Leveraging AI to Enhance Mastery Learning and Cater to Diverse Learning Styles in Community Colleges

Sabbatical Proposal
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Project Description:

In today's rapidly evolving world, STEM education is undergoing significant transformations. As an educator at Oxnard College, I am committed to ensuring that our STEM courses remain innovative, relevant, and inclusive. In alignment with the district's goals for professional growth and student success, I am proposing a sabbatical to explore new approaches to STEM education through AI, mastery grading methods, and inquiry-based learning.

AI is not intended to replace educators but to support them by personalizing instruction and feedback, enabling instructors to dedicate more time to one-on-one interactions with students. By automating routine tasks, providing tailored learning pathways, and detecting academic dishonesty, AI empowers teachers to engage with students more deeply, fostering accountability and integrity in learning. The second part of this study will focus on how understanding students' diverse needs can help build a more inclusive classroom that embraces different learning styles.

This initiative aims to cultivate essential skills such as accountability, collaboration, critical thinking, and lifelong learning, equipping students to succeed academically and thrive in a tech-driven world.

My ultimate goal is to develop an AI app or integrate available tools to track student mastery. At this stage, I am considering platforms like ChatGPT, Google Gemini, or Khanmigo. However, since AI tools are still in the early stages of development, I will reassess the available options at the start of my sabbatical to ensure the use of the most advanced and relevant tools.

Your Background:

I have been teaching full-time at Oxnard College since 2012. In the summer of 2023, I completed a Machine Learning course on Coursera, taught by a Stanford professor. In the summer of 2024, I studied American and World History using ChatGPT as my study and discussion partner. My approach involved reading the chapters independently, then engaging in back-and-forth discussions with ChatGPT to verify my understanding of the material. Khanmigo is currently developing a similar feature for math using ChatGPT, and I anticipate that more applications will be available by the time of my sabbatical.

I also have experience developing open educational resources (OER) for public use. The six template courses I created on MyOpenMath are freely available to everyone and have been utilized by hundreds of faculty members and thousands of students within and beyond the district.

Project Objectives:

The main goal of this sabbatical is to redesign and enhance our courses by using AI tools like ChatGPT, Google Gemini and Khanmigo to support individualized teaching and feedback. This will allow for more personalized student interactions and better support diverse learning needs. The sabbatical will also focus on introducing alternative mastery-based grading methods that emphasize learning, critical thinking, and integrity, using AI to detect academic dishonesty. This approach aims to build essential skills like problem-solving, communication, and collaboration while creating a more inclusive and engaging learning environment that prepares students for STEM careers in a tech-driven world.

AI offers new opportunities to improve STEM education by personalizing learning, providing real-time feedback, and promoting academic honesty. During my sabbatical, I will explore and create AI-driven tools like ChatGPT, Google Gemini and Khanmigo can be used in STEM courses to adapt lessons to individual students' needs. These tools will give students immediate feedback, helping them better understand complex subjects like statics with real world applications and calculus with physics and engineering applications. By incorporating open-ended questions and using AI-powered questioning models that adjust to student needs, I will create a classroom environment that promotes exploration, innovation, and reflective thinking. I will also develop AI-based tools that add randomization to

quizzes and exams, preventing students from using AI during tests and ensuring the integrity of assessments.

A deeper understanding of student psychology is important for creating inclusive teaching methods that address the needs of all learners. During the sabbatical, I will study educational psychology and cognitive science to learn more about student motivation, behavior, and learning preferences. This knowledge will help me design a learner-center and mastery-learning AI app/tool and redesign our courses to be more inclusive, ensuring that teaching methods support every student in reaching their full potential.

Project Methodology:

1. Research and AI Tool Development

I will conduct thorough research on AI applications in education, with a focus on personalizing learning and maintaining academic integrity. I will create and refine tools using ChatGPT, Google Gemini and Khanmigo, which will be integrated into STEM courses. These tools will offer real-time feedback, detect academic dishonesty, and introduce random changes in quizzes and exams to uphold assessment integrity.

2. Curriculum Redesign

I will redesign STEM courses to include AI-driven tools, inquiry-based questioning strategies, and alternative grading methods. These updates will focus on learning, critical thinking, and engagement. The revised courses will be tested to evaluate their effectiveness in improving student outcomes, particularly in areas like problem-solving, collaboration, and communication.

3. Professional Development

I will participate in professional development activities such as online courses, workshops and seminars on educational psychology and AI-driven teaching strategies. These experiences will help me engage with students more effectively, create inclusive learning environments, and lead dynamic classroom discussions.

4. Pilot Implementation

In Spring following my sabbatical, the reimagined STEM courses will be implemented in a classroom setting, with AI tools assisting in grading, providing personalized feedback, and supporting inquiry-based activities. Information on

student engagement, critical thinking, and learning outcomes will be collected and analyzed to assess the effectiveness of these AI-based teaching methods.

Product of the Sabbatical:
The final products will include a paper report and the development of an AI tool for online OER questions within MyOpenMath. The tool will be pilot in my own courses and share with faculty within and outside of college.

How You Plan to Share Your Sabbatical Results:
I plan to share the results of my sabbatical at Oxnard College and more broadly through academic presentations and release any online tools I developed on MyOpenMath.

Work Plan and Schedule:
The proposed sabbatical will take place over one semester. The timeline is as follows:

Month 1-2: Conduct extensive research on AI applications in education and design my own AI tool, focusing on personalized learning, assessment integrity, and alternative grading methods.
Month 3-4: Redesign and revise courses, incorporating my AI-driven tool, inquiry-based questioning strategies, and mastery grading methods. Develop new teaching materials and design AI tools for random quiz changes to ensure academic integrity.

Value of Project:
To the Faculty Member:

- Gain expertise in using AI-driven educational tools that support personalized teaching and offer real-time feedback.
- Improve teaching by learning more about student psychology and leading to more effective classroom interactions.

To the Students:

- Receive personalized learning tailored to their individual needs and learning styles, with AI tools providing real-time feedback and encouraging deeper engagement with complex STEM concepts.

- Benefit from alternative mastery-based grading practices focused on growth, critical thinking, and collaboration, promoting academic integrity through AI-enabled detection of dishonesty.

To the District:

- Position the district as a leader in innovative and inclusive STEM education by integrating AI technologies and modern teaching practices that prioritize individualized learning and integrity.
- Improve student retention and success by creating more engaging, inclusive, and supportive learning environments that address the diverse needs of community college students.