SAMPLE 1

Faculty Development Plan

Department of Geological Sciences
College of Physical and Mathematical Sciences
Brigham Young University

Overview

This faculty development plan outlines my proposed goals and activities in the areas of scholarship, teaching and citizenship. In this plan, I evaluate my strengths and weaknesses in each of these three themes. Additionally, I describe my short-term (1-2 year) and long-term goals in each of these areas, highlight the relationship between personal goals and department/college needs, and list the resources needed to accomplish them. The main objective of this document is to develop a detailed plan that will prepare me for a successful third year review and establish a foundation of successful research, teaching and service that will prepare me for my sixth-year review and my continuing career at BYU.

1. Scholarship

1.1. Research Outline

My greatest strengths in scholarship include 1) a fascination with the natural world and its history; 2) enthusiasm for my area of research; and 3) a willingness to learn new scientific skills and techniques. I am working to build a vigorous research program that expands on the strong foundation of my graduate and postdoctoral studies, focused on proxy-based investigations of terrestrial paleoclimate conditions during ancient greenhouse periods like the Cretaceous and Early Cenozoic. This research agenda provides abundant field-, lab-, and computer-based research opportunities for undergraduate and graduate students with a variety of research interests and skills.

1.2. Current Research Projects

I am working on five projects revolving around the theme of terrestrial paleoclimate conditions during greenhouse periods, including:

a. <u>Constraining the differences in mean annual range in temperature estimates from lithologic and biogenic paleotemperature proxies.</u> The goal of this project is to improve our understanding of how lithologic and biogenic paleotemperature proxies may be biased towards over- or under-estimates of mean annual range in temperature (MART). This project is important because MART is a primary driver of biogeography and ecological diversity, but its magnitude during past greenhouse periods like the Cretaceous and Early Cenozoic is poorly understood, with climate models and lithologic proxies suggesting MART values similar to the modern, but biogenic proxies suggesting that MART was significantly reduced. This project has been submitted for publication and is currently undergoing revisions.

b. <u>Developing new paleosol bulk geochemistry climofunctions for terrestrial paleoclimate reconstructions.</u> The aim of this project is to develop new climate transfer functions (“climofunctions”) using machine learning techniques. These climofunctions are based on the correlation between climate parameters such as temperature and precipitation and the concentration of major element oxides in paleosol sediments. This project is important because previous paleosol climofunctions have been limited to particular types of paleosols or have

produced paleotemperature estimates that are significantly cooler than estimates from other paleotemperature proxies. This is a collaborative project with a team of statisticians from North Carolina State University (NCSU), and drafting of the manuscript has begun, with a submission target of late 2023.

c. Global proxy-based terrestrial climate zone reconstructions for the Paleogene. The goal of this project is to create nine stage-level, high resolution global climate zone maps for the Paleogene (66 to 23 Ma) using a paleo-Köppen climate zone classification system and spatial interpolations of proxy-based temperature and precipitation reconstructions. This project builds on the methods and results I developed in a previous Cretaceous climate mapping study titled "Cretaceous climates: Mapping paleo-Köppen climatic zones using a Bayesian statistical analysis of lithologic, paleontologic, and geochemical proxies" which was published early this year. This project is important because it will provide quantitative, gridded datasets of global temperature, precipitation, and climate zones that can be directly compared to global and regional climate model output. Comparisons between our proxy-based climate reconstructions and climate model simulations of greenhouse period climate conditions are one of the only methods for testing the accuracy of model simulations of high CO_2 climate conditions and are thus critical for increasing confidence in model-based predictions of future anthropogenic climate change. This project is a collaborative effort with a group of researchers at North Carolina State University and Northwestern University. Additionally, I have enlisted three BYU undergraduate students to help with the data compilation portion of the project. The analytical portion of this project is nearly complete and drafting of a manuscript has begun, with a goal of submitting the work for publication in late fall of this year, or early 2024.

d. Improving the use of soil carbonate clumped isotopes as a paleotemperature proxy. The objective of this project is to quantify the difference in growth season between soil carbonate pendants and nodules by comparing their clumped isotope formation temperatures to modern long-term climate records. This project is important because climate reconstructions based on ancient soil carbonate *nodules* are based on our understanding of the correlation between the isotopic composition of modern soil carbonate *pendants* and climate. The assumption that nodules and pendants have the same isotope/climate correlations has never been formally tested, and the results of this project will improve our ability to reconstruct ancient terrestrial climate conditions. I have currently recruited an undergraduate student to work on preparatory GIS analyses for this project, and I plan to conduct initial fieldwork in late August or September of this year. I am working with the CPMS grant coach, Christine Ackroyd, to develop an NSF grant proposal based on this project that will be submitted to the Geobiology and Low-Temperature Geochemistry program this fall.

e. Early Cretaceous paleoclimate and paleoenvironmental conditions in the southern Peruvian Andes. The objective of this project is to employ soil carbonate clumped isotopes and paleosol bulk geochemistry climofunctions to reconstruct paleoclimate conditions in the under-studied Early Cretaceous sediments of southern Peru. This project will not only fill a gap in our understanding of the temporal evolution of the Cretaceous climate system, but it will also provide new quantitative paleotemperature and paleoprecipitation data for a region that has historically received little attention. My first graduate student and I are currently reviewing the literature on Early Cretaceous sedimentary formations in southern Peru, and we have identified multiple potential sites and in-country collaborators.

We will apply for BYU funding for an initial field campaign in early 2024 to collect samples and generate preliminary data, with the goal of submitting an NSF proposal for ongoing work in the region.

Other projects I am developing or working on with students, departmental colleagues and outside collaborators include 1) Cryosphere conditions of the Cretaceous (Ethan Hyland, NCSI); 2) low-temperature geochemistry of the Meadows, Utah hot spring tufa site (Tiffany Thayne and Steve Nelson, BYU); 3) paleoclimate reconstruction of the Late Cretaceous Maevarano Formation, Madagascar (Raymond Rogers, Macalaster College); 4) regional paleoclimate and paleoenvironmental reconstructions of the coeval Two Medicine and Judith River Formations, Montana (Raymond Rogers, Macalaster College); and 5) development of an online paleoclimate proxy data repository and website (Ethan Hyland, NCSU). Each of these projects will further develop my expertise in the field of terrestrial paleoclimatology and provide opportunities for me and my students to learn new analytical tools and techniques.

1.3. Short-Term Scholarship Goals

The specific short-term scholarship goals that I plan to accomplish by the beginning of Fall semester, 2024 include:

a. Submit Early Cretaceous Peruvian Paleoclimate proposal to BYU for internal funding by October, 2023
b. Submit Clumped Isotopes of Soil Carbonate Pendants and Nodules proposal to NSF by June, 2024
c. Submit Paleoclimate Proxy Database proposal to NSF by September, 2024
d. Submit the mean annual range in temperature project to GSA Bulletin for peer review and publication to by May, 2024
e. Continue to serve as a reviewer for journals and volunteer to serve on review panels

These scholarship goals are well-aligned with departmental needs/expectations. They fulfill the requirement to engage with and contribute to scholarly conversation; positively develop the scholarly reputation of the department and university while being focused on students; and foster the intellectual growth of department faculty and students. Specifically, these goals meet or exceed the requirement to 1) produce at least one peer-reviewed publication featuring original research per year as the primary author; 2) contribute to at least one professional conference poster or presentation per year; 3) involve undergraduate and graduate students in all aspects of research, including writing and publication; and 4) submit an average of one large external funding proposal per year. I will continue to update and modify these goals as I accomplish them and move on to new projects, working towards my 3rd and 6th year CFS reviews.

1.5. Scholarship Resources Needed for Success

a. Continued assistance from Kevin Rey as I finalize my lab space and finish the repair of the DeltaV mass spectrometer that I inherited.
b. Continued departmental support for undergraduate and graduate researchers as I work to submit external funding proposals over the next few months.
c. Possible remodel of laboratory space in C364 to include a sink for cleaning samples and tools.
d. Sample storage space in the ESC central storage area

2. Teaching

2.1. Teaching Outline

My greatest strengths in teaching include a genuine love of the students, a solid foundation in the materials that I teach, and an excitement and dedication to incorporating the Gospel of Jesus Christ and my own testimony of the Savior into my classroom lectures and activities.

My first round of teaching evaluations reflects these strengths, but also highlight areas where I can improve as a teacher. For example, based on student comments, I am working to update my lecture slides so that they are more useful as test review materials. Additionally, I plan to improve the pacing of my classes so that students don't feel overwhelmed.

2.2. Anticipated Future Teaching Schedule

I have already prepared and taught two new full courses and one partial course during the past year: GEOL 101 (Winter 2023), GEOL 546 (Winter 2023), and GEOL 410 (Spring 2023). The courses I plan to teach over the next few years are:

1. Fall 2023
    a. GEOL 490R – Intermediate GIS (new prep, developing course)
    b. GEOL 606 – Paleoclimatology (new prep)
2. Winter 2024
    a. GEOL 101 – Introduction to Geology (repeat)
    b. GEOL 490R – Intermediate GIS (repeat)
3. Spring 2024
    a. GEOL 410 – Field Camp: GIS week (repeat)
4. Fall 2024
    a. GEOL 111 – Physical Geology (new prep)
    b. GEOL 546 – Low Temperature Stable Isotope Geochemistry (repeat)
5. Winter 2025
    a. GEOL 101 (repeat) or GEOL 108 (repeat) or GEOL 112 (new prep)
    b. GEOL 506 – Paleoclimatology (repeat, new course number)
6. Spring 2025
    a. GEOL 410 – Field Camp: GIS week (repeat)
7. Fall 2025
    a. GEOL 108 – Climate & the Earth System (new course)
    b. GEOL 506 – Paleoclimatology (repeat, new course number)

2.3. Teaching Goals

The specific short-term teaching goals that I plan to accomplish by the beginning of Fall semester, 2024 include:

a. Continue to use campus resources like SCOTS and the CTL staff and workshops to improve my teaching methodology each semester
b. Continue to work with Kenneth Plummer at CTL to develop and improve my GEOL 101 and GEOL 606 courses, including incorporating backward design elements into the course structures and learning outcomes
c. Expand opportunities to bring Gospel elements into the classroom; specifically, I plan to incorporate into all of my classes a weekly low stakes writing assignment that encourages students to reflect on how the geological principles and processes we covered in class can be connected to Gospel principles and truths
d. Invite my department faculty mentor (Barry Bickmore) to sit in on at least one of my lectures in each class I teach, every semester
e. Attend classes taught by other professors in the department and wider university. These courses include Advanced Sedimentology (Sam Hudson), GeoMathematics (Barry Bickmore), and Engineering Applications of GIS (Daniel Ames)
f. Continue to document teaching evaluations, course improvements and mentoring activities each semester
g. Continue to develop mentoring opportunities by hiring undergraduate students to work on the various research projects I am pursuing, and recruiting additional graduate students to work with me

I believe that these teaching goals are well-aligned with departmental needs/expectations. They fulfill the department's expectation that faculty "become excellent teachers" who "authentically use their courses to promote the spiritual development of students". Specifically, these goals meet the department's requirement that I generate and provide evidence of high-quality classroom teaching and mentoring and gather peer evaluations of my teaching methodology and course content.

2.4. Teaching Resources Needed for Success

a. Department support to attending teaching and course development workshops
b. Continued department support for teaching assistants
c. Department/College/University course development grants

3. Citizenship

3.1. Citizenship Outline

My greatest strengths in citizenship include my ability to work well with others, a willingness to contribute to department efforts and committees, and a desire to model Christlike compassion and service to my fellow employees and students at BYU. I will strive to create an environment of belonging in my classroom, where students are able to feel the spirit and learn in an open, encouraging environment. I will willingly serve in department, college, and university assignments, and seek to build up BYU wherever I can.

3.2. Citizenship Goals

The specific *internal* citizenship goals that I plan to accomplish prior to my 3rd year review are:

a. Get to know each of my colleagues in the Department of Geological Sciences by inviting them to one-on-one lunches, and looking for opportunities to collaborate with them in research and teaching
b. Continue to help the department revamp and improve its GIS offerings; this has been a major focus of my first year, and I will continue to work on incorporating GIS modules and assignments in each of our geology courses
c. Continue to participate in outreach activities that enhance the department's and University's profile in the broader community
d. Add additional committee assignments as appropriate and according to department needs

The specific *external* citizenship goals that I plan to accomplish prior to my 3rd year review are:

a. Continue to serve as a reviewer for journals and volunteer to serve on grant proposal review panels
b. Continue to work with the multi-university Paleosciences Peer Mentor Program (PPMP) to support and mentor graduate students and postdocs in the paleosciences
c. Work with colleagues outside of BYU to submit and chair a technical session focused on proxy-based terrestrial paleoclimate reconstructions at a suitable international conference (e.g., the GSA or AGU fall meeting)

I believe that these citizenship goals are well-aligned with departmental needs and expectations. They fulfill the department's requirement that faculty members provide service at the department and university level, and with the broader scientific community. As I am given citizenship assignments and opportunities, I will continually look for ways to involve students in those activities.

Geology 606 – Paleoclimatology
Fall, 2023
Course Development Report

Return to long-term performance dashboard
Semester Performance Summary
Semester Improvement Goals

Semester Report Outline

Section 1 - Course Design

COURSE DESIGN ELEMENTS

My teaching approach is based on the Backward Design methodology and consists of five key course components:

1. Course Purpose
2. Learning Outcomes
3. Final Assessment
4. Progress Check(s)
5. Practice Plan

Below is a detailed description of each of these components developed for my Geology 606 section.

Course Purpose

Graduates of Geology 606 – Paleoclimatology will be confident in their ability to explain at a technical level the key components of the climate system and critical events in the Earth's paleoclimate history, evaluate the use of the major tools and methods for reconstructing climate conditions in the past, and identify and apply the appropriate paleoclimate methods and theories in their own research.

Learning Outcomes

Upon completion of GEOL 606 – Paleoclimatology, students will be able to:

1. Explain the basic mechanisms that move heat and moisture across Earth's surface and regulate the surface temperature of the planet.
2. Explain how the three main earth systems (atmosphere, ocean, tectonic) affect and regulate the Earth's climate, and describe the characteristic processes and timescales of climate change associated with each system.
3. Identify the key changes and events that have shaped the Earth's climate system over the past 4.6 billion years and produce a scientific poster that provides a detailed overview of one of the major climate events of the Late Proterozoic and Phanerozoic.

4. Explain at a technical level what key climate processes and paleoclimate events are relevant to their thesis research.
5. Select appropriate paleoclimate tools or methods to apply to their graduate research
6. Effectively employ the selected paleoclimate tool(s) to their graduate research.

Final Assessment

The final assessment for this course is an oral presentation including a professionally designed presentation or scientific poster (exact format depends on class size). To fully meet expectations, students must:

1. Explain at a technical level, whether their project is focused on a greenhouse or icehouse period, and how that impacts the basic climate state of the Earth during that period (Learning Objective 1)
    a. The student will be able to explain what evidence suggests that their question/topic is set within a greenhouse or icehouse period
    b. Based on this, the student will be able to describe the important implications about the climate state at that time (e.g., greenhouse gas levels, albedo, expected magnitude of Milankovitch cycles in the sedimentary record, etc.)
2. Explain at a technical level, what timescale is associated with their project (e.g., decades, millennia, or millions of years)? What system (atmosphere, ocean or tectonic) is driving climate variability at that timescale? (Learning Objective 2)
    a. The student will demonstrate an understanding of various timescales of climate variability, and identify which is most relevant to their chosen topic (e.g., a study set in the Pleistocene will be most interested in millennial-scale climate variations, whereas a study of the Cretaceous will focus on million-year climate fluctuations)
    b. Based on the identified timescale, the student will describe in technical language the systems and processes that are responsible for the given climate variability
3. At a technical level, explain whether the project focuses on a major climate transition or event, discuss in detail the drivers, timescale and effects of the event; if the project is not focused on a major climate transition or event, identify what transitions/events bracket the project? How did those events affect climate during the project time period? (Learning Objectives 3 and 4)
4. Explain why they selected a particular paleoclimate proxy or method to apply to their project. Articulate the limitations and uncertainties associated with those proxies. Evaluate the trustworthiness of the estimated climate conditions. (Learning Objective 5)
5. Demonstrate that they have effectively incorporated paleoclimate methods and/or data from their chosen proxy into their thesis research or course project (Learning Objective 6)

Progress Check(s)

Progress checks, in the form of practice presentations, are scheduled twice over the course of the class. Each practice presentation builds on the previous, requiring more components (e.g., methodology, results, discussion, etc.) and touching on additional course learning outcomes. After each practice presentation, I provide comments and feedback to the students regarding their projects and presentations, as necessary.

Practice Presentation 1. Develop and present (<10 minutes) 3 slides describing A) the climate state of the student's chosen time period and how heat and energy are transported across the Earth during that era, B) the timescale and relevant system driving climate variability during that period. Successfully answer questions regarding A and B from the professor and other students. Learning outcomes 1, 2, and 3.

Practice Presentation 2. Develop and present (<15 minutes) your updated 3 slides from Practice Presentation #1, and 2-3 new slides describing C) basic information about any major

climate events/transitions associated with the chosen time period and D) the paleoclimate proxies that the student has identified as most relevant/appropriate to their project; Successfully answer question regarding A (previous presentation), B (previous presentation), C, and D from the professor and students. Learning outcomes 1, 2, 3, 4 and 5.

Practice Plan

Week	Outcomes	Assignment	Description
1			Lectures and assignments during this first unit of the course are designed to introduce students to the Earth's climate system and the processes that regulate Earth's climate by transferring mass and energy.
2	1	Climate Feedback Activity	
	1, 2, 3, 4, 5 and 6	Research Project Topic Exploration	
	2	Paper Discussion: The Carbon Cycle	
3	5 and 6	Leaf Physiognomy Activity	This week's lectures and assignments introduce students to paleoclimate proxies, with a special focus on the appropriate uses and limitations.
	5 and 6	Paleotemperature Activity	
	5 and 6	Paper Discussion: Paleoclimate Proxies	
	1, 2, 3, 4, 5 and 6	Research Project Proposal	
4	3, 5 and 6	Paper Discussion: The Faint Young Sun Paradox	This week's lectures and reading focus on the earliest paleoclimate events in Earth's past.
5	2	Geochemistry Box Model Activity	These lectures,assignments and readings focus on the Early Phanerozoic paleoclimate events (e.g., events older than ~200 million years). Students give their first practice presentations.
	3, 5 and 6	Paper Discussion: Snowball Earth	
6	3, 5 and 6	Paper Discussion: Paleozoic Ice Ages	
	1, 2, 3	Practice Presentation 1	
7			
8	3, 5 and 6	Paper Discussion: The Permo-Triassic Extinction	
9	3, 5 and 6	Paper Discussion: The Equable Climate Problem	These lectures, assignments and readings focus on the paleoclimate events of the Mesozoic.
10	3, 5 and 6	Paper Discussion: The Cretaceous Supergreenhouse	
11	3, 5 and 6	Paper Discussion: The PETM	The remaining lectures, assignments and readings focus on the key paleoclimate events of the past 66 million years. In week eleven, students give their second practice presentation. Their final presentation is given on week 16.
	1, 2, 3, 4 and 5	Practice Presentation 2	

12	3, 5 and 6	Paper Discussion: Cenozoic Cooling	
13	3, 5 and 6	Paper Discussion: The Pleistocene Ice Ages	
	3, 5 and 6	Paper Discussion: Milankovitch Cycles	
14	3, 5 and 6	Paper Discussion: The LGM	
15	3, 5 and 6	Paper Discussion: The Holocene	
16	1, 2, 3, 4, 5 and 6	Final Presentation	

ALIGNMENT WITH PROGRAM OUTCOMES

This course serves graduate and advanced undergraduate students in the Geology and Environmental Geology.This course's specific contribution to each program are detailed in the table below.

Program	Program Learning Outcomes	GEOL 606 Contributions
Geology	1. Effective Inquiry and Communication 2. Professional Preparation 3. Technical Competence 4. Discussing Society's Impact on the Planet 5. Discussing Science and Religion	Provides an in-depth, quantitative overview of paleoclimatology research methods for upper-level undergraduate and graduate students; focus on the behavior of the climate system in the past and future.
Environmental Geology	1. Effective Inquiry and Communication 2. Professional Preparation 3. Technical Competence 4. Discussing Society's Impact on the Planet 5. Discussing Science and Religion	Provides an in-depth, quantitative overview of paleoclimatology research methods for upper-level undergraduate and graduate students; focus on the behavior of the climate system in the past and future.

Section 2 - Semester Results

STUDENT LEARNING

Course grades over the past three years

Winter 2023*	Winter 2024	Fall 2024

A	100.0	74.1	52.9	61.1
B	0.0	0.0	9.9	8.9
C	0.0	0.0	1.0	0.8
D	0.0	0.0	0.2	0.1
E	0.0	0.0	2.6	0.5
W	0.0	0.0	4.3	1.4
	Section	Dept	College	Univ

*Average grade re-calculated to exclude auditing students

Course Level Results

This was my first semester teaching this course, and as it was a huge learning experience. As shown in the table below, 100% of the Fall 2023 students met expectations, which was ~24% higher than the department average for the course. These high grades are not unexpected. First, the section only had four students, all of whom expressed a great deal of excitement for the course subject matter. Second, the students were either graduate students or advanced undergraduate students with a substantial foundation in geology. However, there are also several updated I have planned for the course which should increase the difficulty.

Semester	**Class size**	**Meets** Expectations *(100 - 90%)*	**Partially Meets** Expectations *(89.9 - 80%)*	**Does Not Meet** Expectations *(Below 80%)*
Fall 2023	4	100%	0%	0%

Course Final Assessment Results

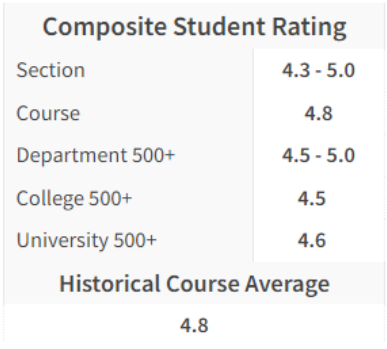
The table below details the students' performance on the two practice presentations and the final presentation.

Evidence	**Learning Outcomes**	**Exceeds Expectations** *(100 - 90%)*	**Meets Expectations** *(89.9 - 70%)*	**Does Not Meet Expectations** *(below 70%)*
Practice Presentation 1	1, 2 and 3	50%	50%	0%
Practice Presentation 2	1, 2, 3, 4 and 5	50%	50%	0%
Final Presentation	1, 2, 3, 4, 5 and 6	75%	25%	0%

LEARNING ENVIRONMENT

Student ratings for the past three years

Winter 2023*	**Winter 2024**	**Fall 2024**

		
*Note that only 2 of four students filled out student ratings		

Comment classification report

Click here to view comment classification report.

Typical positive student rating comments

Sometimes topics didn't stick right away and took time but he provided many opportunities and assignments to go over key concepts and difficult ideas in class with a fair system of grading.

Landon provided insightful answers to all questions and encouraged discussion of key topics where lack of knowledge was present.

While I had taken a course on Paleoclimates, this course really added to the methodology behind the science and it has been very rewarding to take as a course. I have already been recommending it to friends.

Typical student rating suggestions and concerns (underlining added)

While the back half of the course is still being decided in some ways, this course has been very regularly structured and easy to follow and stay on top of. He has structured the course very well with regular discussions, clear due dates and reminders in class as needed.

I hope this course it taught for a long time as it is vital to all geologists and is informative, The course seemed at first to be front heavy but that could have been me. I appreciated everything you did for us and taught us Professor. Thank You

Peer Teaching Evaluation Report

Evaluation conducted on Nov. 8, 2023 by emeritus faculty, Dr. Eric Christiansen. Preliminary feedback:

“But you did a great job in class yesterday. I think you (sic) teaching style and materials were well matched for the class and for the skills you won’t (sic) to teach.”

Awaiting formal feedback from Dr. Christiansen.

Section 3 - Improvement Plan

KEY TAKEAWAYS

Final Project. In general, the final project worked as intended and the students produced in-depth, technical presentations, including quantitative analysis. However, I would like to increase the students' use of paleoclimate proxies to produce unique paleoclimate reconstructions (e.g., temperature or precipitation estimates) and discuss the limitations (both quantitatively and qualitatively) as part of the projects. Most of the students successfully used one or two paleoclimate proxies, but the interpretation of the results was fairly surficial.

Research Article Readings. One of my major goals for the class was to get the students reading the primary paleoclimate literature. We read thirteen peer-reviewed papers over the course of the semester, with students leading the in-class discussions for ~75% of those papers. For each paper, I had the students answer a set of questions. These answers were graded as a way of motivating the students to read prior to class. In general, I feel like these readings and reading discussions worked really well, and led to some interesting, in-depth discussions of key questions and problems in paleoclimatology. However, I would like to improve the reading format so that 1) students have more of a say in what papers we choose to read, and 2) the questions I ask the students are more thought-provoking and less generic.

Class Assignments. There were several assignments that I wanted to implement into the class but was unable to because we took too long covering some early material in the class.

ACTION PLAN

Final Project. I am going to improve the Practice Presentation and Final Project rubrics so that more emphasis is placed on correctly applying and interpreting paleoclimate proxies. Additionally, I will update the Project Topic Exploration and Project Proposal assignments so that they more clearly articulate my expectations regarding the use and interpretation of paleoclimate proxies in the Final Project. Finally, when providing feedback on Practice Presentation 1 and 2, I will be sure to provide more constructive comments on their implementation and use of paleoclimate proxies.

Research Article Readings. I have spoken with Dr. Sam Hudson in the Geology Department, who also has students read and discuss scientific articles in his Advanced Sedimentology Class. He allows the students to choose papers within a narrowly defined topic, and then that student is in charge of leading the class discussion about the paper. Additionally, after the class discussion, Dr. Hudson has the students write up a summary of the paper, including details from the class discussion about what the students took away from the paper's findings. I plan to update my own reading assignments to follow this format.

Class Assignments. Next semester, I will add two new assignments into the class schedule. The first assignment will focus on how paleoclimate proxies can be used to calculate paleotemperatures. This assignment will involve calculating paleotemperatures from a carbonate clumped isotope dataset. The second will be a simple climate model experiment designed to help students understand the rate and magnitude of future anthropogenic climate change projections. This assignment will make use of the online Simple Climate Model and allow the students to make basic quantitative predictions regarding future temperature changes.

Additional Goals. In addition to these larger goals, I will also update various lectures and assignments following the goals outlined in the Improvement Goals document for this semester.

Scholarship Development Goals Final Report

Department of Geological Sciences

Scholarship Theme

I am working to build a vigorous research program that expands on the strong foundation of my graduate and postdoctoral studies, focused on proxy-based investigations of terrestrial paleoclimate conditions during ancient greenhouse periods like the Cretaceous and Early Cenozoic. This research agenda provides abundant field-, lab-, and computer-based research opportunities for undergraduate and graduate students with a variety of research interests and skills.

December 2023 Goals

1. Publish a 1st authored paper on constraining the differences in mean annual range in temperature estimates from lithologic and biogenic paleotemperature proxies by December

   Goal status: In Progress

   Evaluation: I made significant progress on this paper over the course of the Fall 2023 semester; however, because of the time constraints caused by teaching two new courses, I was unable to finalize the paper by December as originally planned. I am currently working to finish and submit the paper by April, 2024.

2. Present initial results from my Paleogene climate zone project at GSA Connects 2023 in October

   Goal status: Accomplished

   Evaluation: I successfully presented a poster at GSA Connects and received valuable feedback regarding my ongoing Paleogene climate zone project. The study is now being prepared for final analyses and publication. Additionally, my first graduate student, Carina Kentish, also presented a poster showcasing the initial findings of her thesis research at the same conference.

3. Submit Early Cretaceous Peruvian Paleoclimate proposal to BYU for internal funding by October

   Goal status: Partially accomplished

   Evaluation: I am currently working with Dr. Renata Forste, BYU's international vice president and the director of the University's Latin America Initiative to obtain funding for an initial field season in the Huancane Fm. of southern Peru. One of the Latin America Initiative's goals is to develop humanitarian opportunities in Ecuador and Peru. To that end, I am developing a GIS (geographic information system) training program with Teresa Gomez, director of the Geospatial Lab in the HBLL. Our goal is to train humanitarian groups in Peru in the use of GIS applications and techniques to improve the impact of their work. This humanitarian project will proceed in tandem with my research work.

4. Submit a grant funding proposal to the National Science Foundation by December for a project focused on improving the use of soil carbonate clumped isotopes as a paleotemperature proxy.

   Goal status: In Progress

   Evaluation: I began working over the summer with the CPMS grant coach, Christine Ackroyd to develop this grant proposal and prepare it for submission. The process has taken longer than I expected, mainly because I needed to lay a lot of

groundwork in terms of defining the exact hypotheses I wanted to propose testing. Christine and I have been meeting weekly, and I have developed the proposal to the point that it should be ready to submit by the end of spring semester. I have a detailed timeline, and am working my way through weekly goals in order to stay on track with that submission deadline.

Strategies for Accomplishing these Goals

1. To accomplish my first goal, I plan to block out designated *daily* writing periods on my calendar. During these "writing blocks" I will not respond to email and will turn off web browsers, phones and other potentially distracting apps and devices.

   Evaluation: This strategy worked reasonably well. I have been consistent about blocking out daily writing time; however, I often find that the specific project I planned to work on gets changed at the last minute due to deadlines and other unexpected scheduling challenges. I believe that in the future, I can mitigate (if not entirely avoid) this problem by blocking out smaller chunks of time each day to work on *all* (or most) of my current writing projects.

2. Regarding my second goal, I have already submitted an abstract for the GSA fall meeting. I will schedule a *weekly* meeting with my co-authors where I can report on progress made towards the poster presentation. At the end of each meeting, I will write down a list of action items that I need to accomplish prior to the next meeting.

   Evaluation: This strategy worked very well. While my co-authors and I did not end up having a meeting every week, we met often enough to keep the project moving forward. As described above, the project was successfully presented at the GSA fall meeting, and we are now working towards preparing a manuscript of the study. We are continuing to meet semi-monthly to discuss project action items.

3. Regarding my third goal, I have already begun reaching out to potential collaborators in Peru. I will block out daily chunks of time where I will focus specifically on drafting the internal proposal for travel and research money.

   Evaluation: I did not end up blocking out daily chunks of time to devote to this project. However, my graduate student and I do meet weekly to discuss the project and report back on action items. We have successfully developed a working relationship with a colleague in Peru, Dr. Aldo Alvan (University of San Marcos), and we have continued to work on developing the humanitarian segment of the project as described above. We are continuing to meet weekly to discuss the project and develop the scientific aims of the study.

4. I have been meeting weekly with the CPMS grant writing coach (Christine Ackroyd). These weekly meetings will continue throughout the Fall 2023 semester. Similar to goals 1 and 3, I will block out specific daily writing times where I focus on this grant proposal.

   Evaluation: During Fall 2023 and the current semester, I ended up blocking out bi-weekly writing times for this project (instead of daily), mainly due to teaching-related time constraints. Despite this, the regularly scheduled writing sessions have allowed me to make significant progress on the grant (albeit slower than I originally intended). I will continue to block out specific writing times (currently, Tuesdays from 11 am to 5 pm) during this semester as I work to have the grant submitted by mid-June.

Evaluating Success and Lessons Learned

Originally, I planned to keep a daily log of my writing activities. This did not prove feasible due to other commitments. However, I was able to track on my calendar when other activities (meetings, student mentoring, etc.) interfered with my writing time. Over the course of last year, approximately 75% of my planned writing times were interrupted in some way. Moving forward, my goal is to be more disciplined about restricting my activities to just writing during my blocked-out writing hours.

On a positive note, I do have clear evidence of my success and partial success for each of my goals. I have significantly increased the word count of my in-progress paper and have a clear outline for the rest of the manuscript. I have a finished poster that resulted from my presentation at the 2023 GSA fall meeting. I have made concrete progress in developing collaborative relationships with geologists in Peru and have established partnerships with groups here on campus to develop the humanitarian aspects of my proposed Peru fieldwork. Finally, I have a detailed outline and a partially-completed manuscript of my NSF proposal, and a detailed timeline that I am working through to finalize the proposal and submit it by mid-June. I have updated the scholarship portion of my faculty development plan to reflect the progress I have made on my goals, the lessons learned from tracking my work, and updated timelines for those goals I have not yet completed.

Citizenship Development Goals Final Report

Department of Geological Sciences

Citizenship Theme

My greatest strengths in citizenship include my ability to work well with others, a willingness to contribute to department efforts and committees, and a desire to model Christlike compassion and service to my fellow employees and students at BYU. I will strive to create an environment of belonging in my classroom, where students are able to feel the spirit and learn in an open, encouraging environment. I will willingly serve in department, college, and university assignments, and seek to build up BYU wherever I can.

Goals to Accomplish by December 2023

Internal citizenship goals:

a. Get to know each of my colleagues in the Department of Geological Sciences by inviting them to one-on-one lunches, and looking for opportunities to collaborate with them in research and teaching

   Goal status: In Progress

   Evaluation: I have had one-on-one lunches or other activities (e.g., research sessions, teaching discussions, etc.) with most of the other faculty in my department. Several new research opportunities have resulted from the meetings, and I have received helpful feedback on my teaching as well.

b. Continue to help the department revamp and improve its GIS offerings; this has been a major focus of my first year, and I will continue to work on incorporating GIS modules and assignments in each of our geology courses

   Goal status: Completed

   Evaluation: My biggest achievement for this goal was the development of a new course: Intermediate GIS. I am teaching the course for the second time this semester, and I have already made significant improvements. Additionally, I have compiled a list of all the GIS-related assignments that are taught across the department's major courses. This will allow us to make sure that student's are receiving continuous GIS training and experience. Additionally, for those courses that do not already have a GIS-based assignment (e.g., GEOL 111 and 112) I have developed short assignments that give students the opportunity to gain practical GIS experience.

c. Continue to work with Sam Hudson and Eric Tingey to incorporate digital mapping techniques into the department's field camps and student research projects

   Goal status: Completed

   Evaluation: Eric and I identified the issue with the initial batch of digital mapping tablets the department purchased, and ordered a new batch of tablets that function correctly. Additionally, I am preparing tutorials for our field camp students to familiarize them with the various mapping apps that can be used on the tablets.

E*xternal* citizenship goals:

a. Serve as a reviewer for journals and volunteer to serve on grant proposal review panels

   Goal status: In Progress

   Evaluation: I made significant progress on this paper over the course of the Fall 2023 semester; however, because of the time constraints caused by teaching two new courses, I was unable to finalize the paper by December as originally planned. I am currently working to finish and submit the paper by April, 2024.

b. Work with the multi-university Paleosciences Peer Mentor Program (PPMP) to support and mentor graduate students and postdocs in the paleosciences

   Goal status: In Progress

   Evaluation: I made significant progress on this paper over the course of the Fall 2023 semester; however, because of the time constraints caused by teaching two new courses, I was unable to finalize the paper by December as originally planned. I am currently working to finish and submit the paper by April, 2024.

c. Work with colleagues outside of BYU to submit a technical session focused on proxy-based terrestrial paleoclimate reconstructions at a suitable 2024 international conference (e.g., the GSA or AGU fall meeting)

   Goal status: In Progress

   Evaluation: I made significant progress on this paper over the course of the Fall 2023 semester; however, because of the time constraints caused by teaching two new courses, I was unable to finalize the paper by December as originally planned. I am currently working to finish and submit the paper by April, 2024.

Moving Forward

I have updated the citizenship portion of my faculty development plan to reflect the progress I have made on my goals, the lessons learned from tracking my work, and updated timelines for those goals I have not yet completed.

Using Lego Technic Components to Teach Undergraduate Students about Structural Resonance Frequencies

Teaching Grant Proposal

One key concept that I attempt to teach students in GEOL 101: Introduction to Geology is the behavior of buildings during large earthquakes. My goal is to help students understand that the resonant frequency (the frequency at which a structure is most susceptible to vibrational motion or oscillation) varies between different buildings, each will respond differently to earthquakes of various magnitudes. I have found that this concept can be challenging for students to grasp, and I have been searching for an effective physical model that can demonstrate this principle to a large classroom audience. Several months ago, I came across a YouTube video demonstrating how a model of three buildings of three different heights could be constructed of Lego Technic pieces and attached to a variable-speed motor in order to show the principle of resonant frequency. The video can be viewed here.

After communicating with the developer of the original YouTube video, I propose to use the $500 teaching grant to purchase the necessary Lego pieces to construct a similar model for demonstrating resonant frequency in my class. Additionally, I will use a portion of the money to hire a student to help me assemble the model. The Lego pieces will be purchased from bricklink.com, a second-hand Lego webstore. The breakdown of the expected costs is shown in the table below.

Item	Unit Cost	Number	Total Cost
Technic, Axle 8L	$0.01	120	$1.20
Technic, Axle Connector 2L	$0.01	200	$2.00
Technic, Axle 8L with Stop	$0.01	6	$0.06
Technic, Liftarm Thick 1 x 15	$0.03	64	$1.92
Technic, Liftarm, Modified Bent Thick L-Shape 3 x 5	$0.01	48	$0.48
Technic, Panel Curved 7 x 3 with 2 Pin Holes through Panel Surface	$0.05	28	$1.40
Technic, Panel Plate 5 x 11 x 1	$0.55	28	$15.40
Technic, Liftarm Thick 1 x 9	$0.01	100	$1.00
Technic, Pin with Short Friction Ridges	$0.01	200	$2.00
Technic, Axle 1L with Pin with Friction Ridges	$0.43	100	$43.00
Technic, Gear 16 Tooth - Axle Hole with Closed Sides	$0.02	25	$0.50
Technic, Gear 12 Tooth Double Bevel	$0.03	25	$0.75
Technic, Axle 4L	$0.01	25	$0.25
Tire 56 x 28 ZR Street	$0.26	19	$4.94
Wheel 43.2mm D. x 26mm Technic Racing Small, 6 Pin Holes	$0.15	19	$2.85
Electric, Motor 9V Power Functions XL with Dark Bluish Gray Bottom	$33.99	2	$67.98
Electric 9V Battery Box 4 x 11 x 7 PF with Orange Switch and Dark Bluish Gray Covers	$5.50	1	$5.50
Shipping	$50.00	1	$50.00
Hourly wages for undergraduate student	$13.00	22	$286.00
		Total Project Cost	*$487.23*

These prices represent a best-estimate and may be refined downwards as the undergraduate student helps me develop a more complete parts list. I estimate that ~22 hours (1 week of part time employment) will be necessary for the student to build and troubleshoot the model.