Sabbatical Leave Proposal

A. Applicant

Name: Tom Falbo

Department: Mathematics

Type of Leave: Independent Study

Leave Dates: Fall 2018

B. Purpose of Leave

In order to improve student learning in mathematics courses, I will be studying three-dimensional modeling software including Mathematica and AutoCAD with the express purpose of designing and producing physical three dimensional models for use in the classroom or a laboratory setting. I will also develop materials for instruction on these processes for both my colleagues and students.

C. Leave Objectives

Objective 1: Become proficient at an advanced level in the use of Mathematica, a discipline standard software program, specifically in the development of three dimensional solids and surfaces using systems of equations and inequalities.

Objective 2: Become proficient at an advanced level in the use of AutoCAD, an object based design modeling program, specifically for the design of three dimensional solids by manipulation of standard solids such as a solid cone or solid cylinder with Boolean operations.

Objective 3: Design and produce a minimum of 10 original physical three-dimensional models that will illustrate both specific and general concepts in our mathematics curriculum.

Objective 4: Prepare two one-hour PowerPoint presentations on designing mathematical models and using the software programs Mathematica and AutoCAD together with a 3D printer to create the physical models. One presentation for colleagues, suitable for seminars and conferences and one presentation for students.

D. Narrative

Focus on your major activities related to each objective. Do not simply tell the story of how you intend to spend your sabbatical leave. You will refer to these objectives in writing your report.

Objective 1: Mathematica provides both online mini-courses and regional conferences on a regular basis, there are 11 such events in September 2017 alone. In addition, there are conferences that specifically address 3D design, usually several each week. I plan to attend at least one such conference on my sabbatical. Hopefully, I can attend several that are specifically related to creating mathematical models. Due to the fact that the overwhelming majority of conferences for the period of my sabbatical have not yet been formally announced, I am unable to identify a specific conference. Furthermore, I expect the majority of my study will be from online resources.

Objective 2: AutoCAD also has multiple training classes and regular conferences. As with Mathematica, I expect the majority of my learning to be from independent study.

As examples, listed below are links to *annual* national conferences being offered *this* fall with speakers, workshops and presentations appropriate to objectives 1 and 2. Depending on the location and topics, I may attend one or both conferences in the fall 2018 semester.

Wolfram (Mathematica) Technology Conference:
https://www.wolfram.com/events/technology-conference/2017/program.html

Additive Manufacturing Conference: http://www.additiveconference.com/

Also, Mathematica offers both open online courses and scheduled courses on a variety of topics:
https://www.wolfram.com/wolfram-u/catalog/product-training/mathematica/

A list of conferences and training events for AutoCAD can be found on the link below, however again, the scheduling does not extend as far as my sabbatical dates, and so this is representative of what I expect to be available:
https://gems.autodesk.com/events/Calendar/Calendar.aspx?cal=6d8746ce-d119-4a82-b4d6-ebe35e8bbdbe

Objective 3: Many concepts in mathematics are either based on geometric objects or more easily understood by a geometric construction. Equations and inequalities in two variables can always by represented by a two-dimensional graph. In a way, the equation or inequality *is* the graph. For example, the equation $x^2 + y^2 = 1$ is the *unit circle*, that is, the circle whose radius is one and whose center is the origin. In the same way, an equation, inequality or system of equations and/or inequalities in three variables has a graph that is a surface or solid in three dimensional space. Understanding the geometric equivalent of an algebraic relation is critical to student learning in nearly every mathematics course at the high school level or above. In our curriculum at Santa Rosa Junior College, every course above beginning algebra requires students make the connection between equations and graphs in three dimensions. In some courses, such

as multivariable calculus (Math 1C), we cover concepts that are almost exclusively three dimensional in nature. For obvious reasons, it is difficult, even for a well-trained hand, to draw most three-dimensional objects on two-dimensional paper. There are a variety of computer programs that can with greater detail and flexibility produce three-dimensional images, but ultimately, these are still being represented on a two dimensional screen. The best way to 'see' a three-dimensional object is to physically hold the object in your hand, examine the depth, feel the contours and view it from many angles. In this objective, I will conceive, design and manufacture at least 10 original physical models that illustrate fundamental concepts in our curriculum with the goal of enhancing student learning.

Objective 4: As I learn more about Mathematica and AutoCAD and develop both virtual and physical models, I will prepare two one-hour PowerPoint presentations that would focus on the mathematics and software required to produce physical models. One presentation with an intended audience of colleagues who might wish to produce their own models and one presentation for students with similar goals.

E. Evaluation Summary

1. How will the objectives of this sabbatical leave enhance my work performance at the college?

I will have a better grasp on discipline specific software which would provide me with additional ways to think about and provide instruction.

2. How will the objectives of this sabbatical leave benefit students in my discipline?

By the use of physical models in three-dimensional space, students will gain a greater understanding of the concepts being taught. These students would also benefit by learning how to design and produce three dimensional models.

3. How will the objectives of this sabbatical leave benefit my department?

My colleagues would benefit from learning how to use the software to design and produce models, also the models and PowerPoint presentation will be available to my colleagues for use in the classroom.

4. How does your proposed project address the SRJC Strategic Plan and/or your department's educational plan?

While this project should support all phases of the SRJC Strategic Plan, the strongest correlation is with the second objective: Foster Learning with Academic Excellence. Visualizing abstract concepts in a concrete way supports student's learning. Creating, designing and developing three-dimensional models engages students and develops their intellectual curiosity.

F. Abstract for Board Proposal Summary

Tom Falbo will research the design, development and use of three-dimensional mathematical modeling in the mathematics curriculum. He will learn the requisite computer design software by attending conferences and through independent study. He will develop learning materials including PowerPoint presentations and original physical mathematical models.

G. Approval

Applicant Name
Department/Program
Review and Signature

Department Review

Signature of Department Chair Date

Sabbatical Leave Committee Review

Signature of Committee Chair Date

Board of Trustees Review

Action Taken Date