Evolution of an Open Courseware for a STEM Course

2018 Textbook Affordability Days
USF, Tampa
January 24, 2018

Autar Kaw
http://AutarKaw.com
University of South Florida
Textbook Sharing
Graduate School
What happens if?
Crazy Idea in 1990
Open Courseware

Holistic Numerical Methods
Transforming Numerical Methods Education for the STEM Undergraduate

INTRODUCTION
Introduction  Measuring Errors  Sources of Error  Binary Representation  Floating Pt Representation  Propagation of Errors  Taylor Theorem Revisit

DIFFERENTIATION
Primer on Differentiation  Continuous Function  Discrete Function

NONLINEAR EQNS
Quadratic Equations  Cubic Equations  Bisection Method  Newton-Raphson Meth  Secant Method  False- Position Method

SIMUL LIN EQNS
Intro to Matrix Algebra  Gaussian Elimination  Gauss-Seidel Met  LU Decomposition  Cholesky and LDLT Decom

MathForCollege.com
Resources Available

SOURCES OF ERROR
CHAPTER 01.03
How a Learner Can Use This Module

PRE-REQUISITES & OBJECTIVES
- Pre-Requisites for Learning Sources of Error [PDF] [DOC]
- Objectives of Sources of Error [PDF] [DOC]

TEXTBOOK NOTES
- Text Chapter of Sources of Error? [PDF] [DOC]

DIGITAL AUDIOVISUAL LECTURES
- Round-off Error: Definition and Examples [YOUTUBE 3:47] [TRANSCRIPT]
- Effect of Carrying Significant Digits [YOUTUBE 7:48] [TRANSCRIPT]
- Truncation Error: Definition [YOUTUBE 8:34] [TRANSCRIPT]
- Truncation Error: Example: Series [YOUTUBE 6:14] [TRANSCRIPT]
- Truncation Error: Example: Integration [YOUTUBE 6:12] [TRANSCRIPT]
- Truncation Error: Example: Differentiation [YOUTUBE 14:44] [TRANSCRIPT]

MULTIPLE CHOICE TEST
- Test Your Knowledge on Sources of Error [HTML] [FLASH] [PDF] [DOC]

PRESENTATIONS
- A PowerPoint Presentation on Sources of Error [PDF] [PPT]

BLOG ENTRIES
- Comparing Two Series to Calculate pi [BLOG]
- Myth: Error Caused by Chopping a Number is Called Truncation Error [BLOG]

WOLFRAM DEMONSTRATION
- (External link: What are Wolfram Demonstrations? | Do need free Mathematica Player to run)
- Accuracy of Series of Approximation [NBP]

RELATED TOPICS
- Introduction
- Measuring Errors
- Binary Representation
- Floating Point Representation
- Propagation of Errors
- Taylor Theorem Revisit
Assessment Results

Final exam improvement from average of 54% for traditional class to 62% for blended class (p<0.008) and the effect size was 0.8.
Influence
Economic Diversity at Colleges

Figure 8. Economic Diversity at the Nation’s Top 146 Colleges

### Improved motivation

<table>
<thead>
<tr>
<th></th>
<th>LOW WILLINGNESS OF EFFORT</th>
<th>HIGH WILLINGNESS OF EFFORT</th>
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<tbody>
<tr>
<td>HIGH NATIVE ABILITY</td>
<td></td>
<td>Motivated when facing singular difficult tasks</td>
</tr>
<tr>
<td>LOW NATIVE ABILITY</td>
<td></td>
<td>Motivated to prepare before class and review after class</td>
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“All discussion of reform must begin with the ordinary student, not the genius, not the prospective scientist or professor of abnormal psychology but the citizen of the republic who must earn a living in addition to living a humane life.” - Paige Smith, *Killing the Spirit: Higher Education in America*, 1990, p. 200

Thank you
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