TO: Dr. Sachi Horback, VP of Instruction

CC: Dr. Peter Williams, Dean of STEM

FROM: Sally Keely, Mathematics Faculty

DATE: March 23, 2019

RE: Post-Sabbatical Report, Fall 2018 Sabbatical

1. **Provide a summary of your sabbatical project in each of these areas: preparation and planning for your sabbatical, project products and/or accomplishments, research (Include any focused reading or studying as well as any more formal research.), and self-enrichment.**

Pre-sabbatical preparation and planning:

- Researched to see what, if anything, similar to my plan for a list of mathematics applications exists beyond our college or in our state. According to my findings, the only site that comes close to what I envisioned was built under an NSF grant in the mid-2000's and has not been adequately maintained. (The main faculty owner has since retired and a significant portion of the links are broken or obsolete.)

- Discussed with mathematics faculty around the state specific real-life mathematics applications they currently use as activities in their classes.

- Discussed with Clark mathematics faculty and Clark faculty in other subject areas specific mathematics applications they currently include in their classes or would be interested in including if they had access to an appropriate example.

Courses taken, professional development accomplished, and research conducted during sabbatical:

- Researched a wide variety of mathematics applications available on the internet, over 1000 pages. Reviewed content for scope of subject matter, accuracy, presentation style, ADA accommodation, and mobile technology accessibility.

- Improved my ability to code using a Cascading Style Sheet (CSS) in DreamWeaver web development software by working through the tutorials at w3schools.com.

- Learned scripting for MathJax which is a web software that allows for ASCII MATH coding to display "pretty print" mathematical notation. MathJax is widely ADA accessible and screenreader compatible. I'm in the process of converting all my mathematics websites (over 10,000 pages) over to MathJax during this calendar year.

- Continued my participation in the four-part webinar "Pathway to Calculus" offered through The Dana Center at the University of Texas, Austin TX.

- Participated in two events with the 500 Women Scientists group in B.C. and one event with the 500 Women Scientists group in Seattle. These groups are local "pods" of the

international 500 Women Scientists organization that promotes science and provides opportunities and support for women in STEM. I was one of the original 500 women.

Project accomplishments and products produced:

- For the majority of my sabbatical project I created a comprehensive library of links to real-world applications of mathematics. The site is *AZiMATH: A to Z Internet Applications of Mathematics*. The topics range from 'mathematics in agriculture' and 'mathematical models in balloon design' all the way to 'mathematical relationships in yoga poses' and 'mathematical history of zero'.

  There are approximately 75 topics (e.g., dance, nursing, whales), approximately 100 separate real-life applications. Most are tagged with mathematical concepts to which they relate (e.g., logarithms, parabolas, vectors). The list includes academic topics (e.g., electromagnetism), career areas (e.g., fire fighting), and hobbies (e.g., horseback riding). Students can refer to the list to connect the mathematics they are learning to their own major subject areas, career goals, hobbies, or personal interests. Faculty can refer to the list for extensions/enhancements to their curriculum and to provide students motivation to learn mathematics.

- Produced the document *Active Learning Types of Activities Explained* in which I wrote clear descriptions of each type of activity the mathematics department is creating for active learning activities in the classroom as part of our new math pathways curriculum. I included some personal tips-for-success based on my 30+ years of teaching in an active learning environment. The types of activities described in the document include: sorting

activities, bingo game, jeopardy game, math bees, card/board/other games, and quick activities such as heads together, pair-and-share, and one-minute essay.

- Identified, vetted, and made available to math faculty web applications for creating math bingo and math jeopardy games that could be used to create these games as active learning activities in the classroom (face-to-face and online).

Self-enrichment:

Time away from teaching permitted me to contemplate my own life-long learning experiences and evaluate my teaching methods, andragogy, successes and failures. This in itself is enriching. So too is the sense of accomplishment earned from completing the sabbatical projects and goals I had set for myself and seeing how the current winter-term students are already benefitting from the resources created. Additionally,

- Completed a 6-week beginner course of jazz piano offered online through Lynda.com (now Linked-In Learning). I haven't played piano since I was a child so this was a challenge, but a good way for my brain to step away from mathematics and teaching.
- Watched two courses (my 29th and 30th) offered through The Great Courses company: *Plant Science – An Introduction to Botany* and *The Science of Information – From Language to Black Holes*.
- Traveled with my husband and teen daughter in early/mid September. We took a 3-week camping/hiking trip through Banff and Jasper National Parks in Canada. I consider this much needed "research of the mind and body".
- Spent time with my parents on Vancouver Island and did some sea kayaking.

- Read several non-fiction books and one novel that had been waiting on my headboard for months. I love to read but rarely get the time during the term with online teaching duties that seem to span 24/7. Reading about recent advances in biology and quantum mechanics enhances my ability to teach calculus more than one might assume.

2. Provide a chronicle of your sabbatical activities. If you were awarded a 1-quarter leave, provide a weekly account, if you were awarded a two or 3-quarter leave, provide a monthly account.

Week 1 Researched types of active learning activities that are common in college mathematics courses and compared to those that we use at Clark College. Researched wording used to describe each activity and reviewed such for clarity and breadth. Researched sites for creating math games such as bingo, jeopardy, and bees (i.e. spelling/math bees) that could be used to create these games as activities in the classroom (face-to-face and online). Linked the best of these web applications in the "Active Learning" module in the department's Mathematics Collaboration Group in Canvas.

Week 2 Created the document *Active Learning Types of Activities Explained* in which I wrote clear descriptions of each type of activity the mathematics department is creating for active learning activities in the classroom as part of our new math pathways curriculum. Made this document available to mathematics faculty in the "Active Learning" module in the department's Mathematics Collaboration Group in Canvas.

Week 3-7 Each week I concentrated on a chunk of the alphabet (e.g., J-M) and identified a variety of academic subject areas, career goals, hobbies, or personal interests starting with those letters (e.g., juggling). I then researched internet applications of mathematics for each of these

topics. Each application's content was personally vetted and checked for accuracy, reliability, accessibility, and user-friendliness to the best of my ability.

Week 8-9 Designed the AZiMATH website. Coded the site (by hand) using HTML and CSS in DreamWeaver. Added links to the approximately 75 topics and 100 applications. Created the graphics for the header and sections. Wrote the opening introduction and footer details.

Week 10 Double-checked all 100+ links for accuracy and tagged most with specific subject matter for topic searching (e.g., #logarithms #proportions #vectors). Added a few more topics and/or applications and some finishing touches.

Although not part of my sabbatical project, I spent some time cleaning up the Mathematics Collaboration Group in Canvas for the department. (Maintenance for this Canvas group falls on about 3-4 faculty volunteers, but the materials posted there serve the entire department.) There is a lot more to do, but I was able to replace some outdated documents with current versions, fix some broken links, and improve some resources.

3. Restate your sabbatical leave objectives as stated in your original application and elaborate on whether or not you met each objective you intended to accomplish.

To support and enhance the curriculum revisions the Mathematics Department is currently undergoing for the Math Pathways project, the three objectives I had stated in my original application were: (1) building a comprehensive library of real-world applications, an "A-Z of Mathematics Applications", from 'math in art' to 'math in x-ray tech', (2) writing clear descriptions of each type of active learning activity we use, and (3) creating generic templates for the main activities. All were successfully accomplished along with a couple more items for the department that were not included in the original sabbatical application.

Objective (1) was the main goal of my project. Much of my time in creating the A-Z list of applications was spent sorting through the overwhelming amount of mathematics applications available online and vetting the material. Some of the applications I found were too complex for our courses or too elementary for our students, had mathematical errors, had mathematical notation that incorrectly rendered on some browsers, was not ADA accessible, was from unreliable sources, etc.

There were some topics in my original draft list (e.g., birding) for which I was unable to find an acceptable mathematical application. There were topics in my original draft list that had so many good applications I had to edit them down so as not to overwhelm the student. I ended up with about 75 topics, about 100 applications, and at least one topic per application for each of the 26 letters of the alphabet as had been my goal. I was able to include topics from STEM, humanities, fine arts, and extra-curricular activities, all in nice proportion for a good variety of interests.

One thing I would like to add in the future is a "level" indicator for the content of each application, i.e., on a scale from beginner to advanced. I would also like to improve the search capabilities by adding more hash-tagged content connections. I consider the applications library to be a living site that will continue to grow. I'm sure I will keep adding applications to it with passion throughout the rest of my career. (I'm addicted now!)

Regarding objective (3), I altered my original goal slightly in that for some of the active learning activities the "generic template" would simply have been a blank table in MS Word where faculty type in their own equations, so instead I concentrated my time on the two difficult-to-create activities which are math bingo game and math jeopardy game. I researched and

reviewed several web applications for each before deciding on the two most comprehensive yet user-friendly. Those are available to math faculty in our Canvas Mathematics Collaboration Group.

4. Describe how your sabbatical activities benefit the students at Clark College.

The A-Z math applications list will benefit students across campus in that they now have a available a comprehensive list of real-world math applications to which they can refer or be referred to connect math to their own subject area interests, career goals, hobbies, or personal insterests. For instance a student studying to be an x-ray technician can use the list to find how x-ray equipment is tied to algebra which can provide the student motivation to learn the mathematics they are required to study for their degree pathway.

5. Describe how your project will add value to the College and your instructional division or department.

The A-Z math applications list will be useful not only to mathematics faculty but faculty across campus in providing a comprehensive organized list of applications showing how mathematics is actually used in the real world. For example, if a class is discussing quadratic equations and the student wants to know why they need to learn about parabolas to become an x-ray technician, a faculty member can refer them to the x-ray application showing the connection.

As part of the current Math Pathways Project at Clark, the mathematics department is building a library of active learning activities in our Canvas Mathematics Collaboration Group for the new pathways courses and the co-requisite supplementary courses. The addition of my *Active Learning Types of Activities Explained* document will be helpful to mathematics faculty looking for clear desriptions of each of the types of active-learning activities the department is

developing, particularly those faculty new to an active-learning environment. Having easy-to-access web applications for two of the "big" games (math bingo and math jeopardy) will make it less complicated for faculty to create these activities for use in their own classrooms. These two games are particularly useful during exam review sessions so may aid in improved performance on final examinations thus higher success rates.

6. **If applicable, explain how your sabbatical project added or enhanced any previous professional work that you might have completed or performed.**

The mathematics department is currently undergoing a Math Pathways Project that includes big changes in curriculum, changes in our pathways to completion, and a move to more active learning in the classroom. I have been involved in the project for two years particularly in the area of active learning activities. Each part of my sabbatical project was designed and carried out to fill-in some gaps in our classroom resources and enhance those that I had already contributed to the overall project. Together they enrich this new phase in mathematics education at Clark.

7. **List any institutions or other organizations which were affiliated with the project.**

None.

8. **List any other grants or stipends that you used for your project.**

None.

9. **Provide a copy of your original application with this report.**

Attached.