The problem

• Social studies is overshadowed with more time being spent on math and language arts. (Zhao & Hoge, 2005; Lee, 2008)

• Social studies marginalization discourages time-consuming methods, such as projects or field trips, and encourages transmission-driven methods, such as worksheets and textbooks. (Fitchett, Heafner, & Lambert, 2014; Kisiel, 2003; Ransom & Manning, 2013)

• Students find social studies boring and not relevant. (Zhao and Hoge, 2005)
The opportunity

• Games can be engaging.  
  (Kiili, 2005; Sweetser & Wyeth, 2005; Bressler, 2014)

• Some games have been shown to improve learning outcomes.  
  (Van Eck, 2006; Steinkuehler and King, 2009)

• My interests lie with mobile augmented reality games.
Mobile AR History in Context
Research Questions

1. What **flow** experiences do young elementary students have while playing a mobile digital augmented reality game?

2. What relationship exists between young elementary students’ mobile digital augmented reality game based learning experience and their **learning outcomes**?

3. How do **teachers** respond to their role as designers in design-based research involving game-based learning?
Setting: Moravian Academy 2nd Grade

• Located in historic district

• Colonial Moravian History is part of the current curriculum
## Participants

- **Students have a positive opinion of games**
  - Feel a high level of self-efficacy towards games
  - Possess a positive attitude toward learning with games

- **Teachers all had 10+ years of teaching experience**
  - Original curriculum designed by one of the teachers
  - Were "open to doing something new" with the curriculum

<table>
<thead>
<tr>
<th>Year</th>
<th>Classes</th>
<th>N Teachers</th>
<th>N Students</th>
<th>Student Game Attitudes Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>3</td>
<td>3</td>
<td>unknown</td>
<td>Unknown</td>
</tr>
<tr>
<td>1</td>
<td>3</td>
<td>3</td>
<td>37</td>
<td>4.45</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>2</td>
<td>22</td>
<td>t/k</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>2</td>
<td>unknown</td>
<td>t/k</td>
</tr>
</tbody>
</table>
The Dye house only has 3 walls standing. The building was next to the Grist mill. The Dye house only has three walls standing because it was from the colonial Moravian times and that was a long time ago. The dyes came from natural materials.
Revising Curriculum?

Historical Sites
School Buildings
2nd Grade Building
## Methodology

<table>
<thead>
<tr>
<th>Units</th>
<th>XX second graders ages 7-9; grouped in pairs or triads determined by teachers</th>
<th>Approx. 60% female</th>
<th>Multiple classes of 10-13 students; 5-7 pairs or triads</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatments</td>
<td>Groups played AR iPad Game</td>
<td>Teacher-led class debrief sessions after each play session</td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>Assessed flow rates of groups through observations, assessed individual flow rates through survey, post-treatment full class debrief, and selected student interviews (RQ1)</td>
<td>Assess individual learning through teacher-designed curriculum-aligned posttest, debrief, and interviews (RQ2)</td>
<td>[Year 2: Added start-of-unit pretest, more extensive observation, and “stealth” in-game pre/post assessments]</td>
</tr>
<tr>
<td>Settings</td>
<td>Historic district and school campus</td>
<td>Classroom for debrief</td>
<td>School conference room for interviews</td>
</tr>
<tr>
<td>Timing</td>
<td>Each class had 2 play sessions within 5 days.</td>
<td>All classes participated over a 3 week period.</td>
<td></td>
</tr>
</tbody>
</table>
The Game

• Utilized ARIS platform
• GPS triggered AR
• Introduction in classroom
• Students played in pairs or triads
Quests, Levels, & Inventory!

What Animal?
Help us remember what animal is on the Moravian Seal! Go to the front of the Central Moravian Church.

Grave Concerns
Go find the Mohican Indian named Tschoop. He needs help!

-2 Spirit Health : 2 Left

Quest Completed
Missing Missionary
In fact, here is a picture of recruiting some Indians about God.
Exit
Continue

Level 2 - Apprentice
You've leveled up!
Level 2 - Apprentice
Continue

Level 2

Inventory

- Child's Red Ribbon
  x1

- Hat
  x1

- Spirit Health
  x4

There are some Mohican Indians visiting who want to learn about God.
What we need is a MISSIONARY!
Find the right person on the MAP!
Customs of Society

Action of Game

Ah, to renew your spirit we must pray.
Tap to Continue

To pray and get more spirit health, type PRAY into your decoder.
Go in peace.
Feeling like a game...

New Moravian History Mystery
A strange thing has happened in Bethlehem. All of the adults have completely forgotten the history of the colonial Moravians! We need kids to help us restore our missing memories! Complete quests to earn the rank of Master Moravian Historian!

Join A Choir
To blend in with the Moravians, you must join a CHOIR. Choose a secret code and enter it into the DECODER in your menu.
Here are the codes:
Children's Choir code: child
Married Choir code: marry

Count Zinzendorf

The Chickens Have Escaped!
Oh no!
Someone left the gate open and the community’s chickens have escaped!
Quick! Go catch the chickens! You need to get 5!
You have 3 minutes!
Stealth Assessment
Pre and post gameplay

Before we begin, we have to verify that your historical memory is still intact. You have already begun learning about the Moravians in your classroom. Let’s see if any of that info is still in your memory.

Continue

Question 1:
Can you tell me 3 ways the lives of colonial Moravians were different than your life is today?

When you’re done, scan agent code 2.

Record your answer in Mission Control

All Notes
My Notes

Cancel
Audio Note

Cancel
Audio Note

Cancel
Audio Note

Save

Julieoltman.com
Data Analysis

Qualitative data was used to triangulate and contextualize quantitative findings.

Quantitative sources:
- [Game Attitudes Questionnaire]
- Flow Questionnaire
- Post-unit test scores.
- (Year 2: Pretest + posttest)

Qualitative sources:
- Observer and researcher notes
- Post-play debrief sessions
- Teacher interviews and short answer questionnaire
- Student interviews

Image: http://gregmaciag.typepad.com/.a/6a00d8345242c469e2017c382d6256970b-pi
Findings - Flow

Students experienced high rates of flow.

Year 1 - Flow questionnaire results.

<table>
<thead>
<tr>
<th>Class</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1</td>
<td>13</td>
<td>4.36</td>
<td>.35</td>
</tr>
<tr>
<td>Class 2</td>
<td>13</td>
<td>4.23</td>
<td>1.06*</td>
</tr>
<tr>
<td>Class 3</td>
<td>11</td>
<td>4.67</td>
<td>.38</td>
</tr>
<tr>
<td>Overall</td>
<td>37</td>
<td>4.41</td>
<td>.70</td>
</tr>
</tbody>
</table>

(*Student #17 in class 2 had a very frustrating time with his partner who wouldn’t share the iPad and reported all 1’s on his Flow questionnaire)

Year 2 - to come

Observations, field notes, and debrief session transcripts support this finding of flow.

- "Sometimes, I felt like it was so real that I almost wanted to touch it, like shake the person's hand." (20-C2D1-13)
- “It felt like it was only ten minutes long.” (10-C1D2-2)
- "Level 2, YES!” [fist pump] (B1A-OS-51)
Findings - Flow

There were some potential barriers to flow:

- Trouble seeing the iPad in direct sunlight
- Trouble navigating - not understanding geospatial concepts
- “Glitches” with GPS triggering
- Trouble sharing iPad with partner

However, these did not appear to pull students out of the “magic circle”.
Findings - Learning

- 61% of students performed better on game content than non-game content.

- Students who performed below 85% on non-game content (N=13) all but 1 scored higher on game related items than non-game related items. The one exception (StuNum 7) was one of two students who missed a gameplay session, being absent on the second day.

- This concomitant variation suggests that the gameplay experience enhanced students’ learning, particularly among students who were less academically successful.

### Year 1 - Unit test results.

<table>
<thead>
<tr>
<th>Class</th>
<th>N</th>
<th>Total Test Avg</th>
<th>Game related items</th>
<th>Non-game related items</th>
<th>Margin between game and non-game scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1&lt;sup&gt;a&lt;/sup&gt;</td>
<td>12</td>
<td>67.1%</td>
<td>71.7%</td>
<td>62.1%</td>
<td>+7.5%</td>
</tr>
<tr>
<td>Class 2&lt;sup&gt;b&lt;/sup&gt;</td>
<td>13</td>
<td>88.2%</td>
<td>95.3%</td>
<td>91.7%</td>
<td>+2.6%</td>
</tr>
<tr>
<td>Class 3</td>
<td>11</td>
<td>93.0%</td>
<td>95.0%</td>
<td>91.1%</td>
<td>+3.9%</td>
</tr>
<tr>
<td>Overall</td>
<td>36</td>
<td>83.0%</td>
<td>87.6%</td>
<td>81.9%</td>
<td>4.6%</td>
</tr>
</tbody>
</table>

<sup>a</sup> StuNum 7 was absent during the 2<sup>nd</sup> day of game play and StuNum 12’s test score was not made available to the researchers; <sup>b</sup> StuNum 17 had a very poor gaming experience due to partner issues.

Year 2 - to come
Findings - Learning

**Teacher:** And you had to get them in order. Do you remember the order of the buildings? What was the first one? Henry? Do you remember?

**Henry:** The oldest?

**Teacher:** The oldest one. What was it called? Or do you remember how it was spelled?

**Henry:** [spelling out loud] S-A-A-L?

**Teacher:** S-A-A-L, good. And we call that, the way we say that is Saal [pronounced it correctly with a z sound]. Saal, the s sounds like a z. Good. Greg, what was the second one built?

**Greg:** Old Chapel

**Teacher:** The Old Chapel and [pause] Gillian?

**Gillian:** Central Church!

**Teacher:** Central Moravian Church, right! ... we'll be going to the uh Museum and you'll see how they went from having their chapel in a room and the reason why they had to build a bigger church was the Chapel and then a bigger one. So you'll be able to...understand why better once you see that small Saal and then why they had to keep building bigger churches...
Findings – Learning

• Mobile digital game-based learning preferred over traditional learning
  “Like it was more, I mean the game…it had like more, it wasn't just a whole page with um with just one…kind of Moravian...” (S22-C2D1-112).

• Mobile GBL is preferably experienced with a friend
  “I mean like more fun to do it together, we can explain what's happening to each other, and we can um solve out problems together.” (S15-I-55)

• Playing in small teams led to lots of peer scaffolding
  “because I know the child's personality, the one whose a little bit higher, he probably would have been a little pushier in the classroom...as opposed to the game...he was just enjoying the game so much...I really think that helped him be a helper...to succeed with the game.” (T3-TD1-156-159)
GBL Implications

Serious games for social studies can be effective with young elementary students.

"As we were reading through the information, they would make references to things they learned in the game or things they did in the game. I think that's a little bit empowering for them because they're like hey, we already know about this. Whereas before, they didn't know anything until we told them." (T2-TD1-33)
Evolution of teachers-as-designers

Year 1 - Pre Unit  Year 1 - During Unit  Year 1 - Post Unit  Year 2 - Pre Unit  Year 2 - Post Unit

Passive
- What did you bring us?
- Sounds fun
- Nice enrichment activity to curriculum

Engaged
- Play testing
- Recognizing game impact on learning
- Noting game breakdowns
- Making Suggestions
- Planning implementation

Driving
- Want to continue & expand
- Looking for other GBL opportunities
- Understanding game design principles
- Brainstorming new levels
- Game is central piece of curriculum
Next phase?

Ownership
• "We want to implement the following changes..."

Independent Development
• Build without help of researcher

“Mission”-aries for GBL
• Aid other teachers
• Have students build
Game Design Implications

For young learners:

• Geospatial skills require significant scaffolding

• Reading requirements needed to be both grade level and not distracting to gameplay.

• Video content was not received well in initial testing.

• Certain types of gaming activities were popular and well received such as collecting items, typing codes, and figuring out the right order.

• Curriculum content needs to be an active part of the game experience and not provided as "additional info".

• Teachers provided valuable insights that guided the researcher’s design process.
Questions?

Julie Oltman
julie.oltman@lehigh.edu
@joltman1

Dr. Thomas Hammond
hammond@lehigh.edu

arisgames.org