

INTRODUCTION TO MATHEMATICS MANIPULATIVES: PRESERVICE  
TEACHERS CREATE DIGITAL STORIES ILLUSTRATING TYPES AND  
APPLICATIONS OF MANIPULATIVES

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## **Introduction**

Math concepts can be difficult for students to understand due to their abstract nature. Because of this, the National Council of Teachers of Mathematics (NCTM) has urged teachers to focus on the facilitation of students' understanding and conceptualization rather than on drill and practice of rote procedures (NCTM, 2000). The use of manipulative materials in mathematics classrooms supports this attempt to provide students with a more thorough understanding of mathematics by allowing students to discover and apply concepts presented in class (Canny, 1984; Clements & Battista, 1990; Dienes, 1960; Driscoll, 1981; Fennema, 1972, 1973; Skemp, 1987; Sugiyama, 1987; Suydam, 1984).

Manipulative materials are concrete models that can be touched and moved around by the students, thereby providing tangible investigative experiences for abstract mathematics concepts as well as how concepts are related. Incorporating the use of manipulative materials with an emphasis upon the thought process of students provides an opportunity for the teacher to assess and meet the needs of students as they construct personal mathematical knowledge. Since manipulatives are beneficial in teaching mathematics, the classrooms of today often have many manipulatives available to the classroom teachers. Yet due to the lack of training in the use of manipulatives, teachers are often not comfortable with manipulatives and hesitate or refuse to use them in the

classroom (Bellonio, 2001; Heo, 2009). Teacher educators have a responsibility to guide future teachers in the proper use of manipulatives in their teaching practices.

This paper will describe the requirements, processes and outcomes of a project designed to familiarize teacher candidates with mathematics manipulatives. During the project, the candidates research the history and typical uses of an assigned manipulative and then create a digital story illustrating a manipulative-based activity designed to teach concepts from assigned state and national standards. Earlier in their teacher education program, candidates were taught software tools for creating and editing digital stories as well as ways to store and display the digital stories online. The projects from this course will be accessible on Teacher Tube. Over time, this will build a library of digital videos on manipulative use in the PK-12 classroom. Because the videos are available online, candidates can review projects as needed during the tumultuous first year of teaching. Technology needed for the presentation includes projector for computer and Internet access.

### **The Study**

Teacher candidates can benefit from tools that promote classroom instruction and interaction. During an educational technology class, preservice teacher candidates were required to learn how to use tools necessary to design and develop digital stories.

For thousands of years, virtually every culture has employed the art of oral storytelling to share beliefs and morals, express humor and grief, document history, and to pass along values and traditions. Throughout history, storytelling has been a fundamental part of human lives. Whether in the form of oral, pictorial, written, or film media (McClellan, 2007), stories help in the exchange of experiences from one to another. Moreover, the use of props to provide visual images helps the children create more intensive memories of the concept and thus strengthens the ability to transfer the knowledge into reality based situations (Bradley, et al 2008). Mechanisms such as art, drama, music and movement combined with visual images help strengthen the ability to transfer knowledge.

The creation of storytelling projects is reflective of the concurrent internal processing; the right brain (creativity) and the left brain (logic, sequence) are working together to create change. The product can be electronically transferred to video format for classroom, home, or even library computers, to both reinforce and serve as a training tool.

Over the past century, technology has advanced to the point where sharing stories is visually supported by a variety of devices including computers, digital camcorders, digital cameras, and mobile devices (i.e. iPad, iTouch, smartphones, tablets). With the growth and accessibility of multimedia tools the practice of storytelling as an educational tool can be expanded through the use of mobile technology. The creation of the digital stories can be educational for both the originator and the viewer. The stories can be easily converted into various multimedia formats and shared via personal media players, websites and social networking tools. The resulting product will reflect the personal uniqueness and dramatic flair from the creating entity.

During the study, groups of three students were expected to write a three to five page paper describing the history of their assigned manipulatives as well as the mathematical concepts that are usually taught using the manipulative. Students then created and activity using the manipulative to teach an assigned concept. The activity was recorded using Windows MovieMaker and the recording was presented to the class. After the presentations, students completed an evaluation of the Digital Story Project stating their perceptions of the project helpfulness in learning about the uses of manipulatives to teach mathematical concepts.

### **Data Analysis and Findings**

Data examined is taken from the Digital Story Project Evaluations. The evaluations were to determine if the students perceived the digital story project as increasing their knowledge of: (1) the types of manipulatives, (2) concepts to teach with a particular manipulative, and (3) technology used for presentations. The evaluations were anonymous and completed by the students the week after the presentations.

Initial analysis of impact of the project indicates that all students increased their knowledge of the various types and uses of mathematical manipulatives. Cuisenaire rods, ten frames, attribute blocks, and tangrams were listed as the manipulatives that the students learned the most about from the project. Many students stated that they had never seen Cuisenaire rods and ten frames.

Additionally many students reported that while they may have been aware of the manipulatives, they had not had the opportunity to use the manipulative to teach a mathematical concept. Seeing the manipulatives used in an activity not only increased their knowledge of the manipulatives that are available to teachers, but also illustrated exactly how to teach with the manipulative. For example, many students were aware that base ten blocks could be used to teach addition of whole numbers but were surprised that base ten blocks could also be used to teach multiplication of two-digit numbers.

The use of MovieMaker was also seen as a positive experience. The students stated that posting the presentations on the university website for future use relieved their concern of remembering how to use the manipulatives effectively when in their own class.

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