MATHEMATICS SUPPLEMENTS THAT INCLUDE TECHNOLOGY AND WRITING ACROSS THE CURRICULUM

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Abstract

In this paper we describe the process to create undergraduate mathematics supplements that incorporate technology and writing across the curriculum for a number of undergraduate courses. In addition, we will explain the stages of the process in detail and will give examples of the various types of topics and projects that may be included in supplements for different courses.

Introduction

Saint Leo University is a small and yet diverse liberal-arts-based university. The mission and goals for our students include a strong academic focus with emphasis on social justice for all members of the community. To implement these ideas we incorporate the core values of our university; excellence, community, respect, personal development, responsibility, responsible stewardship and integrity, into each of our courses. Saint Leo University is also dedicated to utilizing technology to further enhance learning in and out of the classrooms. All incoming residential freshman students at Saint Leo University receive a laptop. Smart classrooms and laboratory spaces equipped with modern technology allow mathematics students to collect, interpret, and analyze data and become engaged in undergraduate mathematics projects. Finally, as it is the case with many other higher education institutions, Saint Leo University has been implementing the idea of writing across the curriculum as an active teaching and learning tool.

Unfortunately, even the best written traditional undergraduate mathematics texts that we employ in our classrooms neither contain the writing assignments that we wish to require for our students nor address the core values that have become part of the mission of our university. Furthermore, the level and style of the technology based projects recommended by these texts often do not meet the needs of our students. As a result, in order to incorporate technology and the core values into our undergraduate classrooms and to promote writing across the curriculum, we feel the need to create mathematics supplements.

The Process and the Guidelines

It is rather important to exchange ideas with other members of the department and make sure that all the instructors in charge of the course are at ease with the content of the supplement. We strongly recommend that more than one faculty member should work on a supplement. For such a project, collaborative effort often produces a more polished result. Once the team members are selected, you are ready to start. The process begins by selecting an appropriate textbook for the course. You should always keep in mind that there are many good mathematics text books available on the market and that you are simply trying to write a supplement that would complement the main text. After the text book is selected, you need to contact a local representative of the publishing company and start negotiation. Publishing companies do not wish to lose their customers, and as a result, it should be an easy task to find a publisher who supports the idea of a supplement. The initial contact could be a brief phone conversation or an email. It is very important to make arrangements to meet face to face with the publishing company's development editor at the early stages of the development of the supplement.

Prior to the start of the manuscript the authors must decide on the format of the supplement and outline a list of the materials that they wish to include in there. The format of the supplement and the topics that are included vary and depend largely on the course as well as what is expected of the students. We shall return to this topic after discussing the steps involved in the design and development of the supplement. We also recommend that you complete at least one chapter of the supplement and have it ready together with the overall outline of the entire manuscript before meeting with the editor.

There are several items that should be discussed and clarified during the first meeting with the development editor. You must keep in mind that the editor has done this many times and has great insight in regards to publishing books and supplements. The suggestions made by the editor are very valuable and will reduce the time that you may have to spend on revising the supplement as the date to submit the work for publication approaches.

The pace at which you will have to work on your manuscript will depend on the final submission deadline for the manuscript. Typically you need to submit your final manuscript three or four months prior to the start of the semester. Once you agree on the final deadline for the manuscript, you need to set deadlines for the chapters of your supplement. As far as the preparation of the supplement goes, you have to choose from one of the two options. One option is to type your work in any format that you wish and then submit the files to the editor and make a request from the publishing company to format your document. One advantage of this approach is that you do not have to worry about document features such as font size, colors, margins, and so forth. Furthermore, you can count on receiving help from the editor to include diagrams and graphs in your supplement. The main setback of this approach is that it requires more time. Once you submit your manuscript, you have to wait to hear back from the editor and then you will need to carefully read through the revised manuscript to make sure that everything is in

the right order. If you decide to select this option, then you need to submit your final documents no later than end of April or early May. Otherwise, the supplement will not be ready for students by September. The second option is to follow the guidelines provided by the editor and format the supplement by your own. If you choose to go with this option, then you need to read the Author Guideline provided to you by the representative of the publishing company and meet with the editor once or twice before the submission of the manuscript. This will guarantee that the manuscript will meet all the appropriate guidelines, and as a result, less revision time will be necessary as the submission due date nears. It is obvious that you have to be at ease and proficient with technology if you wish to include graphs, tables, and diagrams in your supplement. One apparent advantage of this approach is that it will indeed save you valuable time. Once the manuscript is completed, the publishing company can use the camera-ready technique to prepare your document for publication. Therefore, with this option you can submit the final manuscript to the publisher a month later than the May deadline and confidently expect your students to have the supplement in hand by late August or early September. Unless there are complex features of manuscript that must be engineered by the editor, we highly recommend this second approach.

Selecting Content

You should always remember that the purpose of the supplement is to accompany the text and to help students get a better understanding of the topics that have already been covered in detail in the book. Most undergraduate mathematics texts are complete texts that are written to satisfy the curriculum at various universities. In other words, they are written for a very large audience and they often contain more topics than we wish to cover in our classes. A supplement should be clear, concise, easy to follow, and it must be consistent with the major goals and objectives of the course. In addition, it should contain easy to understand instructions, examples, writing assignments, and relevant technology assignments that are not included in the text. Outline of a supplement varies depending on the course, choice of the text, your expectations, and the curriculum objectives. In the remaining of this paper, we will concentrate on the outline and the topics that we have included or plan to include in several text supplements at saint Leo University.

Statistics Supplement

Currently we are in the final stages of preparing a statistics supplement at Saint Leo University. The manuscript should be completed in the next few months and it should be ready for students as early as the beginning of next semester. Teaching statistics both online and on campus for years, we have come to the conclusion that even though many students find statistics easier than algebra based courses, they find it more difficult to study and follow the complex procedures and concepts of confidence interval, hypothesis testing, and line of regression from the text. Furthermore, many of our students directly apply statistics to analyze data in their major courses. Our main audience for a course in elementary statistics at Saint Leo University includes students majoring in biology,

business administration, accounting, computer information system, and of course mathematics. Majority of these students are interested in the practical real life applications of statistics. As a result, we decided that despite the fact that the text chosen for the course is an excellent text with many fine examples, there is a need to include a summary of the major concepts and procedures in the supplement. The main focus of the chapter notes is the practical topics that students expect to see in their major courses as well as the minimum required theoretical topics for the course. The concentration will be on descriptive statistics, normal distributions and their applications, hypothesis testing, and line of regression, with emphasize on using technology to avoid tedious computations. There will be only a brief mention of topics such as Chebyshev's Theorem and binomial probability that have rather insignificant practical applications for our selected group of students. Each chapter of the supplement begins with the title of the sections covered in the chapter. That follows by a list of the objectives that we wish to accomplish in the chapter. The main part of the chapters consists of the highlights of the major topics in a logical order similar to the text. The lecture notes are followed by end of the chapter writing assignments and discussion questions. As we know, there are many real life examples where statistical data has been misinterpreted or misused. There are many ethical questions that can be raised to initiate interesting discussions among students. In order to keep students interested in the subject matter, additional writing across the curriculum assignments and projects related to the students' fields of study are included. The large selection of assignments gives the instructors the option of choosing different projects each semester.

College Mathematics Supplement

The supplement for our College Mathematics course was designed and developed at Saint Leo University by Dr. Jacci White in 2008. The College Mathematics course is a terminal course in mathematics survey and it is a requirement for students majoring in education. The course covers selected topics in algebra, finance, geometry, probability, and descriptive statistics. As it is the case with many other lower level undergraduate texts, it should be easy to find a College mathematics text that is easy for students to read and follow. For this reason we did not feel any need to include any lecture notes or even highlights or a list of the required topics in the supplement. The supplement heavily concentrates on incorporating the six core values of Saint Leo University into the course exercises. On the first page of the supplement, after a brief introduction, students are asked to discuss the mission and the six core values of the University in small groups and then come up with examples of how they might experience or apply each of the values. The introduction is followed by a list of the educational and learning goals. There are eight chapters in the supplement, one for each chapter that is covered in the main text. Each chapter begins with a research exercise under "In the News." The assignment asks students to find at least one article that in some way relates to the topics covered in the chapter. After this exercise, students are asked to work on a number of writing across the curriculum assignments. For example, in the "geometry" chapter of the supplement students are asked to write a report on how geometry is used in specific professions outside the classroom, and furthermore, how the core values of Saint Leo University may

be integrated in these professions. Depending on the topics of the chapter, various examples and exercises are tagged on to the "In the News" and writing across the curriculum assignments. It is notable that due to the level and nature of this course, very little or no technology related exercises are included in the supplement.

Linear Algebra & Differential Equations Supplement

Both linear algebra and differential equations are required courses for mathematics majors at Saint Leo University and many of our mathematics minors also take these courses as mathematics electives. A great deal of technology is employed in solving linear algebra problems, and furthermore, there is at least one chapter of the differential equation course in which linear algebra is used to solve systems of linear differential equations. As a result, it makes sense to us to create one common supplement for both of these courses. As one may expect, one of the main objectives of the common supplement for linear algebra and differential equations will be to provide students instructions on how to utilize technology to solve problems that require tedious computations. Each chapter of the supplement begins with the goals and objectives followed by a list of topics that students are expected to learn. However, the main portion of each chapter of the supplement consists of at least one group project which requires use of technology. The group projects are carefully selected to reinforce the important theoretical concepts covered in linear algebra and differential equations. At the same time, the projects are chosen to address application problems in other fields such as business, physics, and engineering. This also gives us a chance to include writing across the curriculum as part of the projects.

References

1. J. White, The Value of Thinking Mathematically, Pearson Publishing Company, Second Edition, 2008.