Using Wikis to Support Student Inquiry in Large Math Classes

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Abstract: This article explores the use of wikis to support student inquiry in large classes. The traditional tools of inquiry-based learning, such as group work and in-class presentations, are described and their applicability to large classes is assessed. Online learning management systems, and Wikis in particular, can help to address issues of scale and meet instructor needs. Wikis offer a unique collaborative space for writing, and this article surveys the uses and benefits of wikis. In particular, issues of anonymity, stereotype threat, and inclusivity are addressed. These observations were made while using MediaWiki to support student inquiry in a multivariable calculus course.

1. Introduction: Wikis and IBL

1.1. Inquiry Based Learning

There are a variety of different practices which constitute inquiry based learning. Consider, for example, the following definition given by Maass and Dorier:

> Inquiry-based mathematics education (IBME) refers to a student-centered paradigm of teaching mathematics and science, in which students are invited to work in ways similar to how mathematicians and scientists work. This means they have to observe phenomena, ask questions, look for mathematical and scientific ways of how to answer these questions (...), interpret and evaluate their solutions, and communicate and discuss their solutions effectively. [8, p. 300]

Such a broad definition allows for a range of implementations. IBL is a student-centered pedagogy that emphasizes the importance of students' engagement with mathematical practice and their ability to communicate their findings. The intent is for students to engage in ways which model or simulate the mathematical practices of experts. Education researchers have tried to distill this in to a practicable framework for classroom pedagogy. Laursen and Rasmussen [27] identified four fundamental principles underlying much of the work on inquiry based mathematics education:

1) Student engagement in meaningful mathematics
2) Student collaboration for sensemaking
3) Instructor inquiry into student thinking
4) Equitable instructional practice to include all in rigorous mathematical learning and mathematical identity-building

These fundamental principles overlap and are mutually supportive. The list of properties which characterize IBL has been alternatively narrowed and expanded by different educators. There is a wide range of what instructors feel constitutes inquiry based learning, as shown by a survey of teachers in twelve European countries [9]. For example, three leading practitioners of IBL [12] have identified two core principles:

1) Students work on rich mathematical tasks
2) Students work collaboratively to create their own mathematical understanding

Although this formulation of inquiry based learning is very broad, it has been proven to be effective even at large scales. The effectiveness of IBL has been studied across four universities in the United States, spanning over a hundred course sections, and has been shown to improve student learning outcomes, especially for women and other marginalized in mathematics [26]. We will emphasize the collaborative aspect of inquiry based learning. We view it as a student-centered pedagogy which encourages the growth and development of a learning community, through collaboration and sharing of information.

1.2. Wikis

Wikis are interactive websites which facilitate the process of collaborative writing and knowledge sharing. Users log on to a wiki, access various pages, and perform edits. A database manages the edits, keeps track of a history of revisions and edits, and stores additional data related to the textual content such as images or videos. Ward Cunningham, the creator of the first wiki, noted that a wiki is "the simplest online database that could possibly work" [29, p. 15]. The first wiki, The WikiWikiWeb Project, was put online as a central location for storing information about the Portland Patterns Repository, a project dedicated to collecting high-level patterns used in computer programming. For more information about the early history of wikis, see [7].

As software, wikis are pedagogically neutral. They are not necessarily used for teaching and learning. Despite being pedagogically neutral, wikis have many applications in higher education.