STEM Gateway Course Reform Team project information for STEM Gateway website.
Please complete this information and return as a Word file to Gary Smith (gsmith@unm.edu)

Course Name: College Algebra

Course prefix and number: Math 121

Course-reform team members (Name, title, institution; list team leader first and others alphabetically by last name):
Tamra Mason, Lecturer III and Pre-Calculus Director, UNM
Precious Andrew, PT Instructor, UNM
Deborah Casson, PT Instructor, UNM
Ivana Gorgievska, Lecturer II, UNM
Linda Martin, FT Instructor, CNM
Derek Martinez, Lecturer III and Coordinator of Math 121, UNM
Karen Sorensen-Unruh, Graduate Assistant, UNM

Student learning outcomes for the course:
Currently Being Revised

Short description of how course serves as a gateway to courses in your department and to other majors:
Math 121, College Algebra, is truly a gateway course. A student must pass the course, or place out of it, before entering any STEM program. It is the prerequisite for Biology, Chemistry, Physics, Trigonometry and Pre-Calculus. Between UNM and CNM approximately 5000 students enroll in College Algebra each year. Consistent with pass rates across the nation [1] the pass rate for this course has been below 60% at UNM for many years. Improving the learning and success of students in College Algebra would have a significant impact on the number and quality of students entering STEM programs.

Perceptions of reasons for low student achievement of passing grades, rigorous course outcomes, or both:
Possible reasons for low student achievement are that many students are not engaged in class or with the material taught in the class, and learning goals are unclear or not communicated for students and teachers. In addition, many students lack effective study skills and have not retained pre-requisite knowledge.

Course-reform plan (a description of the elements of the reformed course: *specific* curricular changes and/or pedagogical changes that will be designed and implemented with an explanation of how each change will address the perceived reasons for past low student achievement)

1. Enhance and improve the student learning outcomes, tie them to student work, and clearly communicate them to students.

   We hope to identify Key Concepts within the SLOs. Research indicates that students learn best when a few concepts are emphasized, and exploration throughout the course is seen to exemplify those concepts. We believe that we can identify Key Concepts within the SLOs that tie the entire course together into a cohesive exploration.

   Once the SLOs are clarified, they will provide guidance for teachers who are leading the class, and define for students what is expected for them to learn, and at what depth. The learning outcomes will be integrated into classroom discussion and activities, and also be tied to student work. Students will know what the goals of each assignment are, they will be able to see how their work compares to benchmarks for grading, and they will have more direction when they try to improve the quality of their work.

2. Develop students' ability to evaluate their own understanding.

   By developing clear and focused learning outcomes we will be better able to share the learning intentions of the class with students. Grading will be aligned with the SLOs. We will communicate our grading practices so that students can evaluate themselves using the same performance indicators that the teachers will use.

   We plan to create assignments, or other materials that help students monitor their own progress in understanding. These may include computer-based assignments as a way of giving students immediate feedback on their work, assignments that will incorporate questions such as "why this works", "what would happen if…", and "how is this concept like and unlike another", and assignments that will ask students to write their own questions pertaining to the skills and concepts they are learning.

   We expect these strategies, coupled with better engagement in class, will motivate students to improve their understanding when they recognize that they have deficiencies.

3. Engage students in the mathematics in ways that facilitate long term memory and transfer to other situations or contexts.

   We will explore strategies to "invert" the classroom. That is, students will learn some fundamental material before class. This will be material such as definitions and simple examples. We may require it with worksheets due when they come in, quizzes at the beginning of class, quizzes or worksheets due online before class. This will enable students to identify their own understanding (and lack there-of) before class discussion, helping them to be more engaged during the class discussion. This will also free teachers from the time traditionally spent lecturing on fundamental material, giving them time instead to

respond to students' misconceptions and to facilitate class activities that will promote deeper understanding of the material. Students will be actively engaged with their peers during these activities. Approaches to problem solving will be incorporated into activities.

Materials will be made available for teachers to help them structure these activities. The materials will be tied to the SLOs and have clear performance indicators to help them understand the expectations of students on the activities and strategies that they can use to help students meet those expectations.

4. Develop productive study skills

   We will strive to influence how students relate to mathematics outside of class. Teachers often tell their students to study and give them guidelines for the number of hours they should study. We will go further and give students specific and concrete information about how to study effectively. We will incorporate research-based study strategies [3]. As students study they should elaborate on the material by asking questions like "how is this concept related to others", and "how is this concept different from another". Also, if possible, students should try to make the information personal by relating it to their own personal experiences. Finally, after initial reading and practice, students should close their books and self test.

   We hope to develop and communicate expectations for students about study skills. These expectations will be woven throughout the class. They will include productive class participation and the specific study strategies mentioned above. The expectations will also include strategies for students who become discouraged if they do not understand the content immediately.

5. Utilize formative assessment techniques in the classroom to improve student learning.

   Our plans include the five key aspects of formative assessment [4]

   - Clarifying and sharing learning intentions. We accomplish this through clarified SLOs.
   - Engineering effective tasks that elicit evidence of learning. Engaging classroom activities achieve this.
   - Providing feedback that moves students forward. We accomplish this through the use of online quizzes or assignments at the beginning of class, and through teacher-student interaction during classroom activities.
   - Activating students as learning resources for one another. We accomplish this through group work during class when appropriate.
   - Activating students as owners of their own learning. We accomplish this through sharing of SLOs and performance indicators, and with strategies for study skills.

Learning/Achievement Gains Assessment (plan for how the team will assess the impact of reformed-course elements reformed course on student achievement, learning, student satisfaction with their learning and with the course)

We will assess whether we have met our objectives using three approaches:

- Statistical measures that will assess whether we have achieved our goals with regards to success (based on course grade) and retention rates in Math 121 and the follow-on courses. These statistical measures will give us information about objectives 1 and 2.
- Exams will be used in a couple of ways. Exams will reflect the SLOs and will be graded consistent with rubrics provided to students earlier in the course. Common exam problems will be used to assess whether students across sections have understanding of the key concepts in the SLOs. The pre-exams will assess fundamental knowledge, and whether students used the information from the pre-exam to improve for the exam. Exams will assess objectives 3 and 4.
- Surveys will be given to students and teachers. Student surveys will be used to assess their attitudes towards mathematics, their engagement in the class, and their evaluation of the effectiveness of assignments and grading. Teacher surveys will be used to see which resources they found most effective. Surveys will assess objective 3 and 5.

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The results from our assessment will be analyzed and discussed to identify improvements in our approach and materials.

Timeline: (An outline of when different course-reform elements and assessments will be implemented during the next year, including the roles of each team member in each implementation step)

Activity	Timeline	Responsible Party
Develop SLOs		
Review material and concepts in the course to refine SLOs for Content Chapter 2 Chapter 3 Chapter 4 Chapter 5 Chapter 6 Develop SLOs for Practice Set up Wiki for team	6/8 – 6/18	 Karen Derek Precious Linda, Tamra Debby Ivana Karen, Tamra

Complete student learning outcomes Assign Chapter/Section below	During June 18 meeting	Team
Develop assignments that "invert" the classroom including assignments that students complete before class, and class activities. These should be clearly tied to SLOs and to each other. Formative assessment ideas should be kept in mind. Quiz and Exam questions (3-4) should be written based on assignments and SLOs		
Chapter 2 Section 2.1 Section 2.4	6/18-6/25	 TBA TBA
Discuss and complete Chapter 2 resources	During June 25 meeting	Team
Chapter 3 Section 3.1 Section 3.2 Section 3.3 Section 3.5 Section 3.6 Develop expectations and resources for student study behavior and skills	6/25-7/2	 TBA TBA TBA TBA TBA Derek, Tamra
Discuss and complete Chapter 3 resources	During July 2 meeting	Team
Chapter 4 Section 4.1 Section 4.2 Section 4.3	7/2-7/9	 TBA TBA TBA
Discuss and complete Chapter 4 resources	During July 9 meeting	Team
Chapter 5 Section 5.1 Section 5.2 Section 5.3	7/9-7/16	 TBA TBA TBA
Discuss and complete Chapter 5 resources	During July 16 meeting	Team

Chapter 6 Section 6.1 Section 6.2 Section 6.3 Section 6.4 Section 6.5 Section 6.6 Section 6.7 Section 6.8	7/16-7/23	 TBA TBA TBA TBA TBA TBA TBA
Discuss and complete Chapter 6 resources	During July 23 meeting	Team