VALENCIA COLLEGE

Individualized Learning Plan (ILP) Submission Form: Year - 2

Candidate's Name: Sandra D. Bowling

Dean's or Director's Name: Dr. Lisa Macon

Candidate Context

Attach Educational & Professional Background (Brief Resumé) to ILP:

This is a brief resumé that highlights your professional background. The purpose is for your panelists to recognize your accomplishment outside your ILP work. This is not an extensive resumé. This is part of the written ILP and is not evaluated by your panel.

*See attached

Candidate's Workload:

Explain your workload. Try to be as specific as possible. If you are a professor, mention the number and types of classes (preparations) that you have, as well as any lab or clinical work you do. If you are a program coordinator, mention that here. Librarians and counselors should explain the particular work they are doing and will be expected to do. Describe any other professional duties that you have as part of your work at Valencia, including your participation in TLA activities.

Number of Contact Hours: *(fall, spring, summer)* **Typically, I have 15 to 20 contact hours per semester.**

Number of Preparations *(different courses taught or modality)* **- Currently teach 9 different courses.**

- SUR 1101C – Basic Surveying Measurements
- SUR 2640 – Advanced Survey Computation
- SUR 2460 - Subdivisions
- SUR 2202C – Highway Drafting and Route Design
- SUR 2390 - Introduction to Geographic Information Systems
- MTB 2321 - Technical Math
- ETD 1100C – Engineering Drawing
- ETD 1320C – Introduction to CADD
- ETD 1340C – Advanced CADD

Year 1

Fall 2013: MTB 2321 – Technical Math (4 hrs – Modified this course for use of the Blackboard Program), SUR1101C – Basic Surveying Measurements(4 hrs), SUR 2460 – Advanced Survey (4 hrs

- Preparation for the entire class was required), ETD 1100C –Engineering Drawing (4 hrs - Preparation for the entire class was required),

Spring 2014: MTB 2321 – Technical Math (4 hrs), SUR1101C – Basic Surveying Measurements (4hrs) , SUR 2640 – Subdivisions (4 hrs –Preparation for the entire class was required), ETD 1320 – Introduction to CADD (4 hrs), ETD 1100C – Engineering Drawing (4 hrs – This class was split with Professor Ray)

Summer 2014: MTB 2321 – Technical Math (4 hrs – Modifying this course for use of Valencia IMathAS Program), SUR1101C – Basic Surveying Measurements (4hrs) , SUR 2202C – Highway Drafting and Route Design (4 hrs – Developed Application Videos for the Civil 3D AutoCAD Program used in this course), ETD 1100C – Engineering Drawing (4 hrs – Modified this course to match East Campus)

Year 2

Fall 2014: MTB 2321 – Technical Math (4 hrs – Modifying this course for use of Valencia IMathAS Program with open source textbook), SUR1101C – Basic Surveying Measurements, ETD 1100C – 2 Courses of Engineering Drawing (4 hrs), ETD 1340 – Advanced CADD (Preparation for the entire class required)

Spring 2015: MTB 2321 - Technical Math (4 hrs – Modifying this course to a hybrid "flipped classroom" in order to incorporate problem-based learning methods), SUR1101C – Basic Surveying Measurements(4 hrs), SUR 2640 – Advanced Survey Computations (4 hrs), SUR 2390 - Introduction to Geographic Information Systems (3hrs – Preparation for the entire class is required)

Summer 2015: MTB 2321 - Technical Math (4 hrs – Improving "flipped classroom" and incorporate problem/project-based learning methods), SUR1101C – Basic Surveying Measurements(4 hrs), SUR 2460 – Subdivisions (4hrs – Preparation for the entire class is required)

Other Commitments *(e.g., department coordinator, clubs, etc.)*

- **Faculty Internship Supervisor for the Drafting and Design Technology Program and the Civil/Surveying Engineering Technology Program.**
- **TLA seminars and follow-up roundtables, Professional Development classes**
- **Florida Surveying Mapping Society Meetings / Interact with local companies (Surveying and Engineering) to ensure our courses are in line with current technologies.**
- **Department/Division meetings**

Professional Strengths:

Describe what you consider to be your strengths as an instructor, counselor or librarian. Describe in broad terms the skills, abilities and experiences you bring to your position.

Professional Strengths:

- **Professional Experience:** I have been a practicing Professional Civil Engineer for over 10 years and the knowledge I have gained from these experiences supports me in teaching current industry standards in the classes within the Drafting and Design Program and the Civil/Surveying Program. In addition, I can demonstrate how all courses in the program correlate and build on each other. The purpose of my teaching is to provide students with practical skills for employment upon graduation.
- **Content and Teaching Experience:** I incorporate both online and in class components into all my classes allowing me to use various assessment and instructional methods. For example, I've created video tutorials to help students learn a drafting application for the civil/surveying program. This allows students to learn at their own pace and allows me to be available to students who need more one-on-one instruction. I am always assessing the various styles of student learning. Then I create and modify my teaching techniques and implement what I have learned in my future courses.
- **LifeMap and Career Skills:** In the tenure process, I want to create project-based learning components so that students can learn critical thinking skills. My goal is to show students how critical thinking skills I demonstrate can be applied to real life situations
    - Skills (as described by The Critical Thinking Community – Universal Intellectual Standards) that I would like students to learn from the courses I teach:

Skills/Traits	Examples: I relate to in my Courses	Examples: Real Applications
Clarity and Precision	SUR 2202C (Highway Drafting and Route Design) and SUR 2460 (Subdivisions)– Students are required to develop statements defining a design problem and the proposed solutions. These reports are to help reinforce the idea of communicating clear and precise statements.	Communication either written or verbal needs to be clear and precise when working with drafters /designers, engineers, or construction management
Depth and Breadth	In the SUR 2202C (Highway Drafting and Route Design) and SUR 2460 – (Subdivision) - When designing roads or subdivisions there is always more than one solution to the problem. Therefore, there needs to be a reason behind the solution with physical data to support the conclusion.	Construction companies and governmental agencies require reports to be written in depth to cover numerous details of a project.
Skills/Traits	Examples: I relate to in my Courses	Examples: Real Applications
Accuracy	In all classes that deal with mathematical solutions, accuracy is extremely important. For example: • In the MTB (Tech Math) course – When completing cost estimates for contractors and calculations are inaccurate, the construction company may be liable	The following are issues when accuracy is not maintained: ○ Cost Estimating: ○ Under-bidding of a construction project.

	for the error and they will be required to pay the additional cost incurred due to the miscalculation. • In the ETD (Drafting and Design) courses - When drafting production parts, if drafting errors are made, there is a possibility that all parts produced may be rejected.	○ Hydrology and Hydraulics: Flooding of roadways due to errors in pipe sizing. ○ Route Design: Public safety issues due to poor design of roadway.
Logic	When either completing a design or working a math problem, I ask students if their solutions make sense. I explain just because that the computer or calculator gives you an answer doesn't always mean it's the correct answer. • In Tech Math, students learn to use the scientific calculator and if they don't use it properly, they will get an error. For example, if you type into the calculator -2^2 the answer given is -4. We know this isn't true but the calculator doesn't know we meant $(-2)^2$ which will give us the correct answer of 4. • When using the design software Civil 3D (for the survey courses), I explain that the program gives results but sometimes the results have errors and we as the designers need to evaluate what the computer is telling us to determine if the results make sense.	Examples when logic isn't applied and computer programs are taken as correct. ○ Volume calculations on earthwork. Computer states millions of yards of earth is excavated when in fact the site requires import of fill. ○ Error in unit conversions when completing a quantity analysis. ○ Construction scheduling errors due to incorrect assumptions of time management.

- **Educational Background:** I began my academic career at Elizabethtown Community College and I believe that experience allows me to better relate to the students here at Valencia College. I went on to achieve a BS in Agricultural Engineering at University of Kentucky and a MS in Biological System Engineering at the University of Nebraska –Lincoln.

Philosophy of Teaching, Counseling or Librarianship (1-2 pages):

The Professional Philosophy describes how you conduct your professional practice and why. It should overtly influence your course products, such as syllabi, policies, and daily lessons, and it should be unique to you and your field/discipline. More specifically, the philosophy provides concrete examples reflecting your role (teacher, librarian, or counselor), the role of your students, your instructional strategies, and your assessment methods. Note: The FLO's in your ILP should be reflected in the Philosophy statement.

The students in my courses will be employed at design firms, engineering industries, construction companies, and surveying and civil engineering firms. My principal goal for students is to develop a skill set that is based on "real-world" industry experience and knowledge so they become capable and proficient assets to an employer.

Listening, collaborating, and evaluating are important abilities that one must have in order to be successful in my classes. Students need to come to class with the desire and constructive attitude to learn and discover how the subjects they are studying can be applied in their lives.

It is paramount that students understand responsibility, accountability and ethical practice within their professional careers. For drafters, designers, civil engineers, and surveyors, I stress the importance of professionalism. In their positions, errors can cause harm either personally or economically.

One of the courses I teach is Basic Surveying, which is a requirement in two of the AS Degree Programs. The class integrates learning "hands-on" surveying techniques while providing students an opportunity to interact in a cooperative way to complete field exercises. In this way, they are responsible for more than themselves to accomplish goals.

Students come to this course with little or no experience in surveying, and it is a challenge to get them to understand the purpose of surveying techniques and then to have them collect and calculate the data. In order for students to understand how to complete the various survey techniques, I will lecture and demonstrate in class prior to completing the field exercise.

The field exercises are designed so that the students have to create a cooperative and collaborative team to accomplish the task. The students in this course come from diverse backgrounds, ranging in age, race, gender, and academic level. This dynamic of student variety makes up the "crew" for the field exercises. In each team, a "crew chief" is selected per field exercise, thus making everyone in the class accountable for at least one exercise. In addition, to mimic real world survey experience, it is the responsibility of the "crew chiefs" to coordinate the completion of the field exercise and field report.

In my experience, this method of cooperative/collaborative learning has been extremely effective. While not everyone is proficient at working the instruments or capable at completing the calculations, the crews can accomplish all the tasks by assisting and teaching one another all facets of the exercise.

My assessment philosophy and methodology is evolving as I acquire a better understanding about learner-centered teaching. Primarily, I have assessed the student's practical knowledge of the topic through homework, quizzes and tests; however, since becoming aware of other assessment methodologies and the purpose behind each technique, my goal is to create an assessment methodology that requires the student to take ownership in his or her learning. In addition, I have come to recognize the importance of providing "feedback" to students regarding their work. I've always provided the results to tests, homework, and quizzes by the next class period; however, I plan to offer additional feedback to the students regarding their assignment outcomes.

I plan to utilize low stakes formative assessment as part of the class participation grade in my courses. The following are the classroom assessment techniques that I want to implement: *Application Card* (students write down applied applications with respect to current topic taught), *RSQC2* (Recall, Summarize, Question, Connect and Comment to be used at the beginning of each class to evaluate students understanding of the previous class concepts), *What's the Principle*? (Students identify principle or principles to solve problems of various types) and *Concept Maps* (students draw or diagram the mental connections they make between a major concept and other concepts they have learned).
To improve students' critical thinking skills, I want the students to create a "*Discussion*" in Blackboard analyzing a specific topic discussed in class. The students are required to use the

Eight (8) Elements of Reasoning as defined by Richard Paul. The purpose of this assessment tool is to help guide students to critically think about the topic in a detailed manner.

I believe all students can be successful in learning, but it is my responsibility to find a way to give everyone the opportunity to learn by employing the various teaching techniques and strategies for each kind of learner. I was brought up believing knowledge is power. With knowledge comes capability and competency that no one can take away, and, in turn, can provide opportunities and experiences that can better learners and society.

Faculty Learning Outcome & Implementation Plan #1: Action Research Project

(Use the Action Research Project resources, including the Elements of an AR Project, AR Project Rubric, and AR Project Template, to help you to design your project.)

Needs Assessment for Faculty Learning Outcome #1 Action Research Project:

Needs are based on what the faculty member wants to learn to improve student learning. Where do you see a need to improve teaching and learning? Is there a persistent problem or area of concern in your class/professional setting? What is the concern? Why are you concerned? Is there a teaching method you would like to explore/incorporate in your practice? Is there a topic in your discipline you would like to teach or present differently to improve student learning? Would you like to try alternative methods of assessment? Would you like to have evidence of the effectiveness of something you are currently doing?

In the **MTB 2321 Technical Mathematics** course, students have difficulty relating trigonometric functions, Law of Sines, and Law of Cosines in real life applications (survey calculations and vector mechanics). Students can solve the trigonometric equations once the equations have been structured with the values entered into the equation; however, they sometimes confuse when to use the trigonometric functions versus the Law of Sines and Cosines.

For example, a student will know how to solve for the sine, cosine or tangent of a right triangle once I set up the equation and “plug in” the correct values; however, when the students are provided the lengths and/or angles of a right triangle, they have difficulty or are unable to correctly identify which equations to use and how to set up the equations.

I believe students become overwhelmed with the various equations and components that form the equations required to solve triangles.

Faculty Learning Outcome #1:

The FLO statement should be connected to the Needs Assessment and explain what the faculty member will do in terms of improving student learning. An effective FLO meets these criteria: addresses no more than one result/trait; is action-oriented and measurable; action verb identifies the desired cognitive level of faculty thinking; meaning is clear to all disciplines.

The research question must clearly align with the FLO. In other words, the research question is the FLO statement in question form. You may have more than one research question.

FLO Statement: Develop problem-based learning activities and formative assessment techniques to improve students' abilities to solve practical problems using trigonometric functions.

Research Question(s): Will using problem-based learning activities to learning trigonometric functions improve students' ability to solve practical problems?

Essential Competencies Addressed:

List the Essential Competencies and their indicator(s) that you plan to demonstrate in the FLO project. For FLO #1 (Action Research Project), SOTL and all of its indicators must be included and demonstrated.

Assessment:

- Design and employ a variety of assessment measures and techniques, both formative and summative, to form a more complete picture of learning (e.g., classroom assessment techniques, authentic assessments, oral presentations, exams, student portfolios, journals, projects, etc.)
- Design activities to help students refine their abilities to self-assess their learning.
- Align formative and summative assessments with learning activities and outcomes

Learning Centered Teaching Strategies:

- Employ strategies that engage students to become more active learners (e.g., reference interview, counseling inquiry, engaging lectures, classroom discussions, case studies, scenarios, role-play, problem-based learning, inquiry-based learning, manipulatives, etc.)
- Employ methods that develop student understanding of discipline's thinking, practice and procedures
- Incorporate concrete, real-life situations into learning activities.

Scholarship of Teaching and Learning (SofTL):

- produce professional scholarly work (action research or traditional research related to teaching and learning, that meets the Valencia Standards of Scholarship
- build upon the work of others (consult experts, colleagues, self, students)
- be open to constructive critique (by both colleagues and students)
- make professional scholarly work public to college and broader audiences through Valencia's research repository and other means
- collect evidence of the relationship of SoTL to improved teaching and learning
- demonstrate use of current teaching and learning theory & practice

Proposed Action Research Design Plan for FLO 1:

Conditions:

Identify how you will limit or narrow the scope of your ARP. Include information about the course, unit or lesson, and timeline for implementation.

The scope of this FLO will be limited/narrowed to a single section of Technical Math MTB-2321 and will focus on the unit of trigonometry. I will design problem-based learning activities connecting basic surveying techniques to the practical application of trigonometry. The FLO will be implemented in the summer of 2015. The results from the treatment will be compiled by fall 2015.

- **Course:** MTB 2321 Technical Mathematics
- **Unit or lesson:** Trigonometry and Vectors
- **Timeline for implementation:** Summer 2015

Adequate Preparation - Sources and Insights:

Describe the information you have gathered from the four lenses (Self Perspective, Student Perspective, Colleague Perspective, and Expert Perspective) that has helped you prepare for this action research project. Note: List sources consulted and provide a summary of primary insights gained from these sources.

Self:

When students are assessed (by homework, quizzes and final exams) on the application of using trigonometry for solving missing information on oblique and right triangles and vector mechanics, students will often use incorrect formulas or fail to attempt the problems.

For instance, on the final exam, questions 9 through 13 and 15 relate to solving angles and lengths of triangles using trigonometry and vector mechanics (which uses trigonometry to evaluate forces in the X and Y directions). Based on the past years' tests, the following is a breakdown of the percentage of students who correctly solved the trigonometric problems:

Percentage of Students that Correctly Solved the Trigonometry Problem								
Year	Semester	Problem 9	10	11	12	13	15	Total Students
2013	Spring	73%	82%	45%	82%	73%	45%	11
2013	Summer	69%	81%	56%	63%	44%	31%	16
2013	Fall	76%	76%	71%	65%	47%	35%	17
2012	Spring	100%	91%	18%	55%	36%	55%	11
2012	Summer	67%	67%	44%	78%	67%	44%	9
Total		77%	79%	47%	68%	53%	42%	64

Problem	Trigonometry Application
9	Right Triangle
10	Right Triangle
11	Obtuse Oblique Triangle
12	Acute Oblique Triangle
13	Acute Oblique Triangle
15	Vectors - Right Triangle

When I first started teaching this course, I was an Adjunct Professor new to teaching. My knowledge of teaching methods was limited to how I was taught. It was apparent this wasn't working; therefore, each semester I tried something different trying to make a difference. I knew that poor understanding of the trigonometry concept would make the students' future classes that depended on trigonometry harder for them. I came to realize part of the issue is that students do not spend enough time on the topic to master the subject. That is why I started to create a flipped/hybrid course allowing me to spend more time working with students on solving problems instead of lecturing.

Student:

I have surveyed the students in my current Technical Mathematics course to determine their opinion on why they have trouble understanding trigonometry and what could be done to make it easier to learn. Their responses include:

- "To me the most difficult thing about trig is that there are many variations (of formulas) that confuse me such as remembering opp/adj, adj/hyp etc…."
- "The hardest part of learning trig would have to be the endless formulas that you have to memorize and due to the fact that there is so many different parts to each equation with no room for error.
- "The hardest part I think about trig is figuring which points are the adjacent and opposite"
- "What I think that would make trig seem easier or stick to memory may be worksheets to do as the lesson is being taught".
- "Using acronyms SOH-CAH-TOA helps distinguish which equations to use." Sine/Opposite/Hypotenuse/Cosine/Adjacent/Hypotenuse/Tangent/Opposite/Adjacent

Students who leave Technical Math with only a familiarity of trigonometry and proceed to take the courses BCN 2405- Statics and Strength of Materials and SUR 1100C Basic Surveying, which requires a proper understanding of trigonometry, may have difficulties with these courses.

Colleague:

Professor Dennis O'Lenick taught the **BCN 2405-Statics and Strength of Materials** in which trigonometry is used in vector mechanics. Professor O'Lenick expressed that it was his experience at the beginning of his course students have a poor understanding of practical applications of trigonometry. I emailed Professor O'Lenick asking him how well the students are prepared for his class with respect to application of trigonometry. He stated, "Most of the students who start BCN 2405 act as if they never heard of sin, cos, tan, and the inverse Trig functions. All are essential for statics. All are essential for functioning in a technical world. These topics definitely need more emphasis. I would hammer home the basic trig functions, the inverse functions, and the law of sines and the law of cosines."

Professor Irma Berner teaches the MTB 2321 Technical Math course on East Campus and she has identified that the majority of her students don't really understand the trigonometry concept application. "They might "memorize" trigonometric functions but cannot relate them to practical examples in Surveying, Civil Eng., architecture, etc." Professor Berner goes on to say that the "overall the student success in this topic relates to amount of time spent in the subject and how effectively and interesting we deliver content".

For additional feedback, I sent out a request to some of Valencia's Division of Mathematics faculty asking for their opinion on students' understanding of trigonometry with respect to the trigonometric ratios, the Law of Sines and the Law of Cosines. I asked the following questions: 1) When you are teaching these sections of Trigonometry, in your opinion what is the biggest challenge for student learning? 2) How do the students respond to the topic (trigonometry)? The following are the responses I received:

Emily Elrod, Mathematics Professor, Osceola Campus who teaches Trigonometry stated:

1) One of the biggest challenges for the Law of Sines section is them understanding how to solve SSA triangles, and knowing which case applies to a particular situation. 2) Some of my students find trigonometry to be very easy, and they like that it is very applicable. Others struggle with it a great deal, and find it very difficult. I have quite a range of responses.

Daniela Johnson, Mathematics Professor, West Campus stated:

The main issue with students in trigonometry is that they don't always have good algebra skills. There is also the fraction operations issue, which I believe it should not even be an issue in such a high level course. However, students are not used to operate with fractions without a calculator and they do not understand the rules followed. All trigonometric functions are ratios and that's where the main challenge is. Another major challenge is the word problem translation to a mathematical model, and that's in all math classes. Students are too used to selecting the correct answer from a multiple-choice list and they have hard time drawing a figure and making a plan to solve the problem.

Based on the evidence and response from the students and faculty, an alternative teaching methodology could help to improve student learning in the key concepts of trigonometry. I am

considering creating an application problem-based learning assignment that will be completed in a cooperative or collaborative method.

Expert:

The goal for the ***Action Research Project*** is to evaluate if application based problems will improve students' understanding and use of trigonometry.

Project-Based Learning and Problem-Based Learning are student centered approaches to learning material by working in groups to solve a problem. Evidence suggests that students who engage in problem-based learning using real world applications improve their problems solving skills while developing a dynamic understanding (of concepts) and building long-term learning skills. Hmelo-Silver, C. E. (2004).

Project Based Learning

Project-based learning is defined as a model that organizes learning around a complex task, which requires students to design, solve problems, make decisions or investigate hypotheses. It also gives students the opportunity to work autonomously over a period of time to develop a product or create a presentation. Not all projects are considered Project-based learning. Project-based learning projects require the five following criteria 1) projects are central, not peripheral to the curriculum 2) projects are focused on questions or problems that will drive students to encounter and struggle with the central concepts and principles of a discipline 3) projects involve students in a constructive investigation 4) projects are student driven to some significant degree and 5) projects are realistic, not school-like. Thomas, J. W. (2000).

Few studies have been completed on the effects of project-based learning with respect to student achievement - David, J.(2008). Boaler (2002) compared two similar British secondary schools where one school used traditional instruction and the other project- based instruction for teaching mathematics. It was determined that after 3 years; the project based learning school significantly outperformed the traditional school in mathematics skills and applied knowledge.

Blumenfeld et al. (1991) stated teachers must fully understand the concepts embedded in their projects and be able to model thinking and problem-solving strategies effectively in order to use project-based learning successfully.

Challenges with using project-based learning as identified by Marx, Blumenfeld, Krajcik, and Soloway (1997) included the amount of time to complete a project, work productivity, the flow of information from the instructor, technology to be use in the project and assessment of the learning.

Problem-Based Learning

Like Project-Based Learning, Problem-Based Learning is a learner-centered approach where students complete research, integrate theory and practical applications, and apply knowledge and skills to solve an ill structured problem - Savery (2006).

The goals of Problem-based learning are flexible knowledge, effective problem-solving skills, self-directed learning skills, effective collaboration skills and intrinsic motivation per Hmelo-Silver, C. E. (2004). The method of problem-based learning emphasizes the active and transferable process of learning across the curriculum.

Hasna, A. M. (2008) documented that in problem-based learning, the presentation of real life or "authentic" problems are stated as it would be encountered on the job. Thus, using "authentic" problems, the student is able to develop specific problem-solving skills required by their profession. In this approach, the instructor is to facilitate the application and development of the problem-solving process and students must assume responsibility for learning. In addition, students must learn how to acquire information in order to solve problems. Reflection upon completion of the project would increase the transfer of learning to new problems. Lastly, Hasan, A.M. (2008) discusses the difference between collaborative and cooperative learning. The author states that collaborative learning focuses on the process of learning and is learner centered whereas cooperative learning focuses on the product and is teacher oriented.

It is believed, that if students can relate the mathematical concepts with practical contextual applications they are more likely to understand and apply the concept correctly. (Center for Occupational Research and Development, 1999, Teaching Mathematics Contextually: The Cornerstone of Tech Prep).

In order to create the opportunity to use the Problem- based learning method in the Technical Math course, the class had to become "flipped". The class was restructured as a hybrid class, and students are required to review video lectures/lessons demonstrating the concepts that they would use in upcoming class on the practical application based problems. Tucker, B. (2012) stated that flipped classroom becomes the place to work through problems, advance concepts, and engage in collaborative learning.

Bibliography:

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Methods and Assessment Plan for FLO 1:

Student Learning Outcome Statement (SLO):

A Student Learning Outcome states what a student should understand and/or be able to do as a result of what she has learned in a course, library orientation, counseling session. Note: The SLO should align with the FLO and RQ.

SLO Statement: Students will be able to solve practical problems using trigonometric functions.

Teaching, Counseling, or Librarianship Strategies of Student Learning Outcomes:

Describe the methods, strategies, and/or techniques you will use to support student mastery of the student learning outcome(s) you identified in your project. These strategies should be listed in order and should be specific enough for feedback.

I will use Problem- based projects where students will create and analyze data to calculate angles and distances using trigonometry.

- Survey Problem: Student will use a traversing technique to evaluate if a polygon is "closed" using departures and latitudes. This project requires right triangle trigonometry.
- Survey Problem: Students will use the "Closing the Horizon" technique to determine the unknown length between two vectors. This project requires the use of Law of Cosines

Assessment Strategies of Student Learning Outcomes

Describe the tool(s) you will use to measure/gauge how students perform in relation to the Student Learning Outcome. Describe both formative (along the way) and summative (at the end) tools that you will use to assess student learning, as well as tools you will use to inform students of the criteria by which they will be evaluated.

The students will be assessed via formative and summative measures.

- Formative: Pre-quiz worth low stake points
- Formatively assess by the CAT: Problem Recognition Task (Classroom Assessment Techniques, Angelo and Cross pg 214)

- Summative Assessment Lab/Reflective Report
- Summative assessment by: The final exam will be used to evaluate the treatment.

Action Research Design

Describe the types of data you intend to collect and the methods you will use to analyze that data (e.g. pre- and post-surveys, pre- and post-skill or knowledge assessments, experimental group/control group, etc.). Consider whether the type and amount of data collected is reasonable and manageable and aligns with your FLO/SLO/RQ, that is, measures what you intended. Describe the evidence you will use to judge the value of your intervention.

I have taught the Technical Math course for several semesters and have kept the final test results for the class since 2012. The test results will be broken down into specific problems related to the topic of the action research project. In the summer of 2015, I plan to implement the problem-based learning treatment. I will administer the same final at the end of the semester in order to evaluate if my innovation/intervention has improved the students' test results. I can compare these results to all the students that have taken the course; in addition, I can compare the results to just the students that took the course in the Summer sessions. I can also break down and compare the results by the type of questions (Right Triangle, Law of Sines, Law of Cosines and Vector Mechanics). In the previous courses, I did not complete a pre and post test; however, for the action research project I will so that I can evaluate if students improved from the pre-test to the post-test.

I plan to use qualitative measures to analyze the results in determining the value of the treatment.

Faculty Learning Outcome & Implementation Plan #2:

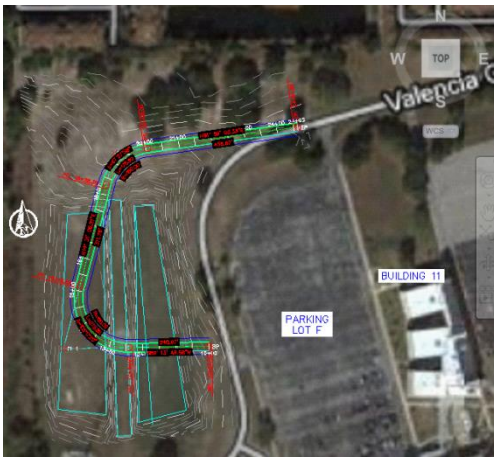
Needs Assessment for Faculty Learning Outcome #2:

Needs are based on what the faculty member wants to learn to improve student learning. Where do you see a need to improve teaching and learning? Explain in general terms what you would like to investigate during your pre-tenure period that would improve your practice and student learning. This might include, but is not limited to, improving such things as specific teaching strategies, assessment tools, implementation of web-based or technology-related tools for students, discipline-specific knowledge, and/or obtaining degrees or certifications.

In the **SUR 2202C – Highway and Route Design** course, the students learn the procedures to design and prepare construction plans for roadways. They are provided real-world exercises to be completed using industry-standard technologies, but the application of the exercise is generic in nature. The students have an understanding of key design concepts and know how to create simplistic construction plan sets as part of a design project.

The design exercises the students are given are instructor led, using specific step by step instructions. This is necessary for building a foundation for the students to understand the basic design concepts and software utilized for the roadway plan; however, this method does limit the student's critical thinking skills.

For example, as part of the required coursework for this class, a small roadway design project is assigned. The project size is appropriate to allow students to design and create preliminary construction plans within one semester. The project site is located on West Campus and the road design utilizes the existing drive connection west of Parking Lot F into the open field, looping back to the road north of Building 11. The project incorporates limited field surveying techniques, engineering design calculations, and drafting capabilities.



The class project is good in that it allows students to learn specific skills; however, I believe the critical thinking component of the design is lacking. Students have commented that they will start working a problem that has several components (which eventually leads to one final answer); but along the way, they forget the purpose of the original problem. Ultimately, this leads me to the idea that students aren't contemplating the "why" or "how" a road is designed - just that they know how to apply equations to complete a design. The "why" is usually a result of client requirements, environmental concerns and design standards set by governmental agencies with regard to public safety. The "how" is based on understanding the formulas for horizontal and vertical curves.

I would like to utilize a critical thinking design platform called Engineering Reasoning as developed by "The Critical Thinking Community" to improve each student's ability to develop and understand the components of a typical roadway project. In addition, I believe having the students complete an engineering reasoning plan for the design of a roadway will improve their critical thinking skills for other classes.

The plan would require them to address items such as:

- What is the purpose of the project?
- Does the work meet the design standards set for the project?
- Do the drawings communicate how the design needs to be constructed?
- Are the drawings completed per industry standards?

In order to improve the student's critical thinking skills, students will complete a discussion activity (which will be posted to Blackboard) on a specific design topic where they address the 8 Elements of Critical Thinking. Each of the topics covered will be a required part of the engineering reasoning plan for the design project.

Planned Project:

At the start of the semester, students will be provided a completed roadway design with an engineering reasoning plan that will include design calculations; thus, establishing the required components of the design project. As the semester progresses, the construction plan and design

calculations will be reviewed and reflected upon with respect to the material covered in class. As a final project, the students will be required to revise the initial plan based on "comments" that would mimic the real world context of outside criteria (client requests and governmental agency requests). In addition, the student will be required to develop an engineering reasoning plan in order to analyze the critical components of the design.

After discussion on the topic of engineering reasoning, the students in the Summer session 2014 of **Highway Drafting and Route Design** course were asked to define engineering reasoning and why it is important. The students' responses were:

- *"All engineering reasoning seeks to figure something out, to settle some questions and solve some engineering problems. Breaking down large questions into smaller questions, also determines if the question has one right answer, or requires reasoning from more than one point of view."*
- *"To establish an approach to solving problems with an emphasis on intellectual integrity."*
- *"The work of engineering has implications for helping or harming living creatures, and for improving or diminishing the quality of life on earth. Therefore, the highly skilled engineer's concerned with the ethical implications of engineering discoveries and inventions, and the potential of engineering for both good and ill."*
- *"To help develop critical thinking skills and effective reasoning of future engineers, thinking for yourself rather accepting viewpoints of others. To help future engineers focus on traits other than just memorization and calculations. "*
- *"The purpose of engineering reasoning is to equip engineers to develop the critical thinking skills required to effectively decipher design, permitting and construction of mechanisms that usually serve the public interest."*

Faculty Learning Outcome #2:

The FLO statement should be connected to the Needs Assessment and explain what the faculty member will do to improve student learning, as applicable. An effective FLO meets these criteria: clearly relates to the Needs Assessment; is specific, action-oriented, cognitively appropriate, and measurable/assessable; and meaning is clear to all disciplines.

FLO Statement: Implement active learning opportunities to improve students' abilities to formulate an engineering reasoning plan for designing a roadway.

Essential Competencies Addressed:

List the Essential Competencies and their indicator(s) that you plan to demonstrate in the FLO.

Inclusion and Diversity:

- Design and support learning experiences that address students' unique strengths and/or needs
- Use diverse perspectives to engage and deepen critical thinking

Life Map:

- Help students identify academic behaviors that can be adapted as life skills (e.g., library search skills, decision-making, communications skills, scientific understanding, etc.)
- Employ digital tools to aid student contact (e.g., Atlas, MyPortfolio, Blackboard, Ask-A-Librarian, email, etc.)

Outcomes Based Practice

- Help students understand their growth in the acquisition of student core competencies (Think, Value, Communicate & Act) and program learning outcomes.
- Collect evidence of progress toward student achievement of unit, course, or program learning outcomes

Conditions:

Identify how you will limit or narrow the scope of your FLO 2. Include information about the course, unit or lesson, and timeline for implementation.

The scope of this FLO will be limited/narrowed by using a single section of Highway Drafting and Route Design, and one unit within that course, developing an engineering reasoning plan for designing a roadway project. The FLO will be implemented in the Fall of 2015. The results from the treatment will be compiled by Spring 2015.

Products/Evidence of Learning:

What evidence of learning will you produce to demonstrate achievement in your FLO?

Examples: learning unit(s), rubric(s), lesson/unit plan(s), formative and summative assessment instruments, student-constructed work, surveys, classroom assessment techniques, course design(s), conference presentation(s), Valencia presentation(s), scholarly publication(s), professional certification(s), etc.

- I will provide a lesson plan for the development of creating an engineering reasoning plan by using a case study of an existing road way.
- I will create a rubric to assess the engineering reasoning plan.
- The students will be required on the final design project to develop an engineering reasoning plan, and I will use this as my summative assessment of the learning outcome.
- The final exam will require students to identify key components missing on a plan and profile construction drawing.

Note: As this is the first time using this treatment, I do not have samples of good/bad plans for the students to review. My goal is to have sample plans the next time this course is taught.

Faculty Learning Outcome & Implementation Plan #3:

Needs Assessment for Faculty Learning Outcome #3:

Needs are based on what the faculty member wants to learn to improve student learning. Where do you see a need to improve teaching and learning? Explain in general terms what you would like to investigate during your pre-tenure period that would improve your practice and student learning. This might include, but is not limited to, improving such things as specific teaching strategies, assessment tools, implementation of web-based or technology-related tools for students, discipline-specific knowledge, and/or obtaining degrees or certifications.

The Drafting and Design AS Program trains students to communicate engineering designs, specifications, and calculations into accurate working drawings by utilizing computer aided

drafting and design programs. One of the leading drafting applications used in industry today is AutoCAD developed by Autodesk.

In Introduction to CADD, Advanced CADD, Mechanical Drafting 1 and 2, and Electromechanical Drafting, the Autodesk application, AutoCAD is utilized in teaching the concepts of CADD (computer aided drafting and design). Students in the Civil/Surveying Engineering Technology AS Program use the Autodesk AutoCAD Civil 3D software in the SUR 1102C Basic Surveying, SUR2202C Highway Drafting and Route Design, and SUR 2460 Advanced Survey Computations courses for creating topographic surveys, roadway plan and profiles, and site plans. For the Building Construction Technology AS Program, the Autodesk Revit software is used in the TAR 2033 Architectural Design course to create architectural buildings.

The Autodesk programs are one of the leading drafting applications in multiple industry disciplines. I teach Introduction to CADD, Advanced CADD, and the previously mentioned Civil/Surveying courses that utilize the Autodesk software. By being a certified professional user, I will have greater knowledge of the application, thus improving my teaching methodologies in the courses. In addition, as a certified professional user I would know what material content the students would be required to know to become an Autodesk Certified Professional. This professional certification is an industry accepted credential.

Faculty Learning Outcome #3:

The FLO statement should be connected to the Needs Assessment and explain what the faculty member will do to improve student learning, as applicable. An effective FLO meets these criteria: clearly relates to the Needs Assessment; is specific, action-oriented, cognitively appropriate, and measurable/assessable; and meaning is clear to all disciplines.

FLO Statement: Complete the Autodesk Certified Professional course.

Essential Competencies Addressed:

List the Essential Competencies and their indicator(s) that you plan to demonstrate in the FLO.

Professional Commitment:

- Stay current in discipline/academic field (e.g., professional organizations, conferences, journals, reading in the discipline, field work or clinical experience, etc.)

- Contribute to discipline/academic field (e.g., publications, presentations at discipline-based conference, poster sessions, writing articles, editing learning material, curriculum development, field work, sharing clinical experience, contributing to textbooks, sharing research with peers, etc.)
- Engage in expanding and building institutional, programmatic and personal connections to the wider community (e.g., community involvement, service learning, civic engagement, board of [museums, hospital, etc.], partner K12 schools, student development leadership or activities, etc.).

Conditions:

Identify how you will limit or narrow the scope of your FLO 3. Include information about the course, unit or lesson, and timeline for implementation.

The scope of this FLO will be completed by successfully obtaining the Autodesk Certified Professional exam.

In addition, this FLO will include one unit within the Introduction to CADD course were I would develop an assessment that mirrors the practices used in the certification testing by Autodesk.

Products/Evidence of Learning:

What evidence of learning will you produce to demonstrate achievement in your FLO?

Examples: learning unit(s), rubric(s), lesson/unit plan(s), formative and summative assessment instruments, student-constructed work, surveys, classroom assessment techniques, course design(s), conference presentation(s), Valencia presentation(s), scholarly publication(s), professional certification(s), etc

- Autodesk Professional Certification
- Align learning with Autodesk certification requirements and standards.

Professional Development

Attach Professional Development Transcripts (seminars, courses completed, etc.)

Identifying your intended and completed development allows panel members to quickly review the completed work and to perhaps suggest other offerings that may assist you in your pre-tenure work.

Core Seminar Series (in sequence) **Identify which TLA recommended seminars you participated in or plan to participate in.** This section includes courses that provide an overview on the Essential Competencies and courses that will assist you in developing an ILP, constructing a portfolio, and implementing an action research project.				
Professional Development Activity	**Taken** *Place an **X** by the activities you have already completed*	**Date** *Record the date on which you completed each activity*	**Intended** *Place an **X** by the activities you intend to participate in during your pre-tenure work*	**FLO** *To which FLO, if any, does each professional development activity relate? (Place an **X** by all that apply)*
LCTS2224: Interactive Lecture (New Faculty Orientation)	**X**	**8/7/2013**	---	__FLO 1 __FLO 2 __FLO 3
PRFC2120: Launching into the TLA	**X**	**8/12/2013**	---	__FLO 1 __FLO 2 __FLO 3
LCTS2111: Cooperative Learning in the College Classroom	**X**	**9/27/2013**	---	_ **X** _FLO 1 _ **X** _FLO 2 __FLO 3
INDV215: Inclusion and Diversity	**X**	**11/8/2013**	---	__FLO 1 _ **X** _FLO 2 __FLO 3
ASSMT212:1 Assessment as a Tool for Learning	**X**	**10/24/2013**	---	_ **X** _FLO 1 __FLO 2 __FLO 3
PRFC2267: AMP Peer Review / Analysis of My Practice – Peer Review	**X**	**3/21/2014**	---	__FLO 1 __FLO 2 __FLO 3
LFMP2141: LifeMap	**X**	**1/30/2014**	---	__FLO 1 _ **X** _FLO 2 __FLO 3

PRFC 2161: From AMP to ILP - Creating an Individualized Learning Plan/Outcomes-based Practice	**X**	**6/13/2014**	---	__FLO 1 __FLO 2 __FLO 3
SOTL2171: Scholarship of Teaching & Learning	**X**	**9/5/2014**	**---**	_ **X** _FLO 1 __FLO 2 __FLO 3
SOTL2274: ARP Design and Data Collection	**X**	**4/3/2015**	**---**	_ **X** _FLO 1 __FLO 2 __FLO 3
PRFC2264: Understanding Professional Commitment	**X**	**4/4/2014**	**---**	__FLO 1 __FLO 2 _ **X** _FLO 3
SOTL3271: Principles of Good Practice	----	--/--/----	**X**	_ **X** _FLO 1 __FLO 2 __FLO 3
SOTL2272: Developing Effective Surveys	**X**	**3/20/2015**	**---**	_ **X** _FLO 1 __FLO 2 __FLO 3
PRFC 2263: Creating an Evidence-based Portfolio	----	--/--/----	**X**	_ **X** _FLO 1 _ **X** _FLO 2 _ **X** _FLO 3
SOTL2275: ARP Data Analysis and Presentation	----	--/--/----	**X**	__FLO 1 __FLO 2 __FLO 3
Elective Workshops to Inform Your FLO Projects **Identify which activities you participated in or intend to participate in.** This section includes additional courses designed to deepen one's understanding of the Essential Competencies. If you intend to complete additional "other" courses, please expand this worksheet.				
Professional Development Activity	**Taken** *Indicate which activities you have already completed.*	**Date** *Record the date on which you completed each activity.*	**Intended** *Indicate activities you intend to participate in during your pre-tenure work.*	**FLO** *To which FLO, if any, does each PD activity relate? (Check all that apply.)*
Assessment				
ASMT2122: Classroom Assessment Techniques	**X**	**9/9-10/7/2014**	---	_ **X** _FLO 1 __FLO 2 __FLO 3
Inclusion and Diversity				
INDV7310: Working with Conflict	----	--/--/----	---	__FLO 1 __FLO 2 __FLO 3

INDV7311: Creating a Safe Space for Dialog	**---**	--/--/----	---	__FLO 1 __FLO 2 __FLO 3
INDV7312: Mindfulness Tools for Educators	----	--/--/----	---	__FLO 1 __FLO 2 __FLO 3
INDV7313 and 7314: SEED I and SEED II	----	--/--/----	---	__FLO 1 __FLO 2 __FLO 3
INDV 2254: Art and Science of Learning and the Brain	**X**	**9/26/2014**	---	__FLO 1 _ **X** _FLO 2 __FLO 3
INDV7316: How We Treat Each Other	----	--/--/----	**---**	__FLO 1 __FLO 2 __FLO 3
INDV2225: Multiple Perspectives	----	--/--/----	**---**	__FLO 1 __FLO 2 __FLO 3
OTHER: INDV 1153	----	--/--/----	**X**	__FLO 1 _ **X** _FLO 2 __FLO 3
Learning-centered Teaching Practice				
LCTS2222: Case-based Teaching	----	--/--/----	---	__FLO 1 __FLO 2 __FLO 3
LCTS2223: Asking the Right Questions	----	--/--/----	**---**	__FLO 1 __FLO 2 __FLO 3
LCTS2225: Flipped Classroom	----	--/--/----	---	__FLO 1 __FLO 2 __FLO 3
LCTS2226: Write to Learn	**---**	--/--/----	---	__FLO 1 __FLO 2 __FLO 3
LCTS2214: Problem-based Learning	**X**	--/--/----	---	_ **X** _FLO 1 __FLO 2 __FLO 3
LCTS3160: 101 Ways to Demonstrate the Essential Competencies	**X**	--/--/----	---	_ **X** _FLO 1 _ **X** _FLO 2 _ **X** _FLO 3
LCTS 2218: Speaking Across the Disciplines	----	--/--/----	---	__FLO 1 __FLO 2 __FLO 3
LCTS2227: Cultivating a Growth Mindset	----	--/--/----	---	__FLO 1 __FLO 2 __FLO 3

OTHER: LCTS___3213__	**X**	**6/13/2014**	---	_ **X** _FLO 1 __FLO 2 __FLO 3

LifeMap				
LFMP 3348: CARE Strategies	----	--/--/----	---	__FLO 1 __FLO 2 __FLO 3
OTHER: LFMP__3347: Engaging Students through Mentorship	----	--/--/----	**X**	__FLO 1 _ **X** _FLO 2 __FLO 3
Outcomes-based Practice				
LOBP 2230: Core Competencies: Think, Value, Communicate, Act (TVCA)	**X**	**2/18/2015**	---	__FLO 1 _ **X** _FLO 2 __FLO 3
LOBP 3230: Thinking Things Through: Critical Thinking Theory and Practice	**X**	**9/30/2014**	---	__FLO 1 _ **X** _FLO 2 __FLO 3
OTHER: LOBP_____	----	--/--/----	---	__FLO 1 __FLO 2 __FLO 3
Professional Commitment				
PRFC 3365: Learning Partners	----	--/--/----	---	__FLO 1 __FLO 2 __FLO 3
OTHER: PRFC 3260	----	**10/10/2014**	---	__FLO 1 __FLO 2 _ **X** _FLO 3
Scholarship of Teaching and Learning				
SOTL 2273: IR and You: How IR Can Help Faculty Research	----	--/--/----	---	__FLO 1 __FLO 2 __FLO 3
OTHER: SOTL_____	----	--/--/----	---	__FLO 1 __FLO 2 __FLO 3

Describe any other professional development activities, such as graduate courses completed, conferences attended, books read, and/or journal articles read in the space provided below.

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