

## Changes, Challenges, and Opportunities in Teaching Senior High School Earth Science amidst the COVID-19 Pandemic

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### ABSTRACT

The coronavirus disease 2019 (COVID-19) has prompted the shift from traditional face-to-face instruction to new methods in online platforms. As national governments enforce public health measures to minimize the risk of the virus' transmission, learning institutions grapple with the new norms in education. Teachers are finding ways to address the changes attendant to the current situation. Old practices have to be revisited and recalibrated to fit the demands of a global community in a pandemic. This paper describes my personal reflections on the adjustments caused by the pandemic in my practice as an Earth science educator and some of the ways to possibly address them. Changes in plans due to suspension of laboratory activities and postponement of off-campus activities necessitate the search for equally effective alternatives through online teaching. Amidst the COVID-19 pandemic, teachers, students, parents, and all stakeholders are expected to respond proactively to the needs of the time. Changes and challenges can be turned into opportunities that will provide quality education during this uncertain period.



### INTRODUCTION

With more than 10 million cases and half a million deaths worldwide as of June 30, 2020 (Johns Hopkins University Corona Virus Resource Center, 2020), the coronavirus disease 2019 or COVID-19 has dramatically impacted the global community and remains a threat against public health and safety. In the Philippines, the Interagency Task Force (IATF) on Emerging Infectious Diseases has been leading the government's multi-sectoral response against the COVID-19 (World Health Organization [WHO], 2020). As of 4:00 PM (PST), June 30, 2020, a total of 37,514 cases of COVID-19 have been recorded by the Philippine Department of Health (DOH), with 10,233 recoveries and 1,266 deaths (DOH, 2020). Djalante et al. (2020) described the effects of this pandemic to be unprecedented.

One of the sectors adversely affected by the COVID-19 pandemic is the education sector. As of June 29, 2020, more than a billion students, or 61% of the global student population, are affected by school closures (UNESCO, 2020). Schools were forced to stop face-to-face classroom sessions and are now gradually shifting to different modalities such as online distance learning. In the Philippines, the impact of these school closures is evident in both basic and higher education institutions (Nicholls, 2020; Toquero, 2020a). School administrators, teachers, students, parents, and other stakeholders are confronted by the issues and concerns brought about by this paradigm shift. The country's Department of Education or DepEd, in its June 8, 2020 press statement, moreover announced the postponement of face-to-face classes until a COVID-19 vaccine becomes available (Boliver, 2020).

In the Philippines, Earth science is one of the core courses offered in the Science, Technology, Engineering, and Mathematics (STEM) strand in senior high school (DepEd, n.d.; DepEd, 2013). The course focuses on the study of the Earth as a planet - its history, structure, and composition, as well as the different endogenic and exogenic Earth processes and the issues related to Earth resources (DepEd, 2013). Shah (2013) underscored the necessity to promote earth science education globally. Likewise, the Geological Society of America (2016) also recommended the teaching of Earth science as part of science education in K-12 for both public and private schools. Hence, in spite of the current health crisis and the changes it caused to the modalities of teaching and learning, the value of studying Earth science remains. In this paper, I will present my personal reflections on the impacts of the current pandemic to my practice as a senior high school Earth science teacher.

### Challenges and Future Outlook in Teaching Earth Science in an Online Distance Learning Environment

Due to the COVID-19 pandemic, education worldwide is affected by school closures and the shift to other modalities such as e-learning (Li & Lalani, 2020). In online learning, teachers who are accustomed to face-to-face classroom lectures need to adapt to online teaching which can be done synchronously or asynchronously. For students, and even parents, online distance learning translates to having their personal space at home converted into their learning and working space. Majority of the class activities

will be done online and communication and interaction will happen in platforms such as virtual classrooms, online discussion boards, and videoconferencing. While the participants, the teachers and students, remain the same, the venue is much different from the physical setup they have been used to. Moreover, in an online distance learning setup, both the teachers and students must have the means to engage in these online platforms. These adjustments and concerns are not exclusive to Earth science education alone. Challenges related to online teaching in other fields of science such as biology, chemistry, and physics, and the possible ways to address them and/or learn from them have likewise been noted (Arnaud, 2020; Budrikis, 2020; Guidote, 2020; Herzog & Mawn, 2020; Lansangan, 2020).

In my own Earth science class, one of the most evident changes prompted by the shift to online distance learning is the absence of laboratory activities where students can examine real rock and mineral samples, collaborate with their classmates on worksheets, and ask questions with their teacher while being engaged in the laboratory exercises. Tools such as globes, maps, and other laboratory instruments cannot be expected to be available in each of the students' households. Move-type examinations in the laboratory can no longer be done as a form of summative assessment as long as school campuses remain closed. In general, assessments have to be designed appropriately for an online setup. Our plans for museum tours and visits to research institutes are likewise put on hold because of travel restrictions and prohibitions on mass gatherings. More practical issues include the limited or intermittent Internet connectivity at times, which raises a more practical concern regarding students' participation in their class activities.

Nevertheless, opportunities are also present in the current context of Earth science teaching. Students will have greater flexibility in terms of pacing their own progress. Online learning offers the opportunity to maximize Internet resources, widens the students' educational opportunities, and is not constrained by place nor time (Gilbert, 2015). Teachers may also emphasize the value of Earth science in daily life as they develop their lessons to fit the students' current realities. For example, as communities remain to stay indoors, students can be asked to reflect on the importance of minerals used in producing gadgets that are now widely used in online work and studies. Students with granite countertops in their kitchens or rocks in their gardens may be asked to observe the individual crystals present in them—their colors, size, shape, and other observable characteristics. Natural resources such as energy and water that are sometimes taken for granted can now be more appreciated during community quarantines.

In terms of instructional tools, online simulations like the PhET Interactive Simulations of the University of Colorado Boulder (<https://phet.colorado.edu/>) and virtual globes like Google Earth and Google Maps are readily available. Synchronous and asynchronous activities can be done with free online applications. For instance, map observations can be done with Google Earth and other applications such as Google Maps and PHIVOLCS FaultFinder (Landicho, 2020). Materials provided by academic organizations (e.g., International Geoscience Education Organisation; <http://www.igeosced.org/teaching-resources/>), free online lecture notes, online databases (e.g., <https://www.mindat.org> for minerals and rocks), and educational videos can further enrich our teaching resources. Other activities like field trips may likewise be substituted by virtual tours through Google Maps, with its three-dimensional view option. In addition, faculty development activities, webinars, and professional conversations among Earth science educators may provide opportunities to share best teaching practices during the pandemic. In a paper detailing his own experience of teaching junior high school chemistry online, Lansangan (2020) also noted the value of collaborative actions among teachers, such as sharing of practices and gaining insights from colleagues' experiences, which can motivate them to "deliver quality education by maximizing the available resources in times of emergency remote teaching" (p.30). Finally, if time and resources permit, teachers may also explore the possibility of inviting experts to give a short talk or lecture in their online classes. By doing so, students gain valuable insights from invited scientists and researchers and might even be inspired to pursue careers in the Earth sciences.

## CONCLUSION

The COVID-19 pandemic has drastically affected the global community and pushed educators to revisit their preparedness for online teaching. In my own experience as an Earth science teacher, some of the adjustments in the current context include the absence of laboratory activities, field visits, and other off-campus engagements (e.g., tours), and the shift to online delivery of lessons. With these changes come the challenges that include the redesigning of lessons and assessments, the limitations on technological resources, and the effects of other factors such as decreased social interactions among learners and teachers. Nevertheless, opportunities to explore novel solutions to these challenges are called for. Toquero (2020b) considered this pandemic as a decisive moment for the country's education sector. Indeed, teaching and learning in the COVID-19 and post-COVID-19 periods face unprecedented challenges that require carefully designed responses and efficient solutions. School administrators, teachers, students, and parents must be synergistically involved in delivering lessons through different modalities. Parental support is crucial in the academic success of children and the present overall online learning process (Sarkar, 2020). Curriculum experts and education policymakers are called to reevaluate the readiness of existing education infrastructures to continue even in situations such as the COVID-19 pandemic. To address future emergencies like the current health crisis, school districts should consider the preparation and readiness of students and their families for online learning, the preparation of teachers to adapt to online teaching, and the redesigning of assessments that are compatible with online learning and are equitable (Mabry, 2020). In addition, digital divides should also be closed and addressed (Janssen, 2020).

The suggestions and insights mentioned in this paper are just a few of the many possible ways to maximize the learning experiences of our students while studying in an online learning environment. Readers are also reminded that the author expounded on his perspective as a teacher in an online distance learning setup. This paper does not aim to provide an exhaustive list of classroom

activities or resources for Earth science teaching but rather emphasizes the idea that changes and challenges can be turned into opportunities that will push us to think of more efficient ways to ensure quality education during this uncertain period and in the future.

## NOTES

An earlier preprint version of this paper was posted by the author on his personal ResearchGate profile. Ethics committee permission is not applicable because this article does not contain any studies with human or animal subjects.

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