Adding Explicit Ignatian Pedagogy to a *Women in Mathematics* Course

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The course and goals

My goals for this project were three-fold: infuse Ignatian pedagogy into a mathematics course, be explicit when the course has incorporated or addressed tenants of the Jesuit mission (thus increasing students' awareness of them) and encourage solidarity and service to underserved communities within the STEAM fields.

Math 125, Women in Math, is a mathematical survey course that meets Xavier's core Mathematical Perspectives requirement. The course introduces students to historical female mathematicians and explores topics in mathematics that influenced and were influenced by their work. The course is rooted in the Ignatian principles of *Solidarity* and *Service Rooted in Justice* by highlighting the lived experiences and mathematical contributions made by underserved members of STEM community. The only prerequisite knowledge for the course is basic arithmetic and algebraic skills, so the course has a secondary goal of showcasing mathematics as an exciting and varied field of study.

This spring, Math 125 was offered to our APEX students in an accelerated- fully online format. The student audience and their unique needs were kept in mind while adjusting the course and adding in the core tenants of the Ignatian pedagogical process: **context, experience, reflection, action, and evaluation**.

Changes were made to the existing structure and course assignments with Ignatian pedagogy in mind. I changed the overall structure and course flow, added weekly discussions and reflection assignments, and adjusted a final culminating presentation project. I, then, surveyed the students at the end of the course to get their feedback on the specific course changes that were made and whether it enhanced their learning and understanding of Xavier's Jesuit principles.

Course structure changes

In the spirit of Cura personalis, the delivery of the course **content** was changed to consider, "the ways in which family, friends, peers… effect the learner" (Kolvenbach, 2005). To better meet the unique needs of the APEX students, I developed weekly Modules that each had the same general set up and students worked through the modules in order and at their own pace. Group work/projects were broken down to allow individuals to collaborate over larger spans of time without hurting the integrity of the assignment. To improve learning and introduce students to the mathematical concepts covered in each module; short course lecture videos and accompanying guided notes were created. Pop-up questions and end of video quizzes were added to all lecture videos to increase material interaction and provide more opportunities for **self-evaluation**. Students were given more opportunities to **experience** the mathematical content through ungraded practice and small-group content discussions. The content discussions had the added benefit of helping to foster a greater sense of community among the members of the course as they struggled through more difficult mathematical content together.

Weekly Discussions

Ignatian pedagogy calls on teachers to "create conditions whereby learners gather and recollect the materials of their own **experience** in order to…understand…in terms of facts, feelings, values, insights, and intuitions they bring to the subject matter at hand" (Kolvenbach, 2005). At the start of each week's module students in Women in Math were assigned a discussion question that asked them to reflect on

their previous mathematical experiences in a way that connected their prior knowledge/understanding to the stories of the female mathematicians or to the specific mathematics introduced in the current module. Below is the discussion prompt from week 1 of the course:

> *We will be reading and learning about the mathematical journeys of several female mathematicians. Comparing our journey to theirs will occur naturally and is part of the human experience. To this end, a good place to start our discovery of mathematical perspectives is through Xavier's Jesuit Principles of Experience and Reflection. You will take a moment to consider what your own experiences will bring to this class by writing several paragraphs about your personal mathematical journey.*
>
> *Some things to consider in your writing:*
>
> - *How do you feel about mathematics overall (it is ok to admit you don't like math, I promise I will not take offense!!)?*
> - *Did you have any moments in your schooling or outside experiences that shaped how you feel or felt about mathematics?*
> - *Have you ever experienced bias, favoritism, or any other negative/positive experiences where math was concerned (again this is very broad and will vary per person)?*
> - *What is your favorite math topic? Least favorite? and why? (You can be very specific here, or broad.... your choice.*
>
> *As you respond to your classmates' posts, consider what their journey is teaching you and how it compares/contrasts to your own- I will have write more about this at the end of this week's modules in the module 1 reflection assignment.*

Each discussion question addressed directly different Xavier gifts, but all had an element of relating prior student experience to upcoming learning.

Weekly Student Reflections:

At the end of each module students were assigned a three-question **reflection** assignment. Each reflection assignment consisted of a question about the life experiences of the female mathematicians from the week's readings, a direct question about the mathematics learned in the module, and/or a primer question about the mathematics that were going to be addressed during the next module. Some weekly reflection questions called back to the week's initial discussion topic and required learners to discern how their viewpoints had changed as the content was introduced throughout the week. These weekly reflections meet the Ignatian Pedagogical call to have students give, "thoughtful reconsideration of some subject matter, experience, idea, purpose or spontaneous reaction, in order to grasp its significance more fully" (Korth, n.d.). The final student reflection included a call to **action** that had students develop a plan to move forward with their learning and to develop a "best possible course of action" based on what they had learned both mathematically and concerning the lived experiences of minorities in STEM fields (Korth, n.d.).

Final presentation project:

In concert with the ideas of **Action** and **Evaluation**, I tasked students with identifying and researching the life and mathematics of a female mathematician not discussed in the course. This could be a female who was currently alive, or even someone they knew that they could interview. Students then created a short presentation on the female telling their mathematical journey, summarizing their contributions to the world of mathematics (or what type of mathematics they utilize in their daily work), and then comparing/contrasting their experiences with the female mathematicians disused in the course. Students watched each other's presentations and had a dialogue on what they learned from each other and throughout the course.

Student feedback:

Overall students responded well to the changes and were able to see the connections between the parts of the course and the Jesuit principles. In a post-course survey students commented:

"I had never known much about Xavier's values, having them connected to the assignments and readings really helped me to learn more".

"Some of the values really line up with my personal values and I found that learning about what some of the women faced gave me a better appreciation of our current society".

"The discussion and reflection questions really allowed me to think about what I feel about certain topics we had but I kind of felt not so sure what to put down at times. I'm not sure if I was overthinking things or putting thoughts onto a screen as opposed to talking about them challenged me more. I enjoyed them and they definitely made me reflect."

"Project one I learned about even more women in mathematics that I have never even heard about before in my research. It really amazed me how little women get their due in their accomplishments in mathematics. Project two was fun because I was able to see my wife in a different light. I know she is amazing and brilliant but seeing how much she has in common with these amazing women put me in awe. My wife love puzzles, rubics cubes, and all kids of games that need to be solved. Interviewing her was super cool but this courses lessons really educated me about her even more".

"I especially enjoyed the discussions that focused on our personal experiences. In other online classes, I have not experienced the lively interaction that we enjoyed. It was a pleasure hearing so many interesting ideas from my classmates. I looked forward to reading new posts when they appeared."

Conclusion

Overall, I am happy with the changes made to the course and outcomes they garnered from my students. I think that, with any class, things will continue to be updated and improved as future sections of the course run. The IMP program really helped to increase my understanding of the five aspects of Ignatian pedagogy, which I have come to believe that all teachers should incorporate into their courses. I hope to continue to enhance my courses with the Ignatian principles in mind and to explicitly highlight their inclusion for my students.

Resources:

Kolvenbach, P. H. (2005, September). *Jesuit Education and Ignatian Pedagogy*. Jesuit Resource.org. https://www.xavier.edu/jesuitresource/resources-by-theme/documents/jesuit-education.pdf

Korath, S. (n.d.). *Ignatian Pedagogy: A Practical Approach*. Jesuit Resource. Org. https://www.xavier.edu/mission-identity/programs/documents/Korth-PrecisofIgnatianPedagogy.pdf

Schoenstedt, S. (n.d.). *Five Elements to Enhance Student Learning through Ignatian Pedagogy* [slideshow]. Jesuit Resource.org. https://www.xavier.edu/mission-identity/conway-institute/documents/IgnatianPedagogy.pdf

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