäuser et al., 2023), meaning that in total, students lost out on about 35% of a normal school year's learning. This shows that the majority of remote learning initiatives put in place during the first round of school closings in spring 2020 were not effective for student learning. However, findings also showed little evidence for an accumulation of learning deficits over time that was frequently feared (Betthäuser et al., 2023). In this context, few studies found that using online learning tools had a favorable impact on students' achievement. When favorable impacts were visible, this was mostly the case for students that were already familiar with working with online learning programs and did not have to adjust to a new learning environment.

Loss of Critical School-Based Services. Besides learning losses, problems were identified regarding critical school-based services becoming inaccessible due to school closures (e.g., healthcare, programs for children with disabilities, nutrition programs). This was particularly problematic in different low-middle-income countries

where healthcare and nutrition was strongly embedded in school programs (Mayurasakorn et al., 2020).

Well-Being and Health. In addition to the disruption of daily routines, COVID-19 school closures were linked to mental and physical health concerns, particularly regarding negative emotional responses. These negative consequences became increasingly prominent the longer the lockdowns were in place. However, effects of school closures and larger societal lockdowns cannot be distinguished using data that are bound to the initial COVID-19 lockdown (Viner et al., 2022). The effects on well-being that were previously described are presumably the result of a variety of lockdown-related variables including social isolation, family stress, and general pandemic fears, as well as school closures. Nevertheless, there is compelling theoretical evidence that suggests school closures may have caused a significant fraction of these effects, especially harms to mental health by reducing social interactions with peers and teachers as well as limiting the role that schools play in supporting health-conscious behaviors among children and adolescents (Viner et al., 2022).

Increasing Social Inequalities. Alarming, school closures due to COVID-19 specifically impacted younger children and families with low socioeconomic status (see Hammerstein et al., 2021, regarding student achievement). Children with disabilities and those from lower-income families were especially affected by school closures during COVID-19 because they no longer had access to school-based resources and essential services needed to bridge socioeconomic gaps.

Other Measures

Besides physical closures of schools, additional measures were introduced which focused on enabling safer contact (e.g., mask wearing, hygiene, distancing, ventilation), reducing contact (reducing and alternating student numbers, reducing opportunities for contact), as well as surveillance and response (e.g., screening, testing, quarantine). However, these aspects were typically not comprehensively researched (Krishnaratne et al., 2020).

Summary of Recommendations and Future Directions

Looking forward, when considering closing schools in times of crises, the findings of the assessed reviews suggest that it is crucial to conduct tailored benefit and risk assessments specific to the socioeconomic environment, healthcare system, and educational resources in the area. Notably, most research conducted on school closures during the COVID-19 pandemic focused on developed countries. However, measures were implemented differently within different countries, further emphasizing the importance of considering the broader context that schools are situated in Tadesse and Muluye (2020). Adding to this, research should attend to potential

unintended consequences of school closures (Kratzer et al., 2022), especially for students of low socioeconomic status. Therein, investigating additional health and social implications of school closures, such as the quality of life of children and their families, lifestyles, screen time, education/learning, cognitive development, as well as social connections (including social media use) was suggested as an important step forward. Beyond this, on a micro level, educational policy-makers should identify potential supportive measures that support time spent actively learning. On a larger scale, policy-makers should identify potential corrective actions to aid students in their learning, to prevent academic failure, and to build up mental health resources that are easily accessible for all.

E-Teaching and Learning: Opportunities, Challenges, and Psychological Impacts

Regarding e-teaching and learning, 14 systematic reviews and one meta-analysis were assessed. Most of these examined advantages and disadvantages of e-teaching during COVID-19. Some considered specific aspects such pedagogical implementations (Aisha & Ratra, 2022; Ibna Seraj et al., 2022), digital tools (Deepika et al., 2021), or students' attitudes, satisfaction, and learning outcomes (Masalimova et al., 2022; Nakhoda et al., 2021; Panagouli et al., 2021). Others engaged deeply with the roots of the problems that emerged and how they could be addressed (Na & Jung, 2021). All types of formalized educational levels (primary, secondary, and tertiary education) were considered, as well as the specific perspectives of students and teachers.

While a few studies sought to evaluate the merits of e-teaching and learning in general (e.g., Camilleri & Camilleri, 2022), most researchers were cautious about contrasting the digital education brought on by COVID-19 with regular digital education (Hodges et al., 2020). As opposed to well-planned online programs, this crisis-driven ad hoc *emergency remote teaching* was characterized, on the one hand, by a rapid transition frequently without adequate preparation for curricula, timetables, guidelines, technology infrastructure, content rights, etc., and on the other hand, by professional development for teachers and students to ensure successful teaching and learning (Bergdahl & Nouri, 2021).

With regard to advantages, disadvantages, psychological impacts, and recommendations for e-teaching and learning, these works addressed the impact of the change from face-to-face to virtual teaching on education, students' experiences and performance, the specific tools used to facilitate e-teaching, the respective policy-making, and the issue of equality (disparities between different social groups and its impact on accessibility and equity).

Opportunities

Multiple benefits and opportunities of e-teaching and learning were consistently identified in the covered works, extending beyond the emergency online teaching during COVID-19 (e.g., Aisha & Ratra, 2022; Deepika et al., 2021; Saikat et al., 2021). These include:

Accessibility. Through e-teaching, increased freedom and convenience for students to study and voice their ideas beyond time and geographical location were noted, along with wider access to education without discrimination. Especially during physical closures of secondary and tertiary institutions, e-learning was a sensible alternative for academic continuation.

Efficiency. Online programs were described as having the potential to be cost-effective, as they allow for saving on maintenance costs on physical campuses and reduce travel/commutes to and from colleges, meetings, conferences, and seminars. Regarding the latter point, the time cut down on commuting can be used more effectively for teaching and learning. Beyond this, online modes of education allow for learning material to be stored and updated more efficiently, and students can skip and repeat materials according to their own needs.

Individualization. It was acknowledged that e-learning can facilitate more individualized and thus effective learning, through self-regulation at one's own pace, higher autonomy, personalization, tracking of own progress, and opportunities for self-assessment.

Convenience. E-learning was noted as being more integratable with other aspects such as physical activity compared to traditional learning forms, thus also allowing for healthier lifestyles in general.

Resources. E-learning allowed access to more resources and opportunities to reuse them (e.g., rewatch videos) as well as a rich potential for interaction, discussion, and communication, also within large lectures.

Digital Literacy. Through exposure to technology itself, technological literacy gaps can be addressed, and expertise in online media fostered. This also allows for better preparation for technology-reliant job markets (however, the amount, duration, and difficulty must be adapted to the level of learners).

Further Skills. E-learning included innovative and additional methods to foster collaborative skills, self-regulation skills, problem-solving skills, etc.

Impetus for Change. The transition to e-learning exposed problems within the system and pushed educators to advance technological acceleration.

Challenges

Despite these opportunities, the quick transition to e-teaching and learning caught most teachers, institutions, and governments off guard (Fernández-Batanero et al.,

2022). The key challenges and disadvantages of e-teaching and learning that were identified in the reviews were as follows:

Communication. Due to lacking face-to-face contact, difficulties were noted with building, maintaining, and sustaining relationships; developing rapport; providing clear instructions; facilitating student engagement; and teaching with little feedback (especially when not seeing students' faces/reactions). Group work was also more complicated to facilitate, and increased external distractions and interruptions were noted. Also, on an organizational level, clearer strategies regarding communication and collaboration tools were called for.

Availability. Students often complained about teachers not being available. Teachers, in turn, complained about difficulties answering students' questions in real time and a lack of direct control over the learners in general.

Assessment. A key challenge was redesigning evaluations so that they fairly and reliably captured performance, especially in practical courses.

Misuse. Fraudulent acts by students (e.g., academic dishonesty) were observed, as well as concerns regarding data protection and breaches of privacy.

Workload. Increased workload, not only for teachers, but also for students, was also frequently mentioned.

Inadequacy. E-teaching was mostly not considered a complete substitute for traditional education because of its inherent limitations. This is especially true regarding learning requirements demanding hands-on instruction, practical work and fieldwork, live discussions, and/or specific laboratories, especially in numerical, experimental, medical, artistic, and communication fields.

Cost. Students and teachers struggled with acquiring adequate equipment and programs due to high prices.

Digital Literacy. Further support was noted as being necessary for teachers in their learning curve to be able to transition to hybrid and blended learning.

Technical Difficulties. Many technical difficulties emerged, including internet access and reception. Teachers faced numerous obstacles when trying to reach all students and when seeking to improve their work due to lacking resources.

Digital Divide. Especially nontech savvy teachers and students were unprepared and poorly equipped. Also for students without access to the necessary digital tools, e-learning was a large setback. Noted were large differences in the accessibility and quality of e-learning and teaching stemming from students' and institutions' economic backgrounds. As we will elaborate on later, this exacerbated differences between privileged and underprivileged students worldwide (Panagouli et al., 2021).

Psychological Impacts

Besides these insights into e-teaching and learning specifically, several issues were revealed that further compromised well-being of students and teachers above and beyond the issues already noted before the pandemic (Aisha & Ratra, 2022). Among these most frequently noted were as follows:

Worries. Worries, stress, doubts, and concerns about the e-learning curriculum were articulated. Anxiety was increased due to a lack of interpersonal communication. Students were particularly worried about potential academic loss and the changed instructional delivery.

Distress. Students and teachers were often already overwhelmed, and the transition to e-teaching was considered an additional stressor. Individuals frequently felt intimidated and reported low confidence due to online teaching and the delay in their study progress.

Work-Life Balance. Boundaries between academic and personal life ran the danger of becoming blurred, which was further increased when individuals were isolated at home.

Concentration and Motivation. Prolonged screen time affected concentration, and students reported a lack of motivation. Moreover, teachers reported feeling exhausted with regard to online teaching.

Summary of Recommendations and Future Directions

Taken together, the pandemic was considered a much-needed push for change in terms of digitalization. E-teaching and learning during the pandemic catalyzed innovations in education, proving the flexibility and convenience that teaching and learning online can provide. However, as observed during the pandemic, e-teaching and learning also comes with a series of challenges, and still more educational technology is available than can be applied for learning (Guppy et al., 2022). To reach its full potential of becoming as effective as face-to-face teaching (Francescato et al., 2006), future research is essential. Key suggestions to improve online teaching and learning experiences noted throughout the reviews include the following:

Policy-Making. The inequalities created through e-teaching need to be understood and mitigated, and accessibility and equity need to be ensured.

Training. Students and staff alike should be supported in terms of their motivation and digital literacy. Especially for rapid transitions, the difficulties and insecurities encountered by teachers regarding the implementation of such an educational mode need to be considered.

Tools. High-quality, accessible, user-friendly, error-free tools and platforms are required.

Diversity. A variety of learning resources should be provided to avoid monotony when learning online.

Feedback. Providing and receiving feedback needs to be ensured.

Student Centeredness. Effective e-learning environments should be centered around the individual students to meet their educational requirements.

Clarity. Instruction and expectations should be transparent and clear.

Psychological Impacts. E-teaching and learning bring a series of psychological impacts with them, especially under rapid transitions such as during the pandemic. This highlighted the necessity of taking care of the psychological well-being of students and teaching when learning online.

Blended and Hybrid Learning. Looking forward, a promising potential for enriching traditional learning formats lies in combining or switching between online and offline components, allowing students to interact with instructors, peers, and course material in both traditional classroom settings and online (Guppy et al., 2022).

Further Research. More research should be directed at examining the effectiveness of and the differences between traditional and online education to help teachers improve digital education techniques and development.

Interventions: Evidence on Specific Programs to Support Students

To support students in dealing with the ramifications of the COVID-19 pandemic, different interventions were developed to foster mental and physical health and in turn effective learning and adjustment. Specifically, three reviews identified in our search summarized the effectiveness of different types of online interventions used to promote health and mitigate anxiety and depressive symptoms among students. Notably, these interventions solely focused on higher education students; however, no reviews were identified which examined interventions aimed at supporting school students or teachers (who are characterized by substantially different learning needs).

Characteristics of Online Well-Being Interventions

Individual Versus Group Focus. While some interventions operated on an individual-level basis where students were asked to complete programs or materials independently with varied levels of support from trainers and psychologists, other interventions were group-based and entailed the provision of wider spread services to a larger number of students while promoting the exchange of experiences and building of support networks.

Platforms and Delivery Methods. In terms of virtual platforms used to host the different interventions, Zoom, Google Meet, Microsoft Teams, and Adobe Connect were

reported as being frequently used. Regarding specific delivery methods, video conferencing, online chat tools, e-mails, discussion forums, and processing of asynchronous materials such as watching videos or reading information were most often mentioned.

Techniques. Regarding the different techniques used to promote well-being in students, mindfulness techniques (e.g., meditation interventions), cognitive behavioral therapies, dialectical behavior therapies, social support measures, online Isha Upa yoga, positive psychotherapy strategies, and breathing training programs were frequently reported.

Number of Sessions and Duration of Interventions. The number of sessions and duration of interventions varied substantially, with some interventions consisting of as little as one standalone session and others consisting of as many as 88 sessions across upwards of eight weeks.

Effectiveness

The majority of the online interventions were effective in promoting well-being of higher education students during the pandemic based on evidence from randomized clinical trials, quasiexperimental studies, and cohort or case-control studies (da Silva et al., 2022; Malinauskas & Malinauskiene, 2022; Riboldi et al., 2022). Within this, particularly online group mindfulness techniques and web-based cognitive behavioral therapies (da Silva et al., 2022), multicomponent online positive psychology interventions (Malinauskas & Malinauskiene, 2022), and individually catered cognitive behavioral therapies, dialectical behavior therapies, and mind-body practice techniques (Riboldi et al., 2022) emerged as being effective.

Summary of Recommendations and Future Directions

In terms of practice, the assessed reviews suggest that online interventions represent a promising way forward in supporting students both within and beyond crises such as the COVID-19 pandemic. Such interventions have the added benefit of being more cost-effective, easily accessible, and better positioned to cater to a wider and more geographically varied group. Research wise, interventions conducted during the pandemic should be examined more thoroughly to consider the effectiveness of specific strategies, stages of the pandemic in which such strategies were most effective (using longitudinal evidence), and relevant control variables.

Individual Factors: Risk Factors and Resources

Throughout the COVID-19 pandemic, students and educators differed in how they handled and experienced

pandemic-related ramifications, where some fared better than others despite having seemingly similar external circumstances. To shed light on relevant factors that may have contributed to these differences, a total of five systematic reviews assessed different individual-level factors in students and educators and how they mattered for their experiences throughout the pandemic.

Motivation and Satisfaction. Students' motivation and satisfaction were considered important for their online learning experiences throughout the pandemic. Specifically, while their motivation levels mattered for their perceptions of and engagement in online learning, their satisfaction with education mattered for their well-being and subsequent online learning (Aznam et al., 2022). Learning structure, classroom interaction, facilities, and trainer knowledge were found to contribute to students' motivation and satisfaction.

Study Strategies. The study strategies that students employed throughout the pandemic also had an impact on their online learning experiences, where students' personal responsibility in learning activities, use of strategies, and self-regulated learning became increasingly important (Boström et al., 2021). Specifically, strategies used to avoid procrastination, set goals, self-monitor, self-instruct, and self-reinforce were particularly relevant. Moreover, the importance of the experience of authentic learning, as well as students' self-efficacy in how well they believed they could perform and handle the new online learning context were highlighted as important factors that mattered for their learning during the pandemic.

Social Media Use. Students' usage of social media during the pandemic had mixed effects on their mental health, including positive and negative effects, and in some cases, no statistically significant effects at all (Haddad et al., 2021). Following these mixed findings, it was suggested that a focus should be placed on preventing problematic social media use in students through moderation techniques rather than complete abstinence. This could be done by encouraging students to consciously assess their social media usage patterns in terms of how salient their use of social media is, whether they exhibit impulsive use of social media that negatively impacts their learning or whether they experience mood modifications and feelings of withdrawal from social media. Moreover, the establishment of media-free times, such as while eating meals or during studying, can be helpful. Importantly, social media was also considered to be an effective informational tool for quick and widespread access to information about the pandemic and surrounding regulations.

Personality Traits. Students' personality traits were also found to be associated with their learning experiences and well-being throughout the pandemic (see Morfaki & Skotis, 2022). Specifically, while agreeableness was linked to learning, it was also associated with perceived anxiety.

Similarly, openness was associated with learning, self-efficacy, and satisfaction, yet also anxiety. Extraverted students reported lower course achievement and intrinsic motivational regulation as well as increased anxiety, presumably due to the online focus and loss of face-to-face learning opportunities. Finally, conscientiousness emerged as being beneficial and was consistently associated with academic achievement, self-efficacy beliefs, and effective learning styles.

Coping Mechanisms. Teachers often used coping strategies to deal with the ramifications of the pandemic. The most frequently used coping strategies that were considered beneficial for their mental health entailed reaching out for social support, physical exercise, taking part in leisure and spiritual activities, as well as reading and listening to music (Nang et al., 2022). Of these strategies, seeking social support was marked as the most popular strategy.

Summary of Recommendations and Future Directions

Looking forward, a focus should be placed not only on implementing broader strategies to support students and educators during crisis situations but also on the importance of considering individual differences and tailoring approaches to those who may particularly struggle. The reviews captured by our literature search indicate that *one-size-fits-all* approaches, although more feasible, may be shortsighted. Individuals' levels of motivation and satisfaction, study strategies, personality traits, and coping tendencies mattered for their experiences during the COVID-19 pandemic and should thereby be further acknowledged in future research and practical initiatives.

At-Risk Groups: Assessing and Closing the Gaps

As previously noted, the educational experiences of certain groups were more strongly affected by the COVID-19 pandemic than others. A total of five systematic reviews specifically addressed disadvantaged groups. A common finding across all reviews was that across most of the aforementioned outcomes, students from disadvantaged backgrounds were statistically significantly more and persistently negatively affected. This was due to a variety of obstacles, including long-term educational disengagement, digital exclusion, poor technology management, and increased psychosocial difficulties. Besides identifying at-risk groups, the respective studies also elucidated factors explaining why these groups were particularly affected and allowed for the formulation of takeaways of which gaps need to be closed and how, in future crises, such divides can be mitigated.

The specific at-risk groups identified included (1) individuals from poor and underdeveloped countries, (2) individuals with special educational needs and other disadvantages (e.g., hearing difficulties), (3) individuals from families with low socioeconomic status, particularly those who already had contact with social services, as well as (4) underprivileged students with subpar access to quality education, including those who started school behind or were already at the risk of disengagement.

Relevant Factors

Necessary Equipment and Technology. Especially for poorer and disadvantaged students, the availability of tools (such as computers to use for studying) was a prominent issue.

Accessibility and Usage of Learning Materials. Many students struggled due to limited access to learning materials (e.g., due to existence of appropriate materials or lacking internet connection). Parents of children with special needs reported that they spent considerable time and effort catering learning material to the individual needs of their children. Furthermore, availability does not guarantee quality online education for all groups. Instead, special training, quality measures, and additional features (e.g., captioning) may be required. Most importantly, this raises awareness of the need for educational systems to leverage teaching practices that can be easily implemented even amidst environmental crises and be more accessible during pandemic emergencies.

Routine Change. Especially for students with special educational needs (e.g., students with autism), routines were considered essential to lessen stress while encouraging a sense of order. Students' routines were disturbed when the lockdown started due to conflicting expectations and pressures from school, other agencies, and home working commitments. Many families struggled with changing existing and/or new routines and relieving pressure.

Partnerships and Collaboration. Crucial roles were performed by the interplay of authorities, educators, parents, and specialists in enhancing students' educational outcomes. Problems were frequently complex, and perspectives of everyone involved in education need to be included (García-Louis et al., 2022).

Special Needs. It was considered essential to offer special attention to those with special needs during such unprecedented changes (e.g., counseling and psychological services). Isolation left students feeling lonely and cut off from relationships with their peers, teachers, and the rest of their school community (Bakaniene et al., 2022). Inclusive education, however, aims to enhance a student's functioning and learning results by assisting them through the creation of supportive communities and by providing extra services, educational aids, or accommodations (Couper-Kenney & Riddell, 2021). Parents and parent-teacher collaboration and

communication were noted as being important for their children's achievement. Thus, in crises, parents also need to be provided with the time and resources necessary to support their children, especially in terms of at-home learning.

Summary of Recommendations and Future Directions

Systemic imbalances, which have long hindered the academic progress of disadvantaged students, were clearly made worse by COVID-19. Often, the interconnection of a lack of resources, difficulties with mental health, and other aspects such as food hardship affected how students and their families responded to the pandemic. Given that it was mostly social inequities that already existed prior to the pandemic and severely limited the access of these at-risk groups to educational and employment opportunities, which in turn led to vast economic, food, and housing insecurity (García-Louis et al., 2022), it is critical that the aforementioned inequalities be acknowledged by institutional leaders and addressed at a national policy level (United Nations Children's Fund et al., 2022).

Limitations

Several limitations need to be considered when interpreting the findings of this systematic review. First, we only included topics that were relevant enough to have already been examined within multiple research works and in turn, within existing systematic literature reviews or meta-analyses. The inductive process of deriving categories based on existing studies provided us with insights into the directions in which research on the effects of COVID-19 on education is headed. Numerous systematic overviews existing are a strong indication of a topic's relevance. However, a more theory-based approach to preselecting (sub)topics may have provided different results. Second, although we brought together an immense amount of research findings, there is still a significant amount of primary research being reviewed on this topic at the time of publication. It also takes time to include already published work in systematic research syntheses. Although research syntheses focused on this specific time frame are necessary, the accelerated speed of publications during the pandemic and the urgency of robust findings may decrease their half-life/usefulness, which may in turn affect the implications proffered by this meta-review. Third, some reviews included forecasts as actual data of documented losses and based their conclusions primarily on this information (e.g., Zierer, 2021). Such practices are highly misleading, especially

when seeking to inform the public debate on these topics. Finally, it is too early to evaluate the long-term effects of the pandemic on education, and it is important to be cautious when making predictions based on the available evidence collected thus far.

Implications

The quote “In the Middle of Difficulty Lies Opportunity” (attributed to John Archibald Wheeler) applies well to research practices and education alike in postpandemic times. What can we learn from the recent global crisis and which opportunities lie ahead?

As this will certainly not be the last crisis, the science community needs to be prepared and should consider changing their research practices. Robust, reliable, and trustworthy findings from different disciplines will be needed, ostensibly necessitating a trade-off between speed and rigor in doing research. More and higher-quality collaboration between researchers and disciplines as well as increased open science is needed to this end. Although many researchers already worked in a highly collaborative manner and shared data and preprints, joint and open research still needs to be intensified. This also pertains to the review articles we considered: A substantial number of reviews addressed the same topic and were published within the same year and journal, partly with subpar quality. These efforts would likely have been improved if researchers worked together right away and delivered fewer and higher-quality outputs. This should also aid in informing policy-makers and the public. In all phases of the pandemic, and also now, it has become evident that policy-makers *are* listening to researchers after all. Researchers pooling their efforts will therefore be an important asset in steering future crises.

In the midst of constant change, young people need a feeling of stability to digest, adapt, and develop new coping mechanisms. For many, education offers a great deal of stability. As we progressively recover from the pandemic, we must nurture the next generation to prepare them for the tragedies that will inevitably happen again but that we cannot predict. At the same time, COVID-19 increased the fission of our societies in many ways, including how unequally different groups were affected. These groups need to be more strongly considered to understand the effects of crises better (e.g., comparison of different groups sheds light on causal impacts) and to mitigate their effects (e.g., supporting those with lower human capital as a result of the pandemic, also through lifelong learning). Specifically, the impact of the pandemic on education has highlighted the socioeconomic setting in which only select groups may live and learn in safety. In addition, there was considerable

variation in how different countries responded to the challenges of the pandemic and in turn the associated impact on the education systems, students, and teachers. More evidence is needed drawing on comparative research using equivalent approaches and measures. Thus, global efforts should be made to relaunch national and international education equity activities. Increased worldwide awareness of inequities might constitute a window of opportunity for programs promoting educational equity.

Moving forward, it is up to national educational policy-makers to be aware of these impacts and engage with the disciplines of educational and psychological research to put policies in place to lessen or even reverse adverse effects. This is arguably the most important societal responsibility for the post-COVID era to take on.

Conclusion

COVID-19 affected the educational sector on a global front. A vast amount of research was conducted within the (first) three years of the pandemic, illuminating the effects that the pandemic had on education. The pandemic also demonstrated the incredible ability of science to pivot amid a crisis. However, we still lack efficient methods for choosing, organizing, and presenting new findings in a way that maximizes comprehension and application. Even for experts in their respective (sub)fields, it was, and still is, difficult to remain up to date with the enormous number of papers being published on COVID-19. This is problematic, as urgent overviews are required in times of crises for science, policy, and practice. Even though overviews are available, the quality of these research syntheses is not universally adequate for transfer into policy (van de Schoot et al., 2021).

Therefore, in this paper, we provided an overview of systematic reviews and meta-analyses that investigated the impact of COVID-19 on education. In our systematic meta-review, seven major themes emerged that were addressed by previous syntheses: (1) the mental and physical health of students and (2) educators; (3) the role of school closures and other school measures; (4) e-teaching and learning and the opportunities, challenges, and impacts it brought with it; (5) interventions that were conducted to support students; (6) individual-level factors that made a difference; as well as (7) specific at-risk groups who particularly experienced disadvantages.

Specifically, the pandemic led to a time of anxiety and tense conversations about the existential crisis of humanity. Lockdowns, institutional closures, worries about continuing studies, and dim employment prospects all contributed to mental health problems in students. Early on in the pandemic, learning deficiencies quickly appeared and have not significantly narrowed since. Additionally,

unexpected and ill-prepared distance learning, poor digital connectivity, subpar technology, and the inability of students to interact directly with peers and teachers strained students' mental and physical health, resulting in intense emotional anguish. In higher education, many students found the process of learning during COVID-19 to be so unpleasant that they ran the danger of losing interest in learning and deciding to drop out. Furthermore, it has also been difficult for teachers to work under such circumstances, and as a result, many have left the academic field and are looking for alternative employment to support themselves (Tilak & Kumar, 2022).

Moreover, as documented, an institution's and students' economic background significantly determined the quality of online learning and teaching, bringing along a new level of inequality among students worldwide (e.g., only 34% of students in Indonesia reported having a computer at home for academic work, compared to over 95% in Denmark, Slovenia, Norway, Poland, Lithuania, Iceland, Austria, Switzerland, and the Netherlands; OECD, 2020). Thus, the pandemic has revealed yet another ominous facet of educational disparity that transcends geographic and economic disparities (Tilak & Kumar, 2022).

References

- Aisha, N., & Ratna, A. (2022). Online education amid COVID-19 pandemic and its opportunities, challenges and psychological impacts among students and teachers. *Asian Association of Open Universities Journal*, 17(3), 242–260. <https://doi.org/10.1108/AAOUJ-03-2022-0028>
- Auerbach, R. P., Mortier, P., Bruffaerts, R., Alonso, J., Benjet, C., Cuijpers, P., Demyttenaere, K., Ebert, D. D., Green, J. G., & Hasking, P. (2018). WHO world mental health surveys international college student project. *Journal of Abnormal Psychology*, 127(7), 623–638. <https://doi.org/10.1037/abn0000362>
- Aznan, N., Perdana, R., Jumadi, J., Nurcahyo, H., & Wiyatmo, Y. (2022). Motivation and satisfaction in online learning during COVID-19 pandemic. *International Journal of Evaluation and Research in Education*, 11(2), 753–762. <https://doi.org/10.11591/ijere.v11i2.21961>
- Bakaniene, I., Dominiak-Świgoń, M., Meneses da Silva Santos, M. A., Pantazatos, D., Grammatikou, M., Montanari, M., Virgili, I., Galeoto, G., Flocco, P., Bernabei, L., & Prasauskienė, A. (2022). Challenges of online learning for children with special educational needs and disabilities during the COVID-19 pandemic: A scoping review. *Journal of Intellectual and Developmental Disability*, 48(2), 105–166. <https://doi.org/10.3109/13668250.2022.2096956>
- Bergdahl, N., & Nouri, J. (2021). Covid-19 and crisis-prompted distance education in Sweden. *Technology, Knowledge and Learning*, 26(3), 443–459. <https://doi.org/10.1007/s10758-020-09470-6>
- Bethhäuser, B. A., Bach-Mortensen, A. M., & Engzell, P. (2023). A systematic review and meta-analysis of the evidence on learning during the COVID-19 pandemic. *Nature Human Behaviour*, 7(3), 375–385. <https://doi.org/10.1038/s41562-022-01506-4>
- Boström, L., Collén, C., Damber, U., & Gidlund, U. (2021). A rapid transition from campus to emergent distant education. *Education Sciences*, 11(11), Article 721. <https://doi.org/10.3390/educsci11110721>
- Brainard, J. (2022). 'COVID-ization' of research levels off. *Science*, 376(6595), 782–783. <https://doi.org/10.1126/science.add0532>
- Buizza, C., Bazzoli, L., & Ghilardi, A. (2022). Changes in college students mental health and lifestyle during the COVID-19 pandemic. *Adolescent Research Review*, 7(4), 537–550. <https://doi.org/10.1007/s40894-022-00192-7>
- Camilleri, M. A., & Camilleri, A. C. (2022). A cost-benefit analysis on the use of remote learning technologies: A systematic review and a synthesis of the literature. 6th International Conference on E-Education, E-Business and E-Technology, ICEBT 2022.
- Chang, J. J., Ji, Y., Li, Y. H., Pan, H. F., & Su, P. Y. (2021). Prevalence of anxiety symptom and depressive symptom among college students during COVID-19 pandemic: A meta-analysis. *Journal of Affective Disorders*, 292, 242–254. <https://doi.org/10.1016/j.jad.2021.05.109>
- Cortés-Albornoz, M. C., Ramírez-Guerrero, S., Rojas-Carabali, W., De-La-Torre, A., & Talero-Gutiérrez, C. (2022). Effects of remote learning during the COVID-19 lockdown on children's visual health. *BMJ Open*, 12(8), Article e062388. <https://doi.org/10.1136/bmjopen-2022-062388>
- Couper-Kennedy, F., & Riddell, S. (2021). The impact of COVID-19 on children with additional support needs and disabilities in Scotland. *European Journal of Special Needs Education*, 36(1), 20–34. <https://doi.org/10.1080/08856257.2021.1872844>
- da Silva, G. C. L., Rossato, L., Correia-Zanini, M., & Scorsolini-Comin, F. (2022). Online group interventions for mental health promotion of college students. *Counselling and Psychotherapy Research*, 22(4), 844–852. <https://doi.org/10.1002/capr.12561>
- Daumiller, M., Rinas, R., Hein, J., Janke, S., Dickhäuser, O., & Dresel, M. (2021). Shifting from face-to-face to online teaching during COVID-19: The role of university faculty achievement goals for attitudes towards this sudden change, and their relevance for burnout/engagement and student evaluations of teaching quality. *Computers in Human Behavior*, 118, Article 106677. <https://doi.org/10.1016/j.chb.2020.106677>
- Daumiller, M., Rinas, R., Schoon, I., & Lüftenegger, M. (2023). *Supplemental materials to "How did COVID-19 affect education and what can be learned moving forward? A systematic meta-review of systematic reviews and meta-analyses"*. <https://osf.io/9gudy/>
- Deepika, V., Soundariya, K., Karthikeyan, K., & Kalaiselvan, G. (2021). Learning from home. *Postgraduate Medical Journal*, 97(1151), 590–597. <https://doi.org/10.1136/postgradmedj-2020-137989>
- Deng, J., Zhou, F., Hou, W., Silver, Z., Wong, C. Y., Chang, O., Drakos, A., Zuo, Q. K., & Huang, E. (2021). The prevalence of depressive symptoms, anxiety symptoms and sleep disturbance in higher education students during the COVID-19 pandemic. *Psychiatry Research*, 301, Article 113863. <https://doi.org/10.1016/j.psychres.2021.113863>
- Ebrahim, A. H., Dhahi, A., Husain, M. A., & Jahrami, H. (2022). The psychological well-being of university students amidst COVID-19 pandemic. *Sultan Qaboos University Medical Journal*, 22(2), 179–197. <https://doi.org/10.18295/squmj.6.2021.081>
- Elharake, J. A., Akbar, F., Malik, A. A., Gilliam, W., & Omer, S. B. (2022). Mental health impact of COVID-19 among children and college students. *Child Psychiatry and Human Development*. <https://doi.org/10.1007/s10578-021-01297-1>
- Fang, Y., Ji, B., Liu, Y., Zhang, J., Liu, Q., Ge, Y., Xie, Y., & Liu, C. (2022). The prevalence of psychological stress in student populations

- during the COVID-19 epidemic. *Scientific Reports*, 12(1), Article 12118. <https://doi.org/10.1038/s41598-022-16328-7>
- Fernández-Batanero, J. M., Montenegro-Rueda, M., Fernández-Cerero, J., & Tadeu, P. (2022). Online education in higher education. *Heliyon*, 8(8), Article e10139. <https://doi.org/10.1016/j.heliyon.2022.e10139>
- Francescato, D., Porcelli, R., Mebane, M., Cuddetta, M., Klobas, J., & Renzi, P. (2006). Evaluation of the efficacy of collaborative learning in face-to-face and computer-supported university contexts. *Computers in Human Behavior*, 22(2), 163–176. <https://doi.org/10.1016/j.chb.2005.03.001>
- García-Louis, C., Hernandez, M., & Aldana-Ramirez, M. (2022). Latinx community college students and the (in)opportunities brought by COVID-19 pandemic. *Journal of Latinos and Education*, 21(3), 277–288. <https://doi.org/10.1080/15348431.2022.2039152>
- Guppy, N., Verpoorten, D., Boud, D., Lin, L., Tai, J., & Bartolic, S. (2022). The post-COVID-19 future of digital learning in higher education. *British Journal of Educational Technology*, 53(6), 1750–1765. <https://doi.org/10.1111/bjet.13212>
- Haddad, J. M., Macenski, C., Mosier-Mills, A., Hibara, A., Kester, K., Schneider, M., Conrad, R. C., & Liu, C. H. (2021). The impact of social media on college mental health during the COVID-19 pandemic. *Current Psychiatry Reports*, 23(11), Article 70. <https://doi.org/10.1007/s11920-021-01288-y>
- Hammerstein, S., König, C., Dreisörner, T., & Frey, A. (2021). Effects of COVID-19-related school closures on student achievement. *Frontiers in Psychology*, 12, Article 746289. <https://doi.org/10.3389/fpsyg.2021.746289>
- Hascher, T., & Waber, J. (2021). Teacher well-being. *Educational Research Review*, 34, Article 100411. <https://doi.org/10.1016/j.edurev.2021.100411>
- Hodges, C. B., Moore, S., Lockee, B. B., Trust, T., & Bond, M. A. (2020). The difference between emergency remote teaching and online learning. <http://hdl.handle.net/10919/104648>
- Ibna Seraj, P. M., Chakraborty, R., Mehdi, T., & Roshid, M. M. (2022). A systematic review on pedagogical trends and assessment practices during the COVID-19 pandemic. *Education Research International*, 2022, Article 1534018. <https://doi.org/10.1155/2022/1534018>
- Jehi, T., Khan, R., Dos Santos, H., & Majzoub, N. (2022). Effect of COVID-19 outbreak on anxiety among students of higher education. *Current Psychology*. <https://doi.org/10.1007/s12144-021-02587-6>
- Khan, K. S., Kunz, R., Kleijnen, J., & Antes, G. (2003). Five steps to conducting a systematic review. *Journal of the Royal Society of Medicine*, 96(3), 118–121. <https://doi.org/10.1258/jrsm.96.3.118>
- Kiltz, L., Rinas, R., Daumiller, M., Fokkens-Bruinsma, M., & Jansen, E. P. (2020). When they struggle, I cannot sleep well either. *Frontiers in Psychology*, 11, Article 2283. <https://doi.org/10.3389/fpsyg.2020.578378>
- Kratzer, S., Pfadenhauer, L. M., Biallas, R. L., Featherstone, R., Klinger, C., Movsisyan, A., Rabe, J. E., Stadelmaier, J., Rehfuess, E., Wabnitz, K., & Verboom, B. (2022). Unintended consequences of measures implemented in the school setting to contain the COVID-19 pandemic. *Cochrane Database of Systematic Reviews*, 2022(6), Article CD015397. <https://doi.org/10.1002/14651858.CD015397>
- Krishnaratne, S., Pfadenhauer, L. M., Coenen, M., Geffert, K., Jung-Sievers, C., Klinger, C., Kratzer, S., Littlecott, H., Movsisyan, A., Rabe, J. E., Rehfuess, E., Sell, K., Strahwald, B., Stratil, J. M., Voss, S., Wabnitz, K., Burns, J., & Burns, J. (2020). Measures implemented in the school setting to contain the COVID-19 pandemic. *Cochrane Database of Systematic Reviews*, 2020(12), Article CD013812. <https://doi.org/10.1002/14651858.CD013812>
- Kuhfield, M., & Tarasawa, B. (2020). Projecting the potential impact of COVID-19 school closures on academic achievement. *Educational Researcher*, 49(8), 549–565. <https://doi.org/10.3102/0013189X20965918>
- Liyanage, S., Saqib, K., Khan, A. F., Thobani, T. R., Tang, W. C., Chiarot, C. B., Alshurman, B. A., & Butt, Z. A. (2022). Prevalence of anxiety in university students during the Covid-19 pandemic. *International Journal of Environmental Research and Public Health*, 19(1), Article 62. <https://doi.org/10.3390/ijerph19010062>
- Lorente, L. M. L., Arrabal, A. A., & Pulido-Montes, C. (2020). The right to education and ICT during COVID-19. *Sustainability*, 12(21), Article 9091. <https://doi.org/10.3390/su12219091>
- Ma, K., Liang, L., Chutiyami, M., Nicoll, S., Khaerudin, T., & Ha, X. V. (2022). COVID-19 pandemic-related anxiety, stress, and depression among teachers. *Work*, 73(1), 3–27. <https://doi.org/10.3233/WOR-220062>
- Malinauskas, R., & Malinauskiene, V. (2022). Meta-analysis of psychological interventions for reducing stress, anxiety, and depression among university students during the COVID-19 pandemic. *International Journal of Environmental Research and Public Health*, 19(15), Article 9199. <https://doi.org/10.3390/ijerph19159199>
- Masalimova, A. R., Khvatova, M. A., Chikileva, L. S., Zvyagintseva, E. P., Stepanova, V. V., & Melnik, M. V. (2022). Distance learning in higher education during Covid-19. *Frontiers in Education*, 7, Article 822958. <https://doi.org/10.3389/feduc.2022.822958>
- Mayurasakorn, K., Pinsawas, B., Mongkolsucharitkul, P., Sranacharoenpong, K., & Damapong, S. (2020). School closure, COVID-19 and lunch programme. *Journal of Paediatrics and Child Health*, 56(7), 1013–1017. <https://doi.org/10.1111/jpc.15018>
- Morfaki, C., & Skotis, A. (2022). Academic online learning experience during COVID-19—sa systematic literature review based on personality traits. *Higher Education, Skills and Work-based Learning*. <https://doi.org/10.1108/HESWBL-03-2022-0062>
- Na, S., & Jung, H. (2021). Exploring university instructors' challenges in online teaching and design opportunities during the Covid-19 pandemic. *International Journal of Learning, Teaching and Educational Research*, 20(9), 308–327. <https://doi.org/10.26803/ijlter.20.9.18>
- Nakhoda, K., Ahmady, S., Fesharaki, M. G., & Azar, N. G. (2021). Covid-19 pandemic and e-learning satisfaction in medical and non-medical student. *Iranian Journal of Public Health*, 50(12), 2509–2516. <https://doi.org/10.18502/ijph.v50i12.7933>
- Nang, A. F. M., Maat, S. M., & Mahmud, M. S. (2022). Teacher technostress and coping mechanisms during COVID-19 pandemic. *Pegem Eğitim ve Öğretim Dergisi*, 12(2), 200–212. <https://doi.org/10.47750/pegegog.12.02.20>
- Ozamiz-Etxebarria, N., Mondragon, N. I., Bueno-Notivol, J., Pérez-Moreno, M., & Santabárbara, J. (2021). Prevalence of anxiety, depression, and stress among teachers during the covid-19 pandemic. *Brain Sciences*, 11(9), Article 1172. <https://doi.org/10.3390/brainsci11091172>
- Palayew, A., Norgaard, O., Safreed-Harmon, K., Andersen, T. H., Rasmussen, L. N., & Lazarus, J. V. (2020). Pandemic publishing poses a new COVID-19 challenge. *Nature Human Behaviour*, 4(7), 666–669. <https://doi.org/10.1038/s41562-020-0911-0>
- Panagoulis, E., Stavridou, A., Savidi, C., Kourti, A., Psaltopoulou, T., Sergeantanis, T. N., & Tsitsika, A. (2021). School performance among children and adolescents during covid-19 pandemic. *Children*, 8(12), Article 1134. <https://doi.org/10.3390/children8121134>
- Pelikan, E. R., Lüftenecker, M., Holzer, J., Korlat, S., Spiel, C., & Schober, B. (2021). Learning during COVID-19. *Zeitschrift für Erziehungswissenschaft*, 24(2), 393–418. <https://doi.org/10.1007/s11618-021-01002-x>
- Psacharopoulos, G., Collis, V., Patrinos, H. A., & Vegas, E. (2021). The COVID-19 cost of school closures in earnings and income across the world. *Comparative Education Review*, 65(2), 271–287. <https://doi.org/10.1086/713540>

- Riboldi, I., Cavaleri, D., Calabrese, A., Capogrosso, C. A., Piacenti, S., Bartoli, F., Crocamo, C., & Carrà, G. (2022). Digital mental health interventions for anxiety and depressive symptoms in university students during the COVID-19 pandemic. *Revista de Psiquiatria y Salud Mental*. <https://doi.org/10.1016/j.rpsm.2022.04.005>
- Robeyns, I. (2006). Three models of education. *Theory and Research in Education*, 4(1), 69–84. <https://doi.org/10.1177/1477878506060683>
- Saikat, S., Dhillon, J. S., Ahmad, W. F. W., & Jamaluddin, R. A. (2021). A systematic review of the benefits and challenges of mobile learning during the Covid-19 pandemic. *Education Sciences*, 11(9), Article 459. <https://doi.org/10.3390/educsci11090459>
- Schwab, C., Frenzel, A. C., Daumiller, M., Dresel, M., Dickhäuser, O., Janke, S., & Marx, A. K. (2022). I'm tired of black boxes. *PLoS ONE*, 17(10), Article e0272738. <https://doi.org/10.1371/journal.pone.0272738>
- Shea, B. J., Reeves, B. C., Wells, G., Thuku, M., Hamel, C., Moran, J., Moher, D., Tugwell, P., Welch, V., & Kristjansson, E. (2017). AMSTAR 2. *BMJ*, 358, Article j4008. <https://doi.org/10.1136/bmj.j4008>
- Silva, D. F. O., Cobucci, R. N., Lima, S. C., & de Andrade, F. B. (2021). Prevalence of anxiety, depression, and stress among teachers during the COVID-19 pandemic. *Medicine (United States)*, 100(44), Article e27684. <https://doi.org/10.1097/MD.00000000000027684>
- Susilaningsih, F. S., Komariah, M., Mediawati, A. S., & Lumbantobing, V. B. M. (2021). Quality of work-life among lecturers during online learning in COVID-19 pandemic period. *Malaysian Journal of Medicine and Health Sciences*, 17, 163–166
- Tadesse, S., & Muluye, W. (2020). The impact of COVID-19 pandemic on education system in developing countries. *Open Journal of Social Sciences*, 8(10), 159–170. <https://doi.org/10.4236/jss.2020.810011>
- Thomas, J., & Harden, A. (2008). Methods for the thematic synthesis of qualitative research in systematic reviews. *BMC Medical Research Methodology*, 8(1), 1–10. <https://doi.org/10.1186/1471-2288-8-45>
- Tilak, J. B. G., & Kumar, A. G. (2022). Policy changes in global higher education. *Higher Education Policy*, 35(3), 610–628. <https://doi.org/10.1057/s41307-022-00266-0>
- Truzoli, R., Pirola, V., & Conte, S. (2021). The impact of risk and protective factors on online teaching experience in high school Italian teachers during the COVID-19 pandemic. *Journal of Computer Assisted Learning*, 37(4), 940–952. <https://doi.org/10.1111/jcal.12533>
- Turnbull, D., Chugh, R., & Luck, J. (2021). Transitioning to E-Learning during the COVID-19 pandemic. *Education and Information Technologies*, 26(5), 6401–6419. <https://doi.org/10.1007/s10639-021-10633-w>
- UNESCO, UNICEF, & World Bank (2020). *What have we learnt?: Overview of findings from a Survey of Ministries of Education on National Responses to COVID-19*. <https://policycommons.net/artifacts/1278937/what-have-we-learnt/1869007/>
- United Nations (2020). *Policy Brief: Education during COVID-19 and beyond*. <https://unsdg.un.org/resources/policy-brief-impact-covid-19-children>
- United Nations Children's Fund, UNESCO, & World Bank (2022). *Where are we on education recovery?* UNICEF. <https://eric.ed.gov/?id=ED619435>
- Valenzuela, R. L. G., Velasco, R. I. B., & Jorge, M. P. P. C., II. (2022). Impact of COVID-19 pandemic on sleep of undergraduate students. *Stress and Health*, 39(1), 4–34. <https://doi.org/10.1002/smi.3171>
- van de Schoot, R., de Bruin, J., Schram, R., Zahedi, P., de Boer, J., Weijdem, F., Kramer, B., Huijts, M., Hoogerwerf, M., & Ferdinands, G. (2021). An open source machine learning framework for efficient and transparent systematic reviews. *Nature Machine Intelligence*, 3(2), 125–133. <https://doi.org/10.1038/s42256-020-00287-7>
- Viner, R., Russell, S., Saulle, R., Croker, H., Stansfield, C., Packer, J., Nicholls, D., Goddings, A. L., Bonell, C., Hudson, L., Hope, S., Ward, J., Schwalbe, N., Morgan, A., & Minozzi, S. (2022). School closures during social lockdown and mental health, health behaviors, and well-being among children and adolescents during the first COVID-19 wave: A systematic review. *JAMA Pediatrics*, 176(4), 400–409. <https://doi.org/10.1001/jamapediatrics.2021.5840>
- Wang, F., Zhang, L., Ding, L., Wang, L., & Deng, Y. (2022). Fear of COVID-19 among college students. *Frontiers in Public Health*, 10, Article 846894. <https://doi.org/10.3389/fpubh.2022.846894>
- Westphal, A., Kalinowski, E., Hoferichter, C. J., & Vock, M. (2022). K-12 teachers' stress and burnout during the COVID-19 pandemic. *Frontiers in Psychology*, 13, Article 920326. <https://doi.org/10.3389/fpsyg.2022.920326>
- Xiang, M.-Q., Tan, X.-M., Sun, J., Yang, H.-Y., Zhao, X.-P., Liu, L., Hou, X.-H., & Hu, M. (2020). Relationship of physical activity with anxiety and depression symptoms in Chinese college students during the COVID-19 outbreak. *Frontiers in Psychology*, 11, Article 582436.
- Zheng, M., Asif, M., Tufail, M. S., Naseer, S., Khokhar, S. G., Chen, X., & Naveed, R. T. (2022). COVID academic pandemic. *Frontiers in Psychology*, 13, Article 895371. <https://doi.org/10.3389/fpsyg.2022.895371>
- Zhu, J., Racine, N., Xie, E. B., Park, J., Watt, J., Eirich, R., Dobson, K., & Madigan, S. (2021). Post-secondary student mental health during COVID-19. *Frontiers in Psychiatry*, 12, Article 777251. <https://doi.org/10.3389/fpsyg.2021.777251>
- Zierer, K. (2021). Effects of pandemic-related school closures on pupils' performance and learning in selected countries. *Education Sciences*, 11(6), Article 252. <https://doi.org/10.3390/educsci11060252>

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Open Data

Supplementary materials as well as open data and materials are available in the OSF at <https://osf.io/9gudy/> (Daumiller et al., 2023).

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