ABSTRACT

As an alternative to traditional upper-level physical geography pedagogy (labs, quizzes, tests, papers, and occasional field exercises), this article outlines and analyzes a 10-week large-group research endeavor conceived and executed by undergraduates where they explored aspects of project construction, methods, analyses, and group dynamics. These experiences are then critiqued from both instructor- and student-based perspectives. We suggest that pedagogies linking physical geography and traditional humanities disciplines should not be overlooked, especially in physical geography-based courses, as they can expose students to high-level thinking skills such as: not limiting research projects to quantitative observations in a natural setting; implementing a student-friendly medium; putting into practice the (sometimes dryly-delivered) geomorphic content. Additionally, we note that fostering humanities-science inquiry can enhance students’ overall learning, while encompassing an upper-division class’ primary focus of providing meaningful (to them) research experiences and generate crucial connections when applying knowledge to higher-level professional and academic research.

Key Words: geomorphology, music, open-ended learning environments, humanistic physical geography

PRELUDE

Upper-level undergraduate physical geography classes employ many facets to engage students (labs, quizzes, tests, papers, and occasional field exercises), often connecting them with the scientific method through a research project (perhaps even as part of the instructor’s research agenda or expertise area specifically). This traditional pedagogy may seem tried and true at first glance, but upon closer inspection, it lacks higher-order thinking skills. Further, the traditional pedagogy neglects what Herrington, Oliver, and Reeves (2009) note as an important component of student devel-
opment, especially in undergraduate science: authentic, original research. As an unconventional pedagogy then, and with the important task of bridging the too-apparent physical geography-human geography gap (Allen 2012; Allen and Lukinbeal 2011; O’Brien 2011; Inkpen 2005; Gober 2000; Massey 1999a, 1999b), this article outlines and analyzes a 10-week long large-group research endeavor conceived and executed by undergraduate students entwining geomorphology and music. As part of an upper-division geomorphology course, students were tasked with analyzing a landscape of their choosing as a geomorphologist might understand it. Since the term landscape is broadly defined for this assignment, students can explore physical, urban, or even fictional landscapes. The point of this exercise rests in expanding students’ relationship to the physical landscape, helping them understand concepts’ applicability outside the classroom in the “real world”. And this particular group of students stretched the limits, using music as a landscape. To demonstrate that students may make interesting “outside of the box” observations, and that these should perhaps not be overlooked as pedagogy, we critique our approach from both instructor- and student-based perspectives.

INTRODUCTION

Geomorphological landscape assessments in upper-division courses take many forms: from the traditional stereo aerial photo analysis and laboratory exercises to Google Earth and field-based experiences. As part of the requirements for an upper-division geomorphology course, students, as a team, were required to assess a landscape and present it to the class. Team members and landscape type were self-selected, with the professor encouraging creativity and unconventional landscapes. One (rather large) team devised an interesting and novel project: tying geomorphology to music. To illustrate the overall learning experience, after briefly describing the course and rationale behind this pedagogy, this paper’s first section outlines the professor’s observations, interpretations, and involvement in the team’s research. In the second section, students explain their rationale behind their selection of topic, methods, and hypothesis, and analyze their experience of the project as a team-based research exercise and learning experience. They then discuss improvements that could be made to their research project, possibilities for future related research, and the effect and applicability this project has had on their subsequent courses and lives. Through this exploration of how undergraduates think about and conduct meaningful research, we hope that instructors will develop a clearer picture of the effectiveness of unconventional pedagogies to instill an enthusiasm for research in students.

When students conduct research, they invariably encounter the same roadblocks as professional researchers. They learn about team dynamics, biases, data usage and analyses, while juggling several tasks within the context of one research agenda alongside their other coursework requirements and personal endeavors. Additionally, when it comes to conducting undergraduate research, students need to be tasked with something to which they can relate, comprehend, and find meaningful and exciting. Ideally, undergraduate students should experience and understand the research process. This goes beyond merely developing a hypothesis, testing said hypothesis, and reporting on the results. Real research, unlike typical lab exercises, does not have a predetermined course or result, and the sooner in their academic careers that they experience this, the better! Students need (and want) to understand what “real world” researchers do, what frustrations and joys they experience, how they handle crises, and ultimately, what it takes to make research applicable and useful for others.

VERSE ONE: PROFESSOR PERSPECTIVE

The course described in this paper, Principles of Geomorphology, represents a curricular
Using Music to Learn Geomorphology: An Undergraduate Experience

staple offered once each year with an average enrollment of 25 students, of which an average of 80% are geography majors. It is an upper-division course, meant for junior and senior undergraduates who have taken an introductory physical geography or geology course, as well as a basic class in weather and climate. The course begins with a detailed review of landform processes (e.g., earth materials, relief building, weathering, and soils) before using these form-process connections to focus on specific landscape types (e.g., volcanic processes and landforms, glacial processes and landforms). No tests or quizzes are given, as assessment is discussion and project-based, revolving around student interests, giving them a chance to put into practice the course concepts. These include leading discussions of landform analyses based on a non-traditional textbook, John McPhee's *Annals of the Former World* (2000), several hands-on, near-campus field trips and a final formal presentation. The presentation represents the crux of the course. In teams of at least three, students must select their final presentation topic from three broad choices: a current geomorphic topic (e.g., Martian geomorphology), a current environmental problem that might be influenced and addressed by geomorphic concepts (e.g., desert wildfires), or an in-depth presentation of a “Wild, Weird, and Wacky Landscape” (e.g., yardangs of Iran). Half of the team’s presentation grade comes from peer evaluations, and the other half from the professor, with each team member receiving the same grade regardless of contribution. The evaluations used a pre-determined rubric created by the professor, and was used for all presentations in the course. The presentation could take on a variety of formats, from a basic slideshow presentation or creation of a website to a film documentary or skit. In every instance, students are encouraged to be creative in their choices, giving them a chance to relate their interests to course content. As expected, most groups opted for the straightforward slideshow of some favorite landform or landscape.

The goals here rest in helping undergraduate students understand and appreciate group dynamics that all researchers experience, including peer evaluation, and exposing them to an intense research-focused curriculum not often used in U.S. undergraduate education systems. Further, after gaining the necessary background, the students involved in the project described herein spent most of the semester formulating hypotheses, compiling data, and analyzing their results into a meaningful presentation. The subject of this article then, represents an example of creatively merging physical geography (in this case, geomorphology) with human geography, resulting in a rich learning and research experience for undergraduate students on an urban campus (Herrington, Oliver, and Reeves 2009).

This project began with a lone student approaching the professor with the idea of researching correlations between geomorphology and music—using music as the landscape to assess. When asked what prompted the idea, the student responded, “I was driving to school and heard a Hendrix song where he was singing about land falling into the ocean. And I thought: that’s mass wasting!” Although not a traditional way to think of (or teach) geomorphology, I became intrigued, and suggested he see if any other students would be interested (since a team project is required). To my surprise, two-thirds of the class (17 total students in the end) elected to participate in the project.

A literature search on the topic resulted in a couple of short one-page articles that mention a geology-music connection, but never elaborate on it, or how the connection could be used in pedagogical practice (Dietrich 1989; Stinchcomb 1986). Turning to geography, a myriad discussions of music-geography connections can be found in the literature, though they tend to be more cultural in focus, only mentioning physical features in passing (Sternberg 1998; Nash and Carney 1996; Kong 1995; Byklum 1994; Nelson 1993; Paterson 1991; Lehr 1984). Even Morton’s (1996) book *Music of the Earth* is weak in its music-geomorphologic connections, explaining the Earth’s cycles as
one entire musical event rather than relating music itself to landform and process. From “solo performances” like volcanic eruptions and wave actions to “the grand symphony” of plate tectonics and seasons, no connection to specific songs or specific landforms exist in Morton’s book (284). One study however, suggested a model for incorporating music into physical geography, following seven steps:

1) Identifying the lyrics with physical geography content
2) Provide the lyrics
3) Are the lyrics [the focus] or [a facet in] the song?
4) Do the lyrics describe or mention a general or specific feature or process?
5) Accuracy of the lyric’s description
6) Are the lyrics an analogy (and if so, how is it interpreted)?
7) Miscellaneous (additional insight, artist background, history, etc.) (Jurmu 2005, 181-185)

Modifying this model of identifying relevant lyrics (Jurmu 2005, 181), I began working with the team to hone their project. As the team began forming their initial hypotheses (discussed in detail below), it became apparent that they would likely need to revise these to adjust for the course’s short duration. However, the spirit of the assignment—and more importantly, undergraduate students learning about the intensity and overall structure of completing an in-depth physical geography-based team research project from conception to end—would remain intact and provide an invaluable experience in the difficulties often encountered in professional settings. I would consciously play as small a role as possible—offering insights about data gathering, how to handle slackers, ideas for compiling and analyzing data, and so forth. For the most part, students would guide the research effort. This type of self-generated research agenda leads students to create an open-ended learning environment that requires the highest levels of cognitive operation such as exploring and manipulating concepts, generating, testing, and revising meaningful (and multiple) hypotheses, reflecting on prior knowledge, and applying that knowledge to a new endeavor (Land 2000). Among other research plights, the team explored first-hand the process of crafting a research question of manageable scope and size, and the process of creating workable research methods rather than following a pre-determined path. They discovered research group dynamics: motivating fellow researchers, getting timely responses from each other, and having to take up the slack where colleagues did not have as strong an interest or background in the subject. Indeed, on top of these incidents, they also learned to understand and deal with researcher biases, experienced working with large datasets, and realized the rigors of interpreting data. In the end, while their results were skewed and somewhat biased, they recognized these traits themselves, without my guidance, and even went so far as to expand on their presentation on how they would refine the methods and procedures in hopes of one day carrying forward and expanding the research. They also learned how science really works in practice, outside of a classroom. The upcoming sections demonstrate these invaluable experiences from the students’ perspectives.

VERSE TWO: STUDENT PERSPECTIVE

Our study of the representation of geomorphology in music began as many research projects do, with an observation of the song “If 6 was 9” (Hendrix 1967), which refers to mountains crumbling into the sea—a basic mountain-building and erosion process. This prompted a few of us to wonder how often geomorphology was referenced directly or indirectly in music, and when it was, how accurate the form-to-process linkages were. We inquired of our professor to determine if the idea merited research, and he suggested we open the project up to the entire class. In the end, a significant number of students
(17) joined the project, and we collectively designed a method to collect, collate, quantify, and analyze geomorphic forms and processes in music. Each team member was required to participate in at least two ways: 1) by collecting at least 20 songs containing one or more reference to geomorphology process or form; and 2) by participating in the compilation, processing and analysis of data or by presenting the findings.

This project proved to be a valuable learning experience for all involved, as no one on the team had ever been given the opportunity to engage in a solely student-driven research agenda in any of their other classes. We identified geomorphic forms and processes discussed in class through pop culture, participated in a research project from genesis to conclusion, and overcame what we learned were typical research obstacles. In the end, the project took over two months to complete and required all participants’ collaboration. Before providing our overall impressions of the experience, we outline below the three main tasks we set for ourselves to accomplish, noting the accompanying difficulties and shortcomings. These include: general organizational structure, methods (including hypotheses)/data analyses, and their relation to the final required presentation. The group came to discover that a true learning experience comes from overcoming obstacles and recognizing mistakes that arise—and we faced no shortage of these during our project! Additionally, as we moved through the research process, we discovered through our meetings and email exchanges, that everyone involved was learning similar lessons. Several students had shared “ah-hah!” moments while listening to a song when they made a geomorphic connection. Others enjoyed tackling a project of their own design. Everyone mentioned the frustrations associated with coordination of efforts, finding the time to actually do their assigned tasks, and being able to interpret what they found. Several weeks into the experience, it was noted in an email discussion that listener bias had not been taken into account, and this could be a potentially devastating problem for the project. Yet in each instance, the group held to our agenda and persevered.

**INTERLUDE: PROJECT OVERVIEW**

Key in undertaking this project was organization. Since the group was so large, we (the students) developed a management structure. A project manager oversaw the progress of the project and directed the activity of the group. This project manager selected certain motivated students to take control of specific aspects of the project, such as data collection and analysis. Another individual led the presentation aspect of the project and brought in the ideas of other subgroups and synthesized them into one coherent presentation. Group members stayed in contact through frequent emails. All of the group’s data was deposited and edited through a free online file sharing program called Digital Dropbox which greatly aided in organization by allowing all of our documents to be collected in a mutually accessible location. Despite these tools to coordinate activity with the group, it remained difficult to stick to a timeline throughout the project. For example, two-thirds of the group did not complete their data sheets on time, jeopardizing the project and adding a great deal of stress. These colleagues were reprimanded by the other one-third of researchers, and data sheets began appearing in the Digital Dropbox. While reprimanding peers was uncomfortable for a few ("I just can’t be that mean and tell them they suck because they’re two days late,” said one student), it demonstrated to us what can occur in a professional setting, and gave us an opportunity to learn our own strengths and weaknesses.

Our analysis of geomorphology in music started with developing a research focus and devising a method. Our ultimate goal was to determine the “best geomorphologic song” according to specific criteria (discussed below), but as we got into the project, our interests expanded. We developed five more-detailed hypotheses based on what the group
had informally observed in their daily lives before the project’s inception, and a group of two or more students investigated each one:

- The “best geomorphologic song” would be between 30 and 40 years old and in the rock genre. This was based on the perception of a greater physical environmental awareness present in songwriters of the era compared to today.
- Corresponding to the rise of the environmental movement, there would be more geomorphology songs from the 1960s and 1970s;
- Owing to the music genre’s perceived intense beats and often aggressive timbre, there would be more references to natural disasters and cataclysmic events in rock and heavy metal songs;
- Because of the usually rural settings, there would be a higher frequency of references pertaining to topography and geographic locations in the country genre; and
- Based on casual observances by the researchers, and perhaps due to the grandeur of the process, there would be more references to orogenesis as opposed to fluvial or Aeolian features across music genres.

Once hypotheses were agreed upon, we designed data collection sheets in a spreadsheet. These data sheets included criteria necessary in effectively evaluating these hypotheses. Our criteria included song title, artist, date, genre, geomorphologic form/process mentioned, the context of the reference, the directness of the reference (whether it was mentioned briefly without much exploration, or if the form/process was explored in depth), and the quality of the reference (its validity and accuracy) (Table 1). With the knowledge that the best geomorphologic songs would be popular ones that spread the message further, we scored song longevity, genre, number of covers, Top 40 status, and whether the album or song went gold or platinum (Table 2). The project’s complete dataset is available online at http://clasfaculty.ucdenver.edu/callen/geomorph/music/geomorphmusic_dataset.xls. This final score represented a quantification of the prevalence of geomorphology in each song collected.

Inexperience as researchers resulted in problems with our methods. The breadth of our subject matter and student subjectivity surely left much room for inconsistencies in interpretation among students within the group. For example, students may vary in their interpretations of how direct the geomorphology reference was, even with guidelines provided (i.e., the modified model based on Jurmu 2005). The project expanded to include a multitude of hypotheses in order to include all researchers’ interests, resulting in a less-specific focus and a more chaotic atmosphere.

The grading of this project was based on an hour-long presentation. After generating conclusions from our statistical analysis, each hypothesis team created several presentation slides outlining their findings. This information was then given to a group of four people who volunteered to compile and present the research to the entire class. The presentation included song clips with lyrics displayed which would be discussed with the class. We were graded and critiqued by both the professor and our peers. We used our top five scoring songs as a springboard for discussion with the class throughout the presentation to add an element of interactivity while we presented our findings. The presentation concluded with our overall impressions of the
Table 1. Partial example from song data collection matrix (recreated for clarity).

1 song title;
2 artist that originally performed the song;
3 a sample of the song lyrics, phrase, title or line related to geomorphologic concepts;
4 applicability of lyrics to geomorphic form(s) and/or process(es);
5 the number of novel times a geomorphologic reference is made within a song, therefore repeated lyrics are excluded;
6 on a scale of 1-5 (1 lowest, 5 highest), refers subjectively to the centrality of geomorphology a particular song. For example, a song may make references, but perhaps these aren’t the focus of the song, and therefore geomorphology is not central or relevant to the song to a high degree;
7 on a scale of 1-5 (1 lowest, 5 highest), refers to the relevance of lyrics where high scores imply a direct reference, lower scores imply weak or indirect references to geomorphology
8 total score for the song.

<table>
<thead>
<tr>
<th>Title</th>
<th>Artist</th>
<th>Line</th>
<th>App</th>
<th>Ref</th>
<th>Rel</th>
<th>Lyr</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Doberman Pharaoh</em></td>
<td>Cradle of Filth</td>
<td>“To and fro, through freeze and thaws”; “Saw lines drawn in the sands appear”; “Beneath a Pharaoh’s granite hand”</td>
<td>Freeze/thaw; rock type; sands</td>
<td>3</td>
<td>2</td>
<td>5</td>
<td>13</td>
</tr>
<tr>
<td><em>Fates Warning</em></td>
<td>Iron Maiden</td>
<td>Volcano erupts and sweeps a town away; Hurricane devastates the cities in its way</td>
<td>Describes the destruction of both volcanoes and hurricanes and the ability they have to change the landscape</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td><em>The Ocean</em></td>
<td>Led Zeppelin</td>
<td>“Used to sing on the mountains but the mountains washed away.”</td>
<td>Describes the effect wind can have on weathering</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td><em>If 6 was 9</em></td>
<td>Jimi Hendrix</td>
<td>“Mountains fell in the sea, fall mountains don’t fall on me”</td>
<td>Mass wasting/ slope instability; possible earthquake</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td><em>I’ve Been Everywhere</em></td>
<td>Johnny Cash</td>
<td>“Crossed the deserts bare, man...I’ve breathed the mountain air, man...”</td>
<td>Topography; aeolian sediment; 68 geographic locations</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>18</td>
</tr>
<tr>
<td><em>Two Feet of Topsoil</em></td>
<td>Brad Paisley</td>
<td>“…A little bit of bedrock, limestone in between...”</td>
<td>Soils; geologic references; superposition</td>
<td>9</td>
<td>5</td>
<td>5</td>
<td>22</td>
</tr>
<tr>
<td><em>Super Massive Black Hole</em></td>
<td>Muse</td>
<td>“Glaciers melting in the dead of night...”</td>
<td>Glacial ablation</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>9</td>
</tr>
</tbody>
</table>
Table 2. Example from Exposure/Popularity matrix (recreated for clarity).

1 song title; 
2 the recording artist; 
3 iTunes-generated classification; 
4 number of albums sold in millions; 
5 “longevity”, or the number of decades the song has been active; 
6 the number of times the song has been “covered” by a subsequent artist; 
7 if the song made and of Billboard’s Top 40 list (this was either a score of 5 for “yes”, or a 0 for “no”); 
8 total score.

<table>
<thead>
<tr>
<th>Song</th>
<th>Artist</th>
<th>Genre</th>
<th>Sold</th>
<th>Long</th>
<th>Cover</th>
<th>Top 40</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doberman Pharaoh</td>
<td>Cradle of Filth</td>
<td>Rock</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Fates Warning</td>
<td>Iron Maiden</td>
<td>Metal</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>The Ocean</td>
<td>Led Zeppelin</td>
<td>Rock</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>If 6 was 9</td>
<td>Jimi Hendrix</td>
<td>Rock</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>5</td>
<td>14</td>
</tr>
<tr>
<td>I’ve Been Everywhere</td>
<td>Johnny Cash</td>
<td>Country</td>
<td>2</td>
<td>6</td>
<td>2</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>Two Feet of Topsoil</td>
<td>Brad Paisley</td>
<td>Country</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Super Massive Black Hole</td>
<td>Muse</td>
<td>Alternative</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>5</td>
<td>8</td>
</tr>
</tbody>
</table>

On the whole, we experienced a sense of accomplishment despite the obstacles we faced and the errors we made. Since we could find no research analyzing music specifically for its geomorphology references, we believed we were the first to perform such an analysis, which was exciting (while Jurmu 2005 outlines a model for using music in teaching geomorphology, for example, no actual music is analyzed to the depths we took it, see Table 2). This project also forced us to apply concepts we had learned in class to a different context, rather than analyzing some obscure form or elaborating on a specific geomorphic process for a laboratory assignment. It was fulfilling to develop the project from the ground up: data collection, creating the scoring system, defining hypotheses, analyzing findings, and finally presenting the product. By being involved in research project, including shortcomings and ideas for future studies. (The final presentation can be downloaded online here: http://clasfaculty.ucdenver.edu/callen/geomorph/music/)

VERSE THREE: STUDENT EXPERIENCE

On the whole, we experienced a sense of accomplishment despite the obstacles we faced and the errors we made. Since we could find no research analyzing music specifically for its geomorphology references, we believed we were the first to perform such an analysis, which was exciting (while Jurmu 2005 outlines a model for using music in teaching geomorphology, for example, no actual music is analyzed to the depths we took it, see Table 2). This project also forced us to apply concepts we had learned in class to a different context, rather than analyzing some obscure form or elaborating on a specific geomorphic process for a laboratory assignment. It was fulfilling to develop the project from the ground up: data collection, creating the scoring system, defining hypotheses, analyzing findings, and finally presenting the product. By being involved in
so many aspects of research at once, we experienced numerous aspects of the scientific method and professional research, and came to realize that every decision we made had an effect on the validity of the research—even personal biases and subjectivity when it came to specific musical genres, for example—forcing us to develop methods that reduced subjectivity and to think of how the task could be done in ideal conditions (e.g., with more time and more-focused hypotheses).

This project drew the interest of many people beyond the classroom. Relatives, friends, and other faculty at the University recommended songs they thought referenced geomorphology. Another side benefit of the project was that by focusing on music, geomorphology—and by extension, physical geography—always came to the front of our thoughts whenever listening to music. This sort of project also kept us actively engaged in the subject matter during our free time—we had to listen to music because it was required for our class. A student from a different class even used our raw dataset for his statistics class as a final presentation, expanding our research project’s potential.

We applied science in a new context, and found a creative link. Tying in the meanings that musicians/artists attached to rivers and mountains added another layer of meaning to the landscape (and music). In some cases, the songs outlined a process—erosion, for example—and it was exciting to apply the deeper knowledge gained from the geomorphology course’s content to what was being depicted in the song. This allowed us to expand upon possible artistic interpretations, deconstructing the lyrics for geomorphological reference much as a literature student might dissect Shakespeare or Hemingway for prose and pentameter. We also became more aware of the interactions between humanistic geography and physical geography, in relation to the artists’ sense of place, something that, as students, we deem as valuable for understanding the whole landscape, but something that is rarely (if ever) touched on in our other physical geography courses.

We also believe this unique large-group project was preferable to more traditional methods of evaluation experienced in other courses. As an open-ended learning experience, it challenged us to focus our efforts on a topic we found interesting, instead of having one already created for us by the professor (and one that most likely would not ignite the passion of as many students). Additionally, as opposed to applying knowledge to short-term memory in cramming for an exam, we gained a deeper and more enduring knowledge of geomorphology because we continually thought of it throughout the day and discussed it constantly throughout this project. While research papers and small-group research are typically included in geomorphology courses, the dynamics of working in such a large group were novel to us. As a few of our non-traditional (i.e., people working professional jobs) fellow researchers pointed out, having to work in this context is more applicable to industry, and we therefore found it to be a valuable experience to have approaching graduation. Ordinarily, an individual student researcher can accomplish things at their convenience. In the context of a large group however, it is important to follow deadlines so that the next step in the analysis can begin. Effective communication was also essential in coordinating the group, and as the project progressed, our project manager became more direct, clear, and concise in his emails, and consistently updated everybody as to the status of the project and what more needed to be accomplished. Most importantly, this project was not easy. Perhaps many students signed on to the group with the expectation that, because there were so many people, they would not have to contribute very much. But, since this was a multi-stage project, everybody was involved in several different aspects. Consistent involvement and the multitude of tasks presented novel and continual problems to be mitigated, making us all better researchers.

CHORUS: DISCUSSION

The research group faced a short timeline of ten weeks for completion of this project.
In professional settings, researchers face similar time constraints. If we had understood the full extent and factors that had to be accounted for, we would have significantly reduced the scope of the research. But although our professor noted this when approached with each new hypothesis and idea, we were so excited to be conducting our own research that we did not heed his suggestions. For example, studying a single genre of music or music produced within a specific time period would have resulted in a much more focused hypothesis. This downsizing would have had a profound impact on reducing the stress of communicating and analyzing these data as part of such a large research cadre, resulting in perhaps more precise findings. These factors and the hurdles we faced, however, helped us to appreciate why a research scientist may choose to focus on a very specific hypothesis and specialized topic (and perhaps work only with specific researchers).

Implementing pop culture facets and techniques from humanities-based disciplines to interpret natural forms and processes may be an innovative way to create a passionate interest in students for science, as it did for all involved in this project. Upon completion of this project, we considered how this unconventional type of research can make connections between other types of media and the sciences. Many students who worked on this project believe that such research could be applied in other areas of education. We began to keenly observe geomorphology and physical geography in music videos, movies, video games, novels, and television programs—on which we thought similar research ideas could be based. Researching music and geomorphology changed the way we perceived media as a whole, and how we now view science in general and its portrayal in pop culture in particular. And these observations were not exclusive to geomorphology, as we began to see representations of many natural processes in popular media, prompting us to conclude that similar research projects could be done in other classes such as geology, biology, environmental science, and climatology. Adding a little music to these physical sciences could help students understand the topics better than conventional methods. As we found with this project, not only was our learning of how to conduct research enhanced, but there are valuable learning experiences to be found in viewing various topics and subject matters through a different lens.

POSTLUDE

Reflecting back on the project as a whole, the experience was constructive. With little familiarity in executing a genuine research study, a large group of undergraduate students turned a creative idea into a research project that captivated people both inside and outside of a geomorphology class. They were able to apply the scientific method, create metrics to assess their hypotheses, and overcome obstacles to produce new knowledge. While the scope of their hypotheses overreached their resources and somewhat diluted their findings, other meaningful outcomes—including a clearer understanding of what a scientific research project can entail—were produced. The article also suggests that using unconventional teaching tools can result in highly useful pedagogy: not limiting research projects to numeric data of observations in a natural setting; implementing a medium to which all students have access; and uniquely putting into practice the (sometimes dryly-delivered) physical geography content learned in class. It further proposes that through large group endeavors, team building, communication, and problem-solving skills generate a long-term beneficial understanding that affects students’ future life experiences, allowing them to take ownership in meaningful-to-them research, while generating important experience crucial for students when applying their knowledge to higher-level professional and academic research. Indeed, the experience supports the idea that allowing student-selected subject matter for research-based experiences engages students more directly, while also encompassing an upper-division class’s primary focus of
giving students authentic and open-ended research experiences, identified by Herrington, Oliver and Reeves (2009) and Land (2000) as vital but often missing parts of undergraduate science education.

The applications from this open-ended learning experience are wide-ranging, and we hope this project inspires other undergraduate projects of comparable nature. If properly guided, when students analyze popular media forms (such as movies, videos, and music) for references to physical forms and processes, their perception of science is not only enhanced, but they also gain a valuable understanding of how research applies to curriculum, while further gaining a sense of how science permeates everyday life. In addition to constructing and managing (large) databases, students also gain first-hand experience in a group research setting and benefit from working with a range of opinions, talents, and learning styles to complete a common goal. These types of problem-solving skills remain invaluable for students, delivering a truer-to-life research experience that extends well beyond common learning experiences. For when it comes to practicing science, there is no true substitute for hands-on experience.

REFERENCES