

We want to thank Reviewer 1 for the detailed and thoughtful review, which really helped us plan revisions to improve the manuscript.

Reviewer 1

Thank you for the opportunity to read this submission. It is clear that the authors have put a lot of time and effort into creating a remote field experience for their students. Unfortunately, this is overshadowed by the confusing set up for the paper and lack of evidence presented to substantiate their claims. I believe that major restructuring is needed for this to be publishable. Below, I describe the bigger picture strengths and challenges that I observed in each section. This is followed by more minor (line-by-line) comments.

We concur that restructuring is needed and details of the plans are given in specific locations below.

Title:

Though the title describes the field course adequately, I find the duplication of almost the exact same word (“applications applied”) to be hard to follow.

We will remove “Applied” and leave the title as “A Remote Field Course Implementing High-Resolution Topography Acquisition with Geomorphologic Applications”

Abstract:

The abstract is well written, but it is too focused on the course context (what is essentially background information). This takes away from describing the impact of the curriculum that you have developed. You only say that “students met the majority of the NAGT field capstone learning outcomes” which is rather vague. I want to know which outcomes specifically were met (or a selection of them at least) and how you measured this. I recommend reducing the details of the course context to 2-3 sentences and focusing more on the project outcomes and recommendations.

Abstract will be rewritten based on this guidance and to match the final version of the paper which reflects these issues. We will remove some details about the course and add details about outcomes, as outlined below.

Introduction:

This section is largely course context information that would be much more appropriate after the relevant literature context is presented. Furthermore, the level of detail about the course context is excessive for an introduction and should instead be a separate section entirely.

The introduction does not flow logically. It begins by describing the course, then talks about the remote field data collection and activities (and where they are available), then goes back to the course context and the data sources, which is then followed by more course context (demographic information). A more common approach would be to discuss the course context, then discuss the specific activity and how it was developed, then follow with where the completed activity may be found. However, as indicated above, I believe this would be more effective as a separate section that follows the introduction.

We are planning to restructure the paper to be:

1. *Introduction*
 - 1.1. *Background (on why/what we did)*
 - 1.2. *Value of course content geologically*
 - 1.3. *Value of remote field learning to remove barriers to participation*
2. *Overview of the course*
3. *Methods in this study*
4. *Course implementation and outcomes*
5. *Lessons learned and implementation recommendations*

The last paragraph of Section 1.0 seems to be suggesting that COVID-19 has caused this particular course to be more diverse. This claim is unsubstantiated and should be removed. There is no comparison to previous year's demographic data, and even that would not be enough to support a causal link. I believe that the literature cited regarding barriers to fieldwork is incredibly important, but it seems out of place here. Perhaps have a subsection of the introduction that is dedicated to synthesizing relevant literature on the barriers to fieldwork and the potential for remote field courses to help address some of those barriers?

We will move demographic data to "Course implementation and outcomes" section (as a result) and will add a comparison with UNC's majors' demographics which support this claim. We will also use different language when referring to groups historically marginalized in the geosciences.

Section 1.1 doesn't seem to be connected to prior or subsequent sections and feels disjointed. I think that moving course context information to a separate section will help, and then this section may be framed as supporting literature context for the work.

Section 1.2 (Overview of Modules and Learning Objectives) is repetitive of prior and subsequent information. I don't think there is any need to give an overview before presenting day-by-day details that are not overly long. I suggest creating two tables to help streamline this information: 1) A table that compares the course learning outcomes to the NAGT field outcomes, and 2) A table that provides an overview of the itinerary (the information currently presented in L118-160).

We agree and will be restructuring as described above.

We plan to use several different tables similar to what the review suggests - in the new sections 2) and 4) in order to more clearly present the alignment between a given course activity, activity learning outcomes, NAGT learning outcomes, supporting student data/evidence, and explanations for why evidence supports claims made. We will plan to use tables and more concise text sections than the original manuscript to accomplish this.

Curriculum description (Section 2):

This section includes student artefacts and performance data. I think it would be helpful to state this in an overarching title or introductory paragraph for the section, so that readers are expecting it. Something like "unit descriptions and evidence of student success"? Evidencing your curriculum's effectiveness is incredibly important, and this is buried at present.

On a related note, I do not see any mention of human ethics (i.e., Institutional Review Board) approval. The figure captions reference compliance, but it is still not clear if the study went through a review process. If human subjects approval was confirmed through the submission process, please disregard my comment.

We will add a short methods section describing what data we have and that we have IRB approval to use course artifacts. We will also explain that because this course was not a designed educational research study (but as a response to COVID19), there are inherent limitations. We will also describe how student work was assessed and provide an example rubric. This will provide context for the percentage scores currently presented.

Some of this section repeats data sources / curricula that were adapted, both of which were described in detail much earlier in the manuscript. I think you could remove that specific information from the introduction in favour of only including it here, as it is much more meaningful when placed in context.

Paper restructuring described above should address this issue as well.

Lessons learned (Section 3):

I appreciate the authors' reflections here, but they would be strengthened if they were supported by evidence (from the literature and/or data in the study).

Student feedback is mentioned in this section without any description of how these data were collected or how the claim of "student appreciation of the course" is supported.

We will be more transparent that a few students provided unsolicited appreciation for the course. We will include statements from students' daily journal entries where relevant. We will pull from the "Course implementation and outcomes" to support assertions made in the "lessons learned and recommendations" section.

Technical (line-by-line) comments:

- L10: I found this phrasing a bit awkward. Perhaps start with a word other than "with"?

- L14: The use of "mock" and "real" undermines the virtual field aspect. I suggest "remote" and "authentic".

- L15-18: Suggest moving the objectives and course content earlier in the paragraph; e.g., after the first sentence. This way things flow a bit more logically and you are presenting the course context before describing a specific activity within it. (However, see my earlier comments about the abstract more generally - I think you could cut this background information down substantially)

Edits will be made as suggested

- L24: Elaborate on what is meant by "field tradition".

- L26: Evidence needed to support the claim that "the majority" of courses were redesigned for remote delivery.

We will cite records from

https://nagt.org/nagt/teaching_resources/field/summer_2020_virtual_field_camp.html

that show a record of virtual field offerings; many field courses were canceled and therefore this resource was compiled, which is how external students found the course.

https://nagt.org/nagt/publications/trenches/v11-n1/online_field_experiences.html

- L38-40: Calling this crowd-sourcing curriculum development undersells the work that went into the project and the evidence that informed it. There were several facilitated, structured working groups dedicated to different topics and a concerted effort to articulate consensus learning outcomes. I appreciate that you are trying to be brief, but I think that more care is needed here. If the authors were not involved in the working groups, it is sufficient to say that the curriculum was added to this resource collection.

We will remove this language and use “working groups” and “community developed” instead.

- L49: What is “workshop style”? Please include more pedagogical detail or a citation here.

We will remove “workshop style” and provide details on session formats and duration, including that each day was composed of multiple synchronous working sessions with asynchronous work time in between.

- L50: How many is “several”? How does this compare to overall course numbers? Even just a rough idea would be helpful here.

Will add actual number of students

- L67: I don’t think “incurred” is the right word here. Also, much more detail and relevant citations are needed to explain the affective factors that are being referred to.

Will change “incurred” to “experience” if we keep this sentence

- L68: Change “major’s” to “major”. Also, what is meant by “most diverse”?

As mentioned above, we will move this to outcomes section, add context, and expand upon what is meant based on the comparison that can be made and change the language as described in response to L69 comment

- L68-70: Remove spaces between numbers and percentage signs.

We will follow the journal’s style guideline

- L69: The term “underrepresented minorities” is deficit-framed and puts the burden on students rather than recognizing the systems that have excluded them from STEM (see this blog post for one example of a critique: <https://cacm.acm.org/blogs/blog-cacm/245710-underrepresented-minority-considered-harmful-racist-language/fulltext>). Please consider if there is a more appropriate term that may be used for your context.

Thank you for pointing this out. If the reviewer has a specific term they recommend, we would be happy to use that. Reviewing current use by NSF, Geopaths, and others it seems that there is not yet consensus on the best terminology. We propose to use “historically marginalized groups” and list them.

- L79: Quotation marks should end before the citation. Also, a page number should be included with the quotation.

We will fix as suggested.

- L110: This seem to be different than the course learning outcomes stated in the abstract and earlier on in the introduction. Or are these field activity specific learning outcomes?

In the new sections 2) and 4) we will more clearly and consistently specify which activity, course, and NAGT learning outcomes that are supported by particular pieces of student evidence.

- L189-190: You mention GPS and GNSS much earlier in the paper, but this is the first time they are defined.

We will make sure all acronyms are defined the first time they are used

- L238-240: Quote all learning outcomes here rather than describing vaguely. Also, you don't present evidence here that students met these outcomes, so it is inaccurate to say "this allowed them to meet the student learning outcome". Rather, the activities are designed to address or align with specific outcomes.

We will be clearer about this as suggested and only make assertions that are backed up by evidence. We will be adding some additional student evidence than is in the original manuscript. We have consulted with an educational researcher to attain additional recommendations on what evidence to use and how to present it.

- L257: Same comment as above re: "allowed students to meet".

See response to L238

- L322: No evidence is provided to suggest that students "enhanced their skills".

See response to L238

- L327: Change "student" to "students".

Will change

- L333-335: Elaborate on why this is a significant outcome.

Will elaborate on this illustrating a student's ability to apply the breadth of methods used in the class in a unique application and highlight this as evidence of the student's self-efficacy and interest in the topic. May be combined with evidence from one or more other students.

- L343-345: I believe this, but it would be better supported with data from the students. Or are you saying that it was exhausting for the instructors? Or both?

Both; will clarify and back up with student evidence from students' discussion posts

- L363-364: Do you have any suggestions for how these may be better addressed?

We do not immediately have a solution but will continue to ponder it during the rewriting process.

- L364-365: Evidence is needed to substantiate this claim.

We agree and will back with evidence

- L398: Atchison is listed twice here.

Will fix

- Figure 4: Are these students in the images? If so, did they consent to their images being included?

Yes; covered by IRB; we will add this to the caption