

Use Dynamic Software to Teach Mathematics

Shuhui Li (Sophie)
Doctoral Candidate in Mathematics Education
Teachers College, Columbia University

Outline

- I. Self-Introduction
- II. Dynamic Interactive Software
- III. My Doctoral Dissertation
- IV. Degree Requirements of CU (PhD)

I. Self-Introduction

➤ Educational Background

- Columbia University (2015~Present)
- SUFE & HvA (2011~2015)
- 2018 TC International Scholarship
- 2016 Lily E. Christ and Duane M. Christ Annual Fund Scholar
- 2015 Shanghai Outstanding Graduates, 2012 Woori Bank Scholarship, 2012 First-Prize People Scholarship



I. Self-Introduction

➤ Working Experiences

- Jimmy Academy: Part-time Math and English Instructor
- Accelerate Academy: Part-time Math Instructor
- Porsche (China) Motors Ltd.: Sales Data Analyst Intern



I. Self-Introduction

➤ Research Experiences

- R1: Teaching Probability Using AR (ICCE paper)
- R2: Teaching Quadratic Relations Using AR and Geometry Sketchpad
- R3: Mathematical Connections in Textbooks

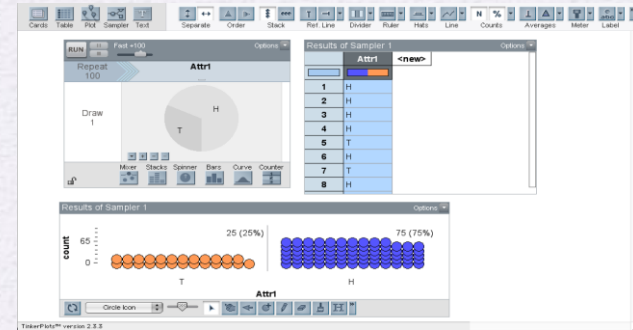
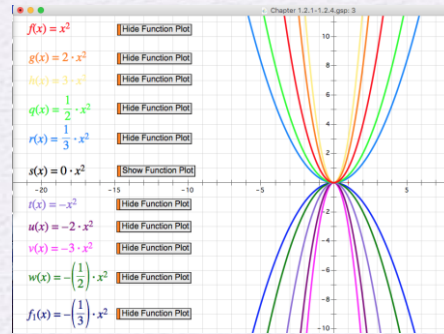
➤ Future Aspirations



II. Dynamic Interactive Software

➤ Background Information

- Augmented Reality (AR);
- Geometry Sketchpad;
- TinkerPlots;
- ...



Research 1: Probability

➤ Need

- Augmented Reality (AR)
- Probability & Statistics
- In Secondary School Level

➤ Solution

- Use AR to teach concepts in probability in secondary school

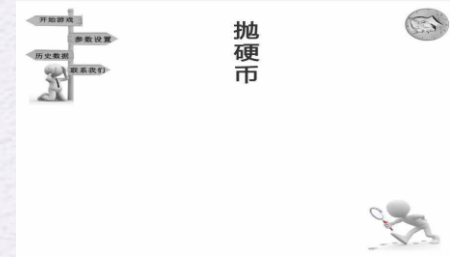
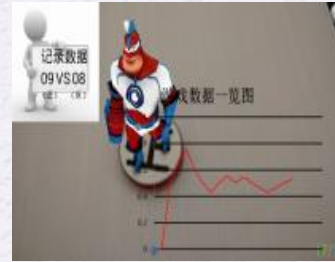
Research 1: Probability

➤ Our Research

- 1) Present a new way to build students' conceptual understanding in probability
- 2) Compare and assess the effect of AR and TinkerPlots application used in teaching probability

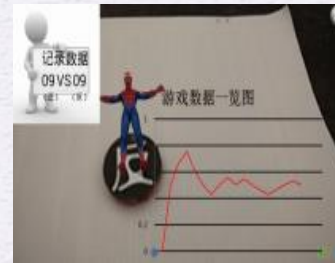
Research 1: Probability

- Case 1: The relations between empirical and theoretical probability



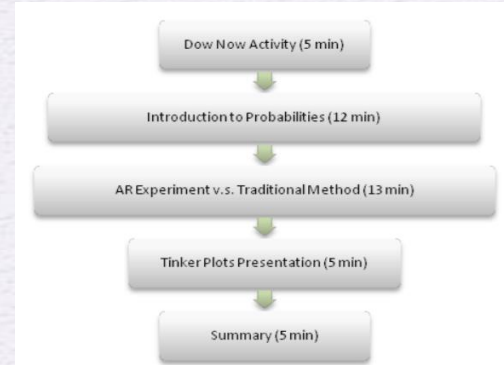
- Dynamic Software

- An AR game - Magic Coins;
- TinkerPlots



Research 1: Probability

- Sample: 7th grade students (Nanjing)
 - Experimental group: 31 students (removed 6 in data analysis)
 - Control group: 28 students (removed 3 in data analysis)
- Structure of the Class



Research 1: Probability

➤ Data

- Quantitative: Pre-test; Post-test
- Qualitative: Questionnaire; Interview

➤ Result

- 1) Learning Achievements
- 2) Learning Experiences

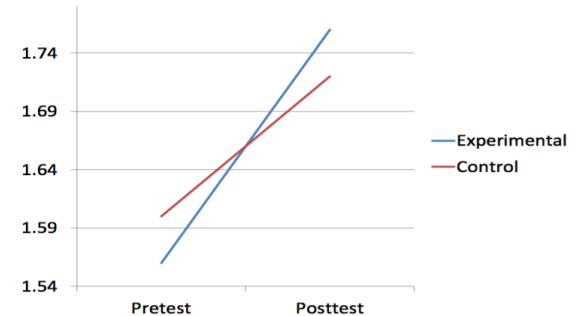


Figure 4. Mean scores of pretest and posttest from two groups.

Research 1: Probability

- Limitations: sample size; time factor; ...
- Improvement
 - From One section to One chapter
 - From One class to One-week Classes
 - From One game to a Set of games

Research 1: Probability

➤ Tools in Case 2

- 1) Who Got Seven?;
- 2) Magic Coins (Same in C1);
- 3) Explore Sample Space



案例：一起来抢七

介绍：通过AR方式投掷骰子，模拟经典博弈游戏“抢7”，让学生初步了解概率的基本概念

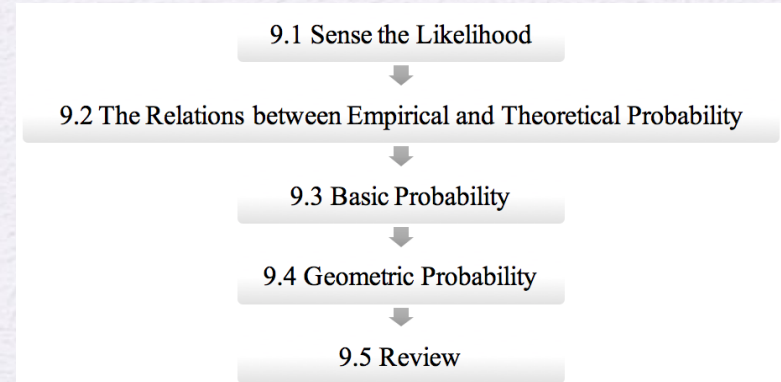


案例：数学概率_感知可能性

介绍：通过AR方式计算并呈现出硬币、骰子、小球、扑克牌四种对象单独出现或两两组合所可能出现的所有样本空间

Research 1: Probability

➤ Structure of the Chapter



➤ Sample: 7th grade students in two groups

- One school in Shandong & One school in Beijing

Research 1: Probability

➤ Data

- Quantitative: Pre-test; Post-test
- Qualitative: Questionnaire; Interview

➤ Result

- 1) Significant Improvements in Learning Achievements
- 2) Positive Learning Experiences

Research 1: Probability

➤ Limitations

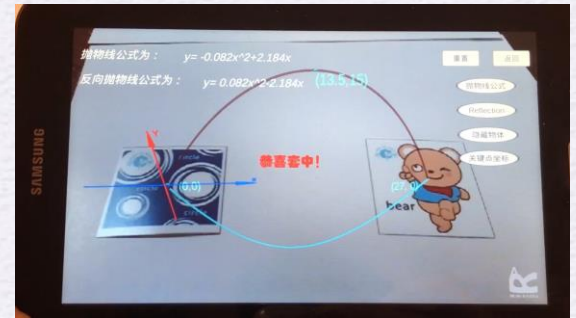
- Technology
- Appropriate mathematical content

➤ Future Directions (Utilized in Research 2)

- 1) Explore other appropriate mathematical content
- 2) Compare the effects of AR with other interactive software

Research 2: Quadratic Relations

- Topic: Introduce Quadratic Relations
- Tools
 - An AR game - Hoopla;
 - Geometry Sketchpad
- Sample: 9th grade students (Ningbo)



Research 2: Quadratic Relations

➤ Data

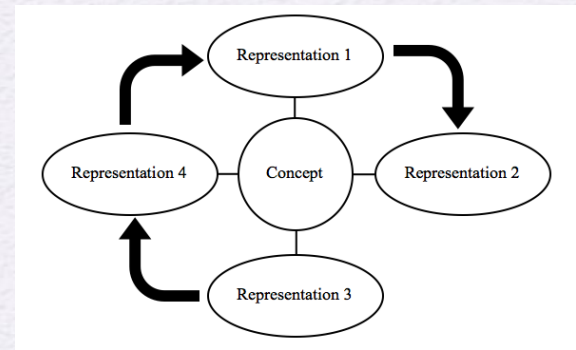
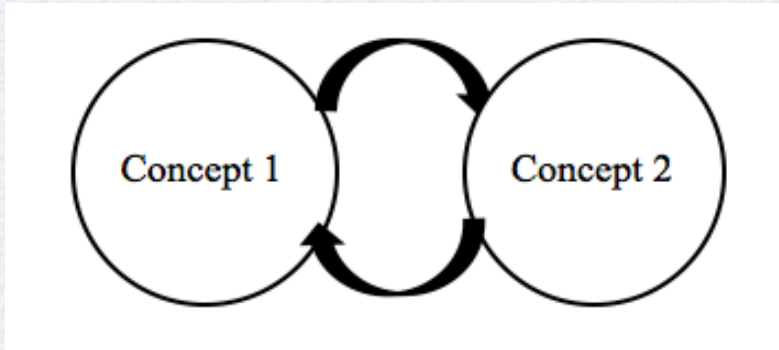
- Quantitative: Pre-test; Post-test
- Qualitative: Questionnaire; Interview

➤ Result

- 1) Learning Achievements
- 2) New Learning Experiences

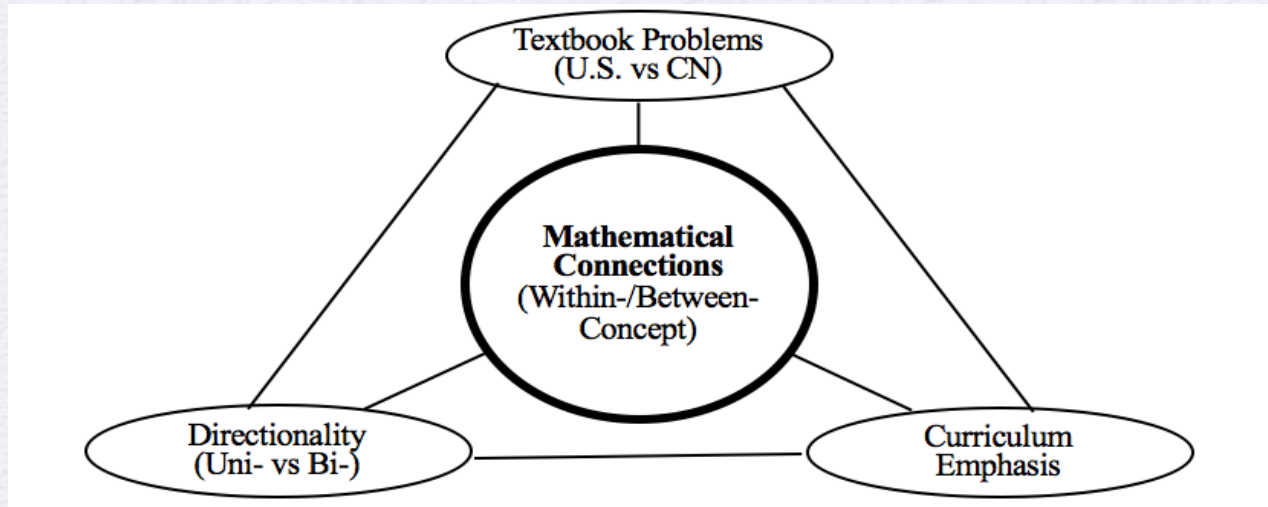
III. My Doctoral Dissertation

- Topic: Directionality of Mathematical Connections
- Two types: BCC & WCC



III. My Doctoral Dissertation

➤ Need



III. My Doctoral Dissertation

➤ Purpose

- 1) Detail the structure of WCC and BCC in problems visually as a way to check the curriculum emphasis and expectations
- 2) Compare BC in text problems, as a way to illuminate the cross-national similarities and differences in embedding BC in different social-cultural contexts, the relationship between BC and textbook problems, and suggestions to design textbook problems

IV. Degree Requirements (PhD)

➤ Required Courses (75 credits)

- Math & Math Edu & Statistics & Computing: 60
- Breadth (e.g. psychological foundations of education): 15
- Advanced credits: at least 35

➤ Two Foreign Language Requirements

- At least one from French, German, and Russian

IV. Degree Requirements (PhD)

- Certification Exams (Math Content; Math Edu)
 - Content: algebra, analysis, computer mathematics, foundations of mathematics, geometry, and probability and statistics
 - Education: current research and theory
- Prospectus (Pre-hearing & Defense) & IRB
- Dissertation (Pre-hearing & Defense)

Q&A

Questions

Thank you!

Reference

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