

JUST IN TIME MATHEMATICS REVIEW FOR ACCOUNTING STUDENTS

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ABSTRACT

This paper describes the Just-in-Time Review developed for an undergraduate accounting course. The review materials cover five topics in algebra. Students take an online assessment, and online materials are made available to help students catch up in those areas where some review is recommended. This paper is a case study of the development and implementation of the Just-in-Time Review for an accounting course at Saint Louis University.

KEYWORDS

review, algebra, accounting

Students taking an introduction to accounting course at the university level often struggle with their mathematics knowledge and skills developed in prior courses. Students need to be familiar with concepts from algebra including, but not limited to equations of lines, percentages, fractions, factoring, and solving word problems to be successful in accounting courses.

Spending a lot of time on mathematics review in an accounting class is not a desirable solution for possible information gaps or problems with recollection. The concept of just-in-time learning was initially borrowed from industry. In education, just-in-time learning suggests that learning is tailored to the individual student, provides easy access, and is directly related to the tasks at hand (see, for instance, Riel (1998) and Irvine (2015)). We have chosen to refer to the process we employed as a just-in-time review because it better describes the purpose of the project. The just-in-time review is a teaching technique used to provide materials to the students as they need them. In the case of an introductory accounting course, the students are provided with a quick assessment of mathematics outcomes needed for the course and resources that help them review materials where they need them.

The mathematics review for accounting students was one of several projects supported by the National Consortium for Synergistic Undergraduate Mathematics via Multi-institutional Interdisciplinary Teaching Partnership (SUMMIT-P) project at Saint Louis University. The goal of the just-in-time review project was to create resources for students that would help them review mathematics concepts and skills where necessary. The skills assessment that was developed, as well as the Google site that was set up to distribute the review materials, could easily be adapted by other institutions. The system is easy to use for both faculty and students. This paper will provide a brief overview of the project at Saint Louis University, the process used to foster collaborations between the mathematics and business faculty, and include a description of the development and implementation of the just-in-time mathematics review.

Mathematics and Business School Collaborations

“You said that we are looking at 43%, but you wrote down 0.43. How did you get that number? I don’t understand how and why you went from 43% to 0.43.” – A student

The SUMMIT-P project at Saint Louis University is a collaboration between the Department of Mathematics and Statistics and the Chaifetz School of Business. Monthly meetings were held by a group known as the Mathematics-Business Committee during which the progress on individual projects taking place through SUMMIT-P was discussed. The meetings allowed mathematics and business faculty to interact and exchange ideas regularly.

A repeated theme in the discussions was the fact that some students in business had weaknesses in their mathematical backgrounds that the business faculty did not have time to address during class. Mathematics at the college algebra level is used extensively in accounting (McCarron & Burstein, 2017; Mkhize, 2019). However, students come into accounting classes with a broad range of mathematics backgrounds and abilities.

Some students have completed mathematics classes recently, while for other students there may be a significant gap in time between the last mathematics class completed and the current accounting class. Not remembering the fine details regarding mathematical notation and computations is a common and well-recognized phenomenon. It can be a real problem for the student who is expected to use the notation and be able to perform computations.

Spending time on mathematics review in a business class sub-optimizes the time available to focus on the primary course content, so ways to provide the necessary review and supporting materials that students could complete independently as needed were explored.

The faculty decided that a skills test and an opportunity for remediation at the beginning of the semester was the most effective way to address the issue. The accounting instructor did an inventory of mathematics topics that are used in the course. The mathematics topics were linked to the business concepts in the course to show students how the two are related and motivate the need for these mathematics skills in an accounting class.

To make a sustainable adjustment to a business course that would be implemented by multiple instructors, the Mathematics-Business Committee agreed that the intervention had to be done with minimal ongoing work from the business faculty and no fees for the students. The committee decided to use WeBWorK as the online platform to deliver the skills test (Bart & Pike, 2017). WeBWorK is a free, open source, homework system used by the Department of Mathematics and Statistics for other courses thereby increasing the likelihood of student familiarity with the tool. It has an extensive problem library that contained existing problems for the selected skills. The accounting professor selected the problems for the skills test from the problem library. The test is divided into five topics (see further detail below) so that students receive detailed feedback and can target their review only to relevant areas where a specific skills gap has been identified. To facilitate easy review for students, the mathematics faculty created a website using Google sites that allowed students to navigate to any of the five topics for which they need to refresh their understanding. Free online videos and problem sets from Khan Academy were selected by the accounting faculty, reviewed by the mathematics faculty, and then made available through the website.

The initial plan had been to provide the skills test and allow students to retake the test after reviewing the topics on which they needed a refresher. After a trial run, it was decided that having the test with feedback from the students and the website was sufficient for providing the just-in-time review. Retesting and documenting student progress was considered, but it increased the duration of the intervention to a point that sometimes exceeded the timing in the course where the mathematics skills were most applicable. In addition, it was agreed that the likelihood of long-term sustainability of the initiative is increased if it is a process that is as simple as possible, not intrusive to the students, and easy for faculty to administer.

Identifying Mathematical Topics used in Accounting

The topics for review were determined by the faculty teaching the accounting course. The topics are not intended to be challenging, but students often need to be reminded of how to perform fundamental computations. The skills test is truly meant as a review and not as an opportunity to teach students mathematics they may not have seen before.

Examples of how the five topics align with the accounting course content are provided on the website to help students understand why they are being asked to review these topics. Transfer of knowledge between courses is difficult for students and providing these explicit links between mathematics and accounting also helps students to understand why they need to review certain topics.

1. *Fractions and percentages* are used throughout the course and students need to have a solid grasp of these topics to follow the lectures. The review included multiplying and dividing fractions, and converting fractions to decimals. Some of the materials linked on

the website are short videos, while other links provide detailed written explanations. The resources have been chosen to provide a quick review.

2. *Factoring* is used in processes such as cost-volume-profit analysis, and the reviewed materials include both articles and videos explaining how one factors simple quadratics. The review includes factoring by grouping.
3. *Computational skills* including expressions with two variables are used extensively in all business applications. It is, in fact, quite common for business applications to have more than one variable. The review provides a quick overview and some examples.
4. *Graphing lines* are used in cost-volume-profit analysis. The review provided includes videos on how to find the slope given a graph and finding the slope given two points.
5. *Articulating word problems* is a concept necessary for cost-volume-profit analysis and incremental analysis. The review includes examples of percentages. The examples and practice problems were chosen because of their applications to business topics.

A skills test was devised in WeBWorK to assess these five topic areas. Aligning the skills to accounting concepts creates an efficient way to level-set the student. The test is scored so that students know how well they perform in each of the five areas. This helps optimize the additional review the students may need to do. They can still review all areas covered in the test but being able to focus first and foremost on the areas where they score lowest is most beneficial.

The website lists these five areas of mathematics content so that students can easily find the topics they need to review. The videos and pages have been chosen to provide a fast review of the subject matter. Creating a resource that is not too time intensive for the students increases the likelihood that they will make use of it. The topics covered and questions used in the skills test were selected by the accounting faculty. The selection of remediation material was a collaborative effort of mathematics and accounting faculty.

Implementation and Sustainability

The just-in-time review was piloted in Fall 2017. After the initial pilot, the involved faculty decided that the pre-and post-testing model was not optimal and moved to a model where students are now given the skills test early in the semester and are encouraged to engage with the review materials when necessary.

Students who took the skills test were able to review the mathematical concepts as needed. The online resources were chosen to facilitate a quick review. Short videos were selected so that each review would take no more than 15 minutes. Further resources were made available for students who want more practice. Students have commented in online discussions about the usefulness of the review.

The current format does not require significant work on the part of the accounting instructor and is easy to use by the students. Operational ease is needed to obtain the broad buy-in for the process to be used by multiple faculty across the sections of the course. Currently, the review is used in all sections of the accounting course it was designed for that are taught by full-time faculty. The total number of students involved is approximately 250 per academic year. The accounting faculty include an incentive for participation as part of the syllabus. Sample email verbiage is provided to all instructors to help explain the process to students. Good communication also helps create buy-in. One accounting faculty member provides enrollment information to a mathematics department colleague who sets up the WeBWorK assignment. A different accounting faculty member acts as the designated person for analyzing the skills test

results that are collected early in the semester and also helps to coordinate the feedback provided to the students. The outreach to the students who need review is important. The students are meant to see the review as supportive and as an indication that faculty are caring and setting the students up for success. The result is students with stronger mathematics skills, which allows the accounting faculty to focus on the course subject matter.

Discussions are ongoing about the just-in-time review process as we are still using the skills test as a diagnostic at the beginning of the introductory accounting classes. This practice continued for all but one section after the pivot to teaching online during the pandemic. The current focus is on reviewing and updating the associated website to ensure that the review materials are easily accessible. Any website used in a course requires regular review and revisions to account for linked sites that are either no longer available or changes to web addresses after site updates. There are ongoing discussions about expanding this practice to other courses. In addition, the just-in-time review should be applicable to other disciplines.

Conclusion

The just-in-time review for accounting students has been successfully used at Saint Louis University for several years. The skills assessment using WeBWork and the website created for the introductory accounting course can easily be duplicated for use by students and faculty at other institutions. Furthermore, the concept outlined in this paper can be applied to disciplines besides accounting. Creating an inventory of mathematical skills required for a course in a partner discipline and finding appropriate problems in the WeBWork library of online problems would take some time but is not a difficult process. Creating an online presence with links to online educational materials is similarly straightforward.

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