

## ELECTRONIC MATH EDUCATION PORTFOLIOS IN A MATHEMATICS METHODS COURSE

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### Abstract

The purpose of this paper is to share with educators how to set up an alternative form of assessment for displaying knowledge of mathematics and methodologies for teaching mathematics in a mathematics methods course for preservice teachers. Research will be shared on portfolios, electronic versions, and benefits to preservice mathematics teachers. The paper shares the contents of a math education portfolio for and how to do an electronic portfolio along with advantages and disadvantages of doing an electronic math education portfolio. Resources and websites are shared on setting up electronic portfolios.

### Introduction

*"My students find doing the portfolio more meaningful than a paper and pencil test. They are able to express their math knowledge and creativity in the portfolio as a form of assessment. They can use the resources as a future math teacher."*

This paper shares with the reader the contents of a mathematics education portfolio, why students should do a portfolio, and how electronic math portfolios may be a more practical means for storing and presenting learning as an alternative form of assessment for math education majors. Math Education majors can benefit from employing alternative forms of assessment, such as math portfolios, in math methodologies courses as it promotes its use in their own future classrooms.

Contents of a math education portfolio may vary from instructor to instructor. Some items may include a cover design, cover letter, grade sheet, table of contents, math autobiography, math philosophy, lesson plans, math problem solving, math technology, manipulative checklist, math art, children's literature, field experiences in the math classroom, web sites, research, teaching activities, creative projects, and summary of learning.

With the advent of computers and the ability to store large amounts of data on CD's and flash drives, electronic portfolios may be a more practical approach to putting a portfolio together. Electronic portfolios are more practical for the following reasons: (a) uses less space; (b) provides easy to access (CD or flash drive); (c) includes plenty of information, (student readings/problem solving, math problems, etc.); (d) incorporates graphics, video, animation, sound, etc.; and (e) enhances technology skills while giving students a sense



of accomplishment when sharing/presenting their portfolio to others (Abrenica, n.d.).

### **Research on Math Portfolios**

With current research in 2006 suggesting that there is too little math in math (Thompson, 2006) and the emphasis being on standard-based testing, math portfolios can serve as a means to demonstrate the students' math knowledge and abilities, understanding, and appreciation. Since 1989 with the first National Council of Teachers of Mathematics (NCTM) document in the *Standards*, math portfolios are taking hold as an alternative to assessing math more creatively (NCTM, 1989, 1995, 1996, and 2000; Cavanagh, 2006) contends that based on the 2006 NCTM Conference the push is toward creative forms of assessment to improve math teaching/instruction, such as math portfolios.

NCTM has advocated alternative forms of assessment like math portfolios in their documents over the past 25 years. Math portfolios are beneficial to both the instructor and students for instructional decisions and allow students to actively monitor their progress and growth. Portfolios can also improve reading and writing skills and make the learner reflective of their math understanding (Columba and Dolgos, 1995).

Math portfolios are advocated at all levels K-University. At the elementary level, parents can see progress and it can serve as a form of communication; children can see growth while practicing more writing/reading/reflection; it involves more creativity, writing, and problem solving; it is an authentic picture of student's ability and progress over time; it can serve as a way to promote pride in learning (Furner and Grace, 2007; Burns, 2005; Cutler and Monroe, 1999; Ensign, 1998; Micklo, 1997). At the middle grades, the portfolios are beneficial for teachers, students, and parents; enhances communications between school and home; provides a clearer picture of what students have learned; serves as a record of assessment; instills pride in students; and may be used as a study guide/resource for students (Britton and Johannes, 2003; Price, Canarecci, and Conrad, 1997). At the high school/college level, the portfolios serve as the big picture of progress while teaching responsibility, gain self-confidence, and communicating effectively; it is concrete evidence of student performance; they can include problem solving where they demonstrates math understanding in any branch of math; it helps to show appreciation and value for math in life; and it serves to collect and analyze essays of understanding to check for understanding/misconceptions students have (Robinson, 1998). Teacher Education Programs have been advocating the use of portfolios as they serve as: Portfolios are agents of change; as part of the professional portfolio/hiring process; showing understanding of the mathematics; as a teacher resource binder; as a form of self-reflection/teaching philosophy/vision; where they use grade sheets/rubrics for Grading; and it serves to help the instructor for the math educator (Karp and Huinker, 1997; Hartmann, 2004).

### **Why Electronic Portfolios?**

Electronic portfolios are an easier means of storage. In our high-tech world, they increase use and practice of technology skills. Portfolios promote the engagement of students in authentic tasks in authentic contexts. The portfolios can help to improve



communications/writing/reflecting. The portfolio in teacher education can help to meet State/NCATE Standards like in Florida where the Florida Accomplished Practices (FAP's) are used to connect student work to standards for educators. It serves as a pre-professional, part of student-teaching and later in the hiring process as a tool. The electronic portfolio can serve as a resource and include a preservice teachers' philosophy for teaching mathematics (Ring and Foti, 2003; Campbell, Cignetti, Melenzyer, Nettles, and Wyman, 2001). When creating an electronic portfolio it is important to take into consideration the time and planning for doing the portfolio as well as the basic equipment needed in creating the actual portfolio, equipment such as: computer, scanner, digital camera, multimedia software program, and web authoring programs (See Appendix for Portfolio Resources). The advantages in doing a portfolio include: showcases student work; provides a rich form of assessment and future binder of resources; promotes writing and reflection; uses technology and tools; develops philosophy for teaching math; prepares for future job/hiring; shows the true mathematical understanding and creativity; demonstrates knowledge that can be held onto forever; and standards-based (Stenmark, 1991). The disadvantages are: plenty of data (electronic better/easier); time consuming; harder to grade; and lack of students' technology experiences. A template/outline is a way to organize the contents of the portfolio for preservice students (Abrenica, n.d.). Instructions for an electronic mathematics portfolio could be the following:

### **Electronic Portfolio: (+100 Points) Grade Sheet/Rubric/Criteria**

Your MAE electronic math portfolio will be a collection of your work in this math method's class over the semester that will represent your mathematical thinking and learning. Your portfolio (in the form of a Powerpoint Presentation or other electronic presentation like Microsoft Binder) can be divided into several sections, ie. *Sunshine State Standards (SSS)*, Lesson/Unit Plans, Articles/Websites, Extra-Credit, Journal, Creative Projects, Information collected, Teacher Observations, etc. Create a section with math education journal articles OR math ed. Websites useful for you. Also included in your portfolio should be a Cover Design with name and class; Table of Contents with Hyperlinks; Your Math Autobiography; Your Mathematics Education Philosophy Bullets; and a Summary (as a Cover letter) of the learning that has occurred in this class and how this portfolio represents the particular grade that you feel you deserve. Your portfolio of work should be a creative, quality presentation. Your math portfolio can also serve as a binder of resources for the future as well as reflect your knowledge and philosophy of mathematics education. Please include this grade sheet as the first sheet in your portfolio when opened. This portfolio is due one week before the final exam date.

#### **Grading Criteria**

Cover Design with Name, Class, Title.....	+5	_____
Binder/Powerpoint/ or other Electronic Presentation.	+10	_____
Organized/Neat/Easy to Read.....	+10	_____
Table of Contents/Cover Letter with Summary.....	+10	_____
Includes all Sections Mentioned Above.....	+10	_____
Math Auto. and Philosophy Bullets.....	+10	_____



Research Articles on Math Ed./Websites.....	+10	_____
Professional Section with Resume, etc.....	+10	_____
Quality Presentation/Demonstration of Effort.....	+20	_____
Above and beyond minimum (Tech., Org., Qual., & Pres.)	+5	_____
Possible Portfolio Grade =	100	_____

### Summary

*“As the professor, I can see that the preservice teachers like putting their work together, thus giving them a sense of pride and completion. By showcasing their work a math portfolio is more meaningful than a test because as one would memorize and forget for a test, but a portfolio you have forever to look back at. Although doing a math portfolio is time consuming it is very worthwhile. Doing a portfolio for class is worth the time because student then feel very accomplished and very confident about their math and teaching abilities. By doing a math portfolio students are able to reflect on their work and use it efficiently in the future because it is structured. The portfolio serves as a reference guide and resource for the preservice teacher’s own classroom.”*

Electronic portfolios can be a very practical assessment tool with little instructor guidance and with a grade sheet/checklist of requirements for doing a portfolio; students can use the technology to organize their learning/knowledge in an electronic format using little paper. Electronic portfolios are a technology based form of authentic student-based assessment. The portfolio has a collection of student work over a semester or year. It can be made to be practical and effective when rubrics/grade sheets are used. The benefits include clear set standards or expectations, quick access, easy storage and increased technology skills. A multi-media computer, a scanner, and a software package are some of the basic technologies needed to make an electronic math portfolio. A template/outline is a way to organize the contents of the portfolio for your students (Abrenica, n.d.).

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#### Appendix: Electronic Portfolio Resources and Websites

1. **Electronic Portfolio Resources**  
<http://www.uvm.edu/%7Ejmorris/ep/electronicportfolio.html>
2. **What is an Electronic Portfolio?**  
<http://edweb.sdsu.edu/courses/edtec596r/students/Abrenica/Abrenica.html>
3. **FolioLive** <http://foliolive.com>
4. **Super Schools Software-IEP/Portfolio Writer**  
<http://www.superschoolsoftware.com/portfolios.html>
5. **HyperStudio** <http://www.hyperstudio.com/ProductInfo.aspx>
6. **Portfolio Software:** Powerpoint, Word, Publisher, Adobe Acrobat, Portfolio Works