Lesson Plans and Web-Based Tutorials for College Factoring Workshops

A PROPOSAL for a PROJECT in MATHEMATICS

by

JOHN N. BRUNNER

APPROVED: __________________________ Date: May 27, 2010
Dr. George Tintera, Chair

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Style: APA
Abstract

Factoring polynomials can be an extremely difficult skill to master, especially for beginning algebra students. One of the many basic skills that a developmental math student is exposed to and must comprehend is the process of factoring, which in simplest terms states, "What was multiplied together to obtain the given result?" (Bittinger, Ellenbogen, Johnson, p. 304). However, factoring many types polynomials can be an extremely difficult skill to master, especially for beginning algebra students (Kotsopoulos, 2007). Without a strong background in basic mathematical skills, frustration and disillusionment can easily develop, hindering the potential to be a successful college graduate. A local community college provides support for students enrolled in developmental mathematics courses, including workshops, supplemental instruction, and online videos. Factoring workshops are taught twice a semester, providing support for students enrolled in developmental mathematics classes. At the present time, no written lesson plans or videos are provided by the mathematics department for adjunct instructors or student tutors.

The purpose of this project is to develop concise, detailed lesson plans and extensive web-based tutorials on factoring polynomials by use of online video recordings. These tutorials will allow the students unlimited access for viewing on the college's web site.
Introduction

Factoring polynomials can be an extremely difficult skill to master, especially for beginning algebra students. One of the many basic skills that a developmental math student is exposed to and must comprehend is the process of factoring, which in simplest terms states, "What was multiplied together to obtain the given result?" (Bittinger, Ellenbogen, Johnson, p. 304). However, factoring polynomials can be an extremely difficult skill to master, especially for beginning algebra students (Kotsopoulos, 2007). Without a strong background in basic mathematical skills, frustration and disillusionment can easily develop, hindering the potential to be a successful college graduate. A local community college provides support for students enrolled in developmental mathematics courses, including workshops, supplemental instruction, and online videos. Factoring workshops are taught twice a semester, providing support for students enrolled in developmental mathematics classes. At the present time, no written lesson plans or videos are provided by the mathematics department for adjunct instructors or student tutors.

With busy schedules and heavy workloads, some students may not be able to attend the factoring workshops. In addition, online courses and distance modules are growing rapidly in science, mathematics, engineering, and technology disciplines (Hauk, 2006; National Science Foundation, 1998). With technological innovations and the increasing availability of computers, the freedom to view web-based tutorials at the student's discretion would be an additional benefit. Although some web-based tutorials are available for
mathematics courses, there are currently none available for the factoring workshops.

The purpose of this project is to develop concise lesson plans for use at the collegiate level factoring workshops and to create video-based tutorials discussing in length the major topics of factoring polynomials in mathematics. This will facilitate consistent and thorough workshops by providing common lessons and multi-media support materials for workshop instructors and student participants.

The project will be guided by two main principles:

1) Factoring in mathematics is difficult and requires extended learning opportunities which can be provided by the workshops.

2) Online tutorials can provide additional support for students unable to attend the workshops.
Related Works and Justification

Factoring in mathematics can be an extremely difficult skill to master, especially for beginning algebra students (Kotsopoulos, 2007). One of the many basic skills introduced in a remedial level mathematics course is factoring, which is the process of writing terms for an algebraic expression as a product. Without a strong background in basic mathematical skills, students do not succeed in higher level courses such as calculus or linear algebra, nor will they be eligible for many high-technology and high-paying fields after graduation (Paglin & Rufolo, 1990).

Some students enter the higher education environment without the fundamental mathematical proficiency and problem solving skills that are needed to succeed in a college level mathematics course (Hammerman, 2003). Over the past two decades, the percentage of entering freshmen needing remedial mathematics work has increased (Polk-Conley, 2006). Almost a quarter of postsecondary students required remedial course work in mathematics in the fall of 2000, with almost 98% of public two-year colleges and 80% of public four-year institutions offering at least one remedial mathematics course (USDE, 2003).

At a local community college, about 15% of the student population was enrolled in remedial mathematics classes during the fall semester of 2008 (Institutional Research and Effectiveness, 2008). Remedial course work delays the student’s progress toward a degree, does not count towards their GPA, and adds financial cost.

Nolting (2002) asserts “Learning math is different from learning many other subjects because it follows a sequential learning pattern” (p. 22).
Sequential learning patterns are based on knowledge or skills acquired in math today will be used again the next day in order to build a stronger mathematical foundation. One of the topics in remedial mathematics classes is factoring. This skill is understood quickly by some students in the classroom, but others take a longer time to grasp the concept. One reason may be the diversity of learning styles and multiple intelligences that goes unnoticed by educators (Gawlik, 2009). To assist students who are having difficulties conquering the techniques of factoring, further allocation of resources should be provided by means of additional practice, extended study time, additional personnel or a different teaching approach (Hoda, 2006). One pathway for the allocation of those resources is factoring workshops in conjunction with videotaped lessons (Gawlik, 2009).

Computer use and all its encompassing technologies has become a normal part of a person’s daily routines. Technology has shown the potential of allowing more motivation for the student to work at his/her pace. The use of electronic tutorials allowed the student to review and recapture missed work and materials covered in the workshops (Handal & Herrington, 2003).

This project is appropriate for a master’s degree in mathematics because it will produce new curricular materials that will support students struggling with factoring polynomials in collegiate level remedial mathematics classes at a local community college. In addition, this author’s professional development and continued commitment to assist the students at the local community college will be strengthened in part due to complete development of lesson plans/activities.
Current and future instructors will be able to offer consistent and appropriate lessons to students attending the factoring workshops. Furthermore, web-based tutorials can offer just-in-time support for students who may not have time to attend, miss a session, or need additional time with examples. These lessons and tutorials will help foster a better understanding of the various methods of factoring as well as clarify the student’s choices on which factoring technique would work best for a given type of equation. Finally, the author’s professional development will be enhanced due to participation of this project coupled with his continued active tutoring and full commitment to assist the students understand the concepts of factoring at the local community college.
Planned Actions

The project will begin with an extended literature review of prior research in factoring polynomials coupled with web-based instruction. The lesson plans/activities and video tutorials will explain the following ten major topics as related to factoring:

1) Common factors
2) difference of perfect squares
3) sum of cubes, sum of squares
4) difference of cubes
5) trinomials of the type $x^2 + bx + c$ (monic trinomial)
6) trinomials of the type $ax^2 + bx + c$ (non-monic trinomial)
7) factoring by grouping
8) solving a quadratic equation for a specified variable, i.e., $x$ or $y$
9) techniques of factoring to solve assorted quadratic word problems
10) tests for divisibility by the natural numbers 1 through 10

Upon completion of the lesson plans, web-based tutorials will be recorded in the fall of 2010 using the community college’s television production facilities. The tutorials will be developed using a combination of many different technologies, such as document cameras, whiteboards, and tablet PC's. All of the material covered in the lesson plans and web-based tutorials will be uploaded to the college’s website and will be easily accessible for instructors, tutors, and students at any time in the future. Additional, teaching aids, such as graphic
organizers will be developed for uploading onto the college's website for use by the student.
<table>
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<tr>
<th>Timeline</th>
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<tbody>
<tr>
<td><strong>January-March 2010</strong></td>
<td>Write project proposal</td>
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<td><strong>April 2010</strong></td>
<td>Final draft of project proposal to committee</td>
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<td><strong>Second week of May 2010</strong></td>
<td>Defend project proposal</td>
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<tr>
<td><strong>July 2010</strong></td>
<td>Extended literature review</td>
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<td><strong>July-August 2010</strong></td>
<td>Write complete curriculum</td>
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<td><strong>September-October 2010</strong></td>
<td>Create, edit, and upload videos</td>
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<td><strong>November 2010</strong></td>
<td>Final draft of project manuscript to committee</td>
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<tr>
<td><strong>First week of December 2010</strong></td>
<td>Defend project</td>
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End Results Intended

This project will develop ten lesson plans and web-based tutorials based on the major topics of factoring polynomials. These curricular materials will assist students' learning processes while enrolled in various remedial mathematics classes at the community college level. These lessons may clarify ambiguities in the process of factoring different types of polynomials, and most importantly, ease the anxiety associated with acquiring the necessary skills in mathematics at the university level. Web-based tutorials will be made available through the college's website. The materials may be used by all students who are enrolled in the remedial mathematics courses.
BIBLIOGRAPHY


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