

## TEACHING STATEMENT

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Teaching mathematics and doing mathematics are some of the most rewarding endeavors of my lifetime. What I have learned after years of doing both is just how intimately connected these activities are. From a freshman student in an introductory math course to the most cutting edge researcher, when one engages a math problem, the fundamental task is the same: given some information or knowledge, what other knowledge or conclusions may we draw as a result? If one is to be successful, then one must be ready to approach the problem from many different angles, to struggle with strategies that do not pan out, to revisit problems that one has worked on in the past, and finally when the underlying concepts are illuminated and the solution is revealed, to integrate this knowledge as a part of ourselves. I was fortunate to have the mentorship of an excellent professor as an undergraduate, who modeled for me how to be a mathematician and how to take charge of my own learning. This not only inspired me to become a professor myself, but helped me establish the central tenets of my teaching philosophy: To create a supportive, welcoming environment where students take ownership of their learning. To this end, I create meaningful educational experiences, encourage student agency, assess students in a way that encourages growth, eliminate barriers to access for students, and extend this love for math out of the classroom and into the community.

One way of creating student centered experiences in my courses is through the implementation of High Impact Practices (HIPs), which deviate from the classical lecture-testing model of education and demands deep student involvement [8, 17]. In 2018, I was selected at Montana State University-Billings (MSUB) to be part of an inaugural cohort of faculty to implement HIPs in our courses. I specifically chose my Introductory Statistics course: this is a course that students tend to view as a hoop to jump through, and I wanted them to take ownership of the course and see its relevance. I designed a project where over the course of the semester, students in groups (divided by discipline) would gather or acquire data, and pose some hypothesis testing and regression questions. They would then use the statistics language R to run the analysis and generate visualizations. In lieu of a final exam, students presented their findings to the class. The feedback from this change was overwhelmingly positive with students saying: “I love that [the course] allowed us to apply what we learned to our fields of study. It makes what we learn feel all the more worth it.” The success of this implementation led to my selection as a member of the first cohort of Montana University System-Regents Teaching Scholars, where I was tasked to lead a cohort of Faculty at MSUB to implement HIPs in General Education courses. This cohort brainstormed and developed ways to introduce experiential learning into their own first year courses. I was also selected to be on the Teaching & Learning Center Taskforce, charged with brainstorming an implementation of a Teaching & Learning (T&L) Center on this campus. Based on our recommendation, a Teaching & Learning Center will be formed at MSUB in Fall 2021.

Another way I center students in my teaching is through the implementation of Active and Inquiry learning experiences, which have both shown to increase student engagement and retention of knowledge [6, 18]. I have adopted the Active Calculus text for my Calculus course, which guides students to discover the principles of Calculus themselves through a series of carefully designed activities. In my Introductory and Calculus based statistics courses, we have regular R labs where students play with data or simulations to get a hands-on feel for the principles of probability and statistics. These activities move students beyond rote memorization and computation and gives a scaffolded hands-on way to engage with the concepts and theories underlying these subjects. In the fall of 2019, I taught a Modern Geometry course via lectures that did not go well. Students seemed unmotivated to engage with the axiomatic reasoning structure of the course, and upon reflection, I believe this was because they saw themselves as passive recipients of obvious “facts”. So in the summer of 2020, I implemented an Inquiry Based Learning (IBL) online Modern Geometry course, where students used the discussion board in our Learning Management System to build out a theory of Geometry. This ensured that not only were students engaged, but truly responsible for their own knowledge creation [9, 10, 12]. Moreover in teaching Geometry this way, students were forced to confront the need for rigorous proof, and saw the necessity of this methodology. I noticed a much greater willingness to engage in the content than I saw previously. I also observed that allowing asynchronous class conversations which were untethered to class time allowed for deep ongoing engagement by students. I wrote a paper on this topic which has been accepted for publication by PRIMUS [1]. Outside of the classroom, I have mentored several undergraduate research projects, and am a recipient of the Center for Undergraduate

Research in Mathematics grant, funded by the NSF, which funded a team of 3 undergraduate scholars in the 20-21 school year. They were able to prove several deep results about the topic of my research area, and presented their findings in a national online seminar in spring 2021. In all of these, the creative and collaborative nature of this style of learning is emphasized, which provides a deeper richer experience for students, in particular, under-served students [11, 13].

Part of encouraging student ownership of learning is acknowledging the individual pace at which students learn the material. I currently teach at a state institution which serves many working, first generation and rural students, and so timing and pacing can often be a challenge for them. As an instructor, it is ultimately my responsibility to help students learn the content by the time the course ends, not necessarily by some arbitrary deadline within the semester. To this end I have begun implementing Mastery Based Grading (MBG) into my courses, and I have attended a workshop on MBG in the Summer of 2020 to learn more about it's implementation. MBG focuses on students having demonstrated specific mastery in key standards of the course, and allows for reassessment on these topics. This not only makes the grading less opaque for students, but also incentives students to re-learn and re-study material in order to master it. This reduces anxiety in students, encourages higher performance, and in courses where content is cumulative, allows students to master pre-requisite material which leads to better understanding of content built on that [7, 14]. A pre-service teacher in my Calc 2 class said "This is a great example and something that I can use in my classroom because learning is a process and although one day you might not get the score you wanted for some unseen circumstance, there is that option to retry and prove that you are learning."

Access, Inclusion and Equity are cornerstones of my teaching. The pedagogical techniques I've implemented have been a tide which lifts all boats and ameliorates historic performance differences among under-served groups [4, 5, 11, 13, 15]. However, some of the barriers to learning are not merely pedagogical. MSUB serves students which typically have very limited financial means, which can make acquiring course materials difficult. Furthermore, many opt for online courses, as work schedules make face to face learning a challenge. I have received several TRAILS Open Educational Resources (OER) grants to implement OER material for my courses, having done so for seven different courses that I've taught. Having noticed a lack of good OER materials for Finite Mathematics courses, I received a TRAILS grant to develop such a text using the PreTeXt language. This is a language which generates free online texts in html, which can then support videos, animations and interactive elements. I have also developed a IBL resource for Introductory Statistics in PreTeXt, along with a companion exercise bank for the CheckIt platform. CheckIt is a platform for automatically generating large exercise banks for assesment and reassesment for MBG. I was selected to be an inagural fellow as a part of an NSF funded initiative tasked with developing Team IBL materials in PreTeXt and excercises in CheckIt. Students who are in my OER classes are able to participate right away regardless of financial circumstances which has improved performance and retention. This is consistent with the literature [2, 3, 16]. I estimate I have saved MSUB students over \$10,000 over the last 2 years. To enhance our online offerings for students who cannot attend face to face classes, I have developed several online Mathematics courses. I was also selected as the College of Liberal Arts & Social Sciences e-Learning Fellow to support my colleagues in their online teaching, and have organized multiple workshops, roundtables and talks to support this.

As a Mathematician, I believe it is my responsible to serve the learning of Mathematics, whether or not it's within my classes. I am in the 4th year as the founder and director of the MSU-Billings Math Circle, with support from the Mathematical Association of America Dolciani Foundation, and the National Association of Math Circles. We engage 4th through 8th grade students in fun collaborative games and activities which bring out the creative collaborative side of Mathematics. The Math Circle also provides opportunities for our students to interact with and serve the Billings, MT community. The Math Circle, and the Math Club which I advise have participated in assorted STEM outreach activities, including the Atomic Circus, Girls-n-Science, and STEAM-Fest, all of whom encourage the participation of children in STEM and STEAM activities.

I am still a junior faculty member and early in my career, so it is imperative to be open minded and recognize there is still a lot for me to learn about improving my teaching. It is therefore a critical part of my own going development to be a part of learning communities where we can improve our teaching and share ideas. In addition to the MUS-Regent Teaching Fellowship, e-Learning Fellowship, TBIL Fellowship, T&L Taskforce and HIPs Cohort, I am a PNW Section NExT fellow, an organization dedicated to supporting the three pillars of academic work for mathematicians. My participation in the MBG community has led me to be part of a team of mathematics educators studying the effects of MBG on student anxiety during the COVID epidemic. I hope to soon in the future attend an IBL workshop to better improve my understanding and implementation of Inquiry Leaning. I am proud of my teaching and what I've accomplished, but this does not diminish my desire or responsibility to learn more, to do more, and to provide the best, most impactful, equitable teaching to my students.

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“Its hard to imagine any resource that could help that WASN’T given me over the course of this class. The teacher did his best to help his students to succeed, and the discussion-format certainly does much to get back the back-and-forth of a mathematical proofs-based class room.” -Discrete Mathematics Student

“Definitely one of the most challenging classes I had to take. I came from a different department and had a lot of trouble understanding the content, Dr. Chih helped me and he was always available. He used software that is also used in the business world which made the class seem like a grad school type of class. He also provided us with games and examples and helped us with our simulations.” - Probability & Statistics Student

“Everything, you did such a great job teaching this class. When everything got moved online you got WebEx set up so that we were still able to learn at home in this difficult time. You never doubted us and you kept us positive throughout the semester. You were always willing to answer our questions and never held back. You taught me so much this semester and you did an amazing job teaching this class with everything that went on throughout this semester.” Probability & Statistics Student

“I have had Dr. Chih for two years now and love having him as a professor and advisor. He is one of my favorite professors in terms of both care for students and how entertaining and capturing his lectures are. I think Dr. Chih truly cares for all of his students and hopes that they all succeed every day in his class and other classes. I wish the best for Dr. Chih in his future years here!” - Probability & Statistics Student

“Dr. Tien Chih is one of the best math professors I have had since I have been at MSUB. He did a great job at presenting the material, working with students to ensure we understood the material, and took the time to teach how to solve any problem based on a concept, not just how to solve a single problem. The structure of the class was very clear and I felt comfortable asking Dr. Chih for help. I definitely loved the free textbook and the cheaper homework portal. I know I learned more this semester from this one class than I have in all of my other math classes put together.” - Calculus 2 Student

“I enjoyed the Professor’s desire to teach us the concepts and not just relay information to us. He truly wanted us to succeed and learn Calc II.” - Calculus 2 Student

“I have recommended him to many of my fellow schoolmates that are looking to take this class. I am the only one that is in my group for a final project and really takes the time to make sure I am doing well. He is a true poster teacher for if you put in the effort, you will succeed. He truly shows that if you care and put in some time to the class that is needed then you will get the grade you deserve.” - Introductory Statistics Student

“Professor Tien is one of the best professors I’ve had at MSUB. He was always willing to help me understand the concepts, ask me questions to enhance my learning, and make himself available to assist with the final project. He made stats 216 a very manageable course.” - Introductory Statistics Student

“Dr. Chih went above and beyond to ensure understanding of course materials. He was also flexible with assignments and communicated clearly with students. He is a credit to MSUB.” - Finite Mathematics Student

“Really enjoyed having Tien Chih as an instructor. He is very engaging in his approach and makes sure to still have some fun in his classes. This class was hard to say the least, but Chih was always available for extra help when we needed it. Love how enthusiastic and passionate he is about math and it creates a positive environment for students!” - Real Analysis Student

“Tien’s ability to maintain the student-centered nature of the class throughout the whole class period was impressive. Tien is an experienced instructor with a passion for teaching and helping student learning” - Dr. Don Wilathgamuwa, Associate Professor of Mathematics

“Tien displayed an inviting, gentle, and evenly paced teaching style, which actively solicited student participation. The atmosphere was respectful, focused, and students seemed entirely comfortable asking questions” - Dr. John Hoover Professor of Mathematics

“...Tien’s passion for mathematics is infectious, you can see it in the engagement level of his students. Tien’s class is very innovative and seeing the level of excellence he brings to his job makes me proud to be his colleague here at MSUB. ” -Dr. Matthew Queen Associate Professor of Chemistry

“The teaching techniques you used eliminated the polarization typically dividing a class into the smart student versus not so smart. You create an environment that invites all students to participate.” - Ms. Reno Charette Director of Native American Achievement Center