

“I Almost Wanted to Touch It”

Flow and Learning in Game-Based History
Education with Augmented Reality for Early
Elementary Students



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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)



Example?

Pre-existing curriculum for 2nd grade Colonial Moravian History unit



Dye house

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.



THE FIRST HOUSE

The first house was made of Log
One side of the house was for People
The other side was a stable for animals
Upstairs was a place to sleep

Draw three Moravians in the room on the right.
Draw a cow and a horse in the room on the left.
Draw a little girl praying in the room upstairs.
Draw two chimneys on the roof.
Finish the picture your own way.



	We Know	We Think	Want to Learn
Favorite	different ribbons	Moravians are all gone	who wore what color ribbon
My Lessons	thresh wheat berries		year to arrive?
Tools	boys - barn - tools no electricity		how they built
Board	gender different schools		where did they live?
	quills - ink - walnuts		gardening?
	German Doors		pets?
	women - hats		Why Moravians?
	child/yokes/H ₂ O		
	food/wild - grew		
	different houses		

The opportunity

- Games can be engaging and have been shown to improve learning outcomes.
(Kiili, 2005; Sweetser & Wyeth, 2005; Bressler, 2014; Van Eck, 2006; Steinkuehler and King, 2009)
- Teachers open to augmenting/revising existing curriculum.
- History is well-suited for a mobile AR game.

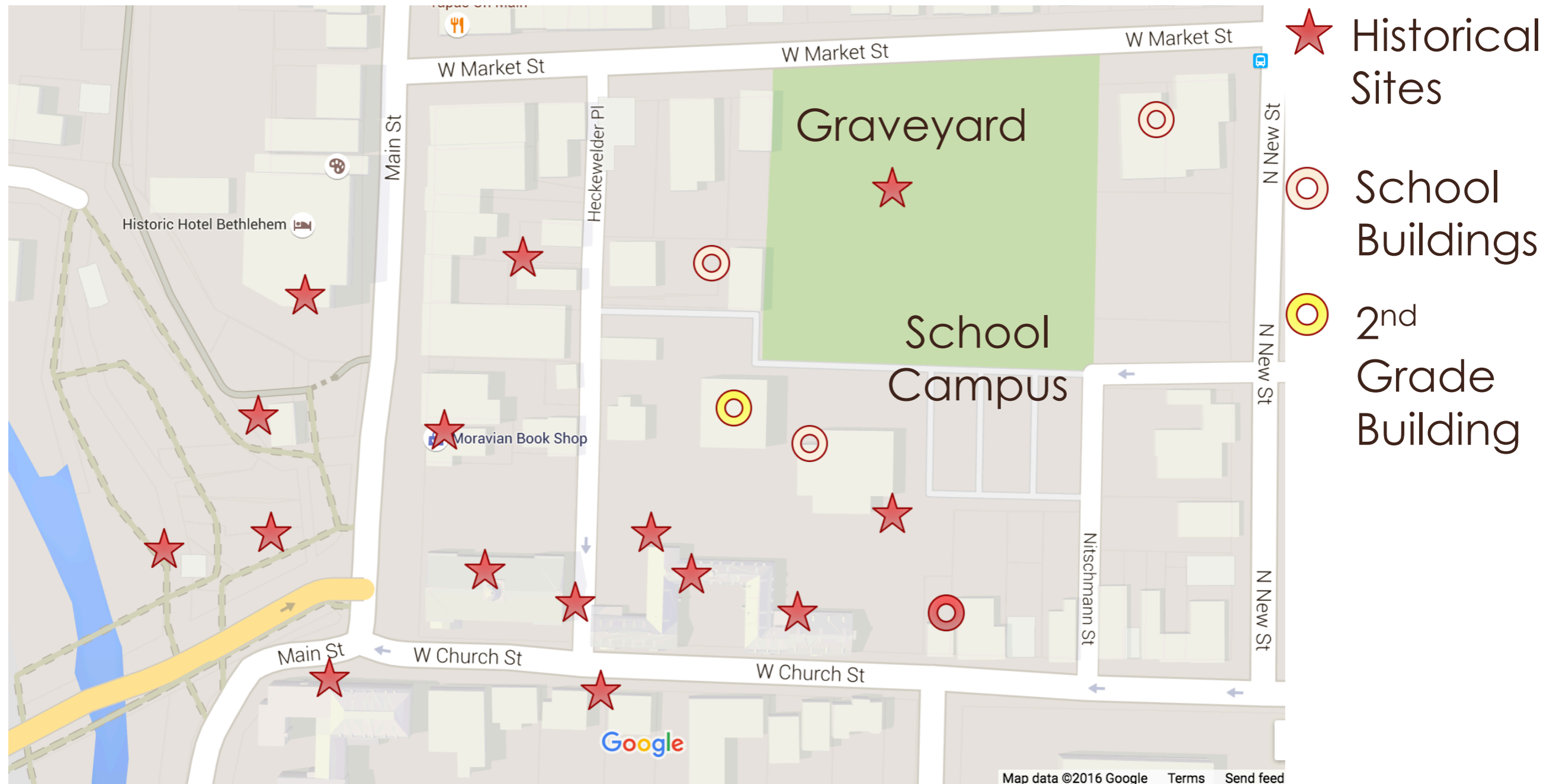




Mobile Game → AR → History in Context

Setting & Participants

- Private, urban school located in historic district
- 3 Classes of 2nd grade students & teachers
- Colonial Moravian History is part of the current curriculum



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**?

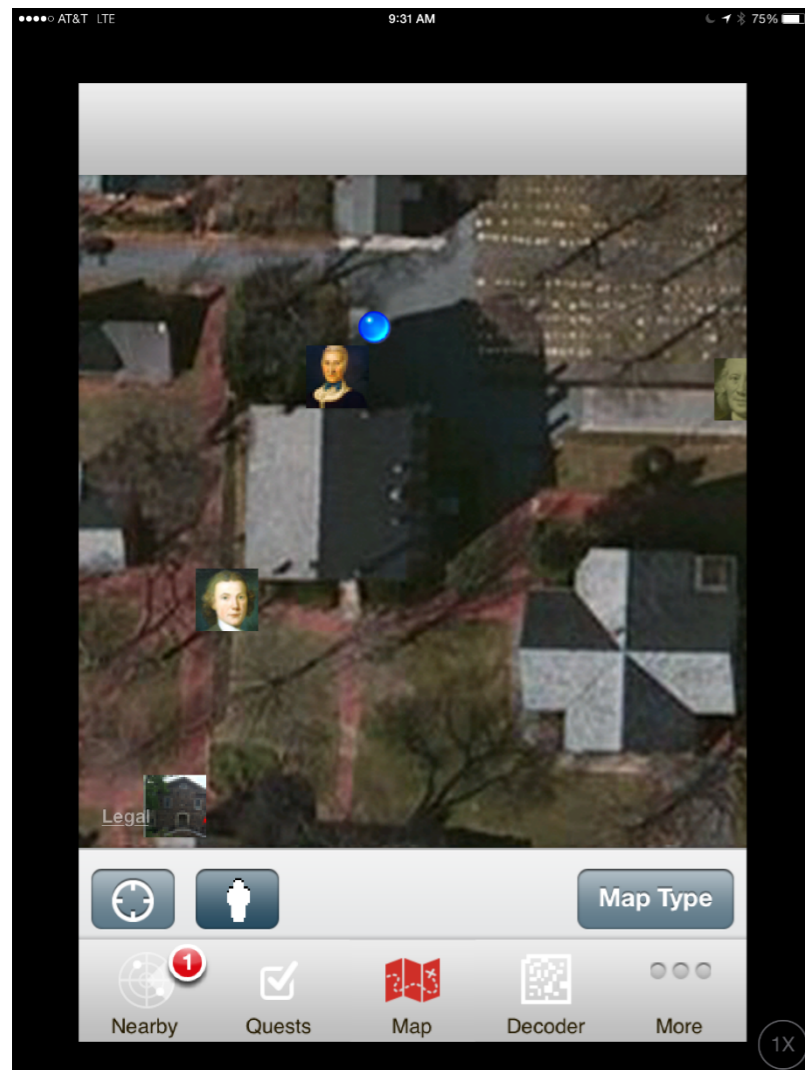
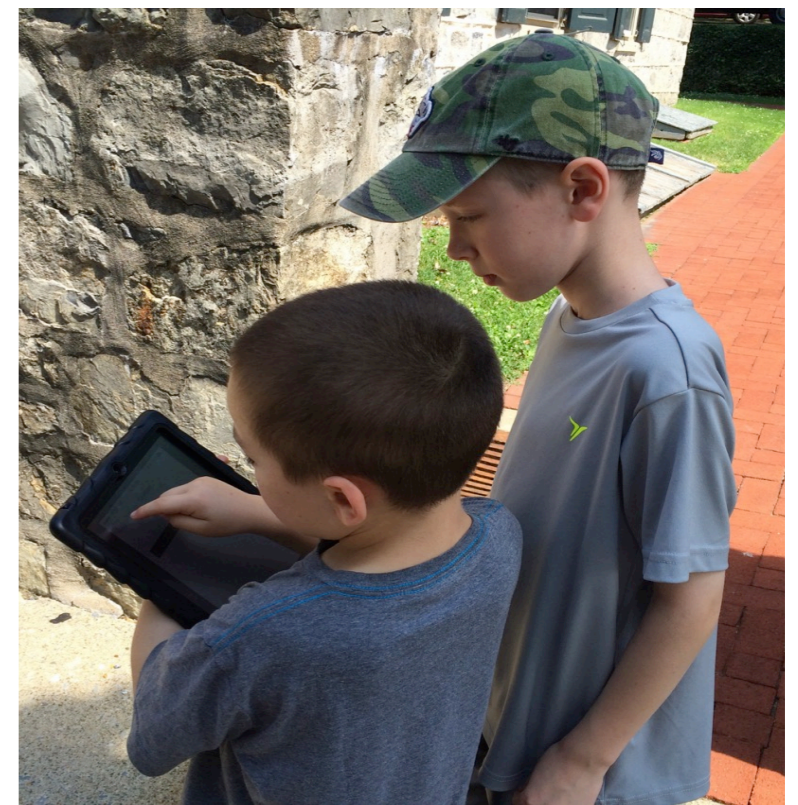
Methodology

- Design-based research approach
- Mixed methods
- For 3 class, 2 days of play, debrief, & self-reporting

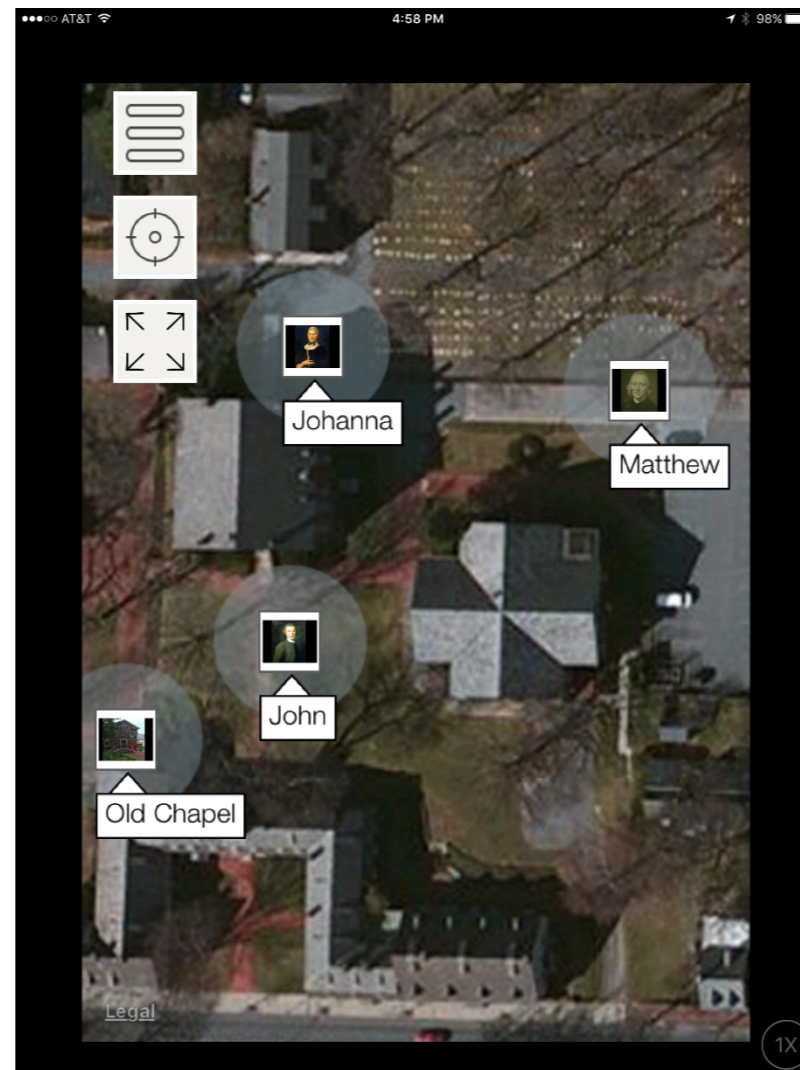
UNITS	37 second graders ages 7-9; grouped in pairs or triads determined by teachers	Approx. 60% female	Multiple classes of 10-13 students; 5-7 pairs or triads
TREATMENTS	Groups played AR iPad Game	Teacher-led class debrief sessions after each play session	
OBSERVATIONS	Assessed flow rates of groups through observations , assessed individual flow rates through survey , post-treatment full class debrief , and selected student interviews (RQ1)	Assess individual learning through teacher-designed curriculum-aligned posttest, debrief, and interviews (RQ2)	[Year 2: Added start-of-unit pretest, more extensive observation, and “stealth” in-game pre/post assessments]
SETTINGS	Historic district and school campus	Classroom for debrief	School conference room for interviews
TIMING	Each class had 2 play sessions within 5 days.	All classes participated over a 3 week period.	

The Game

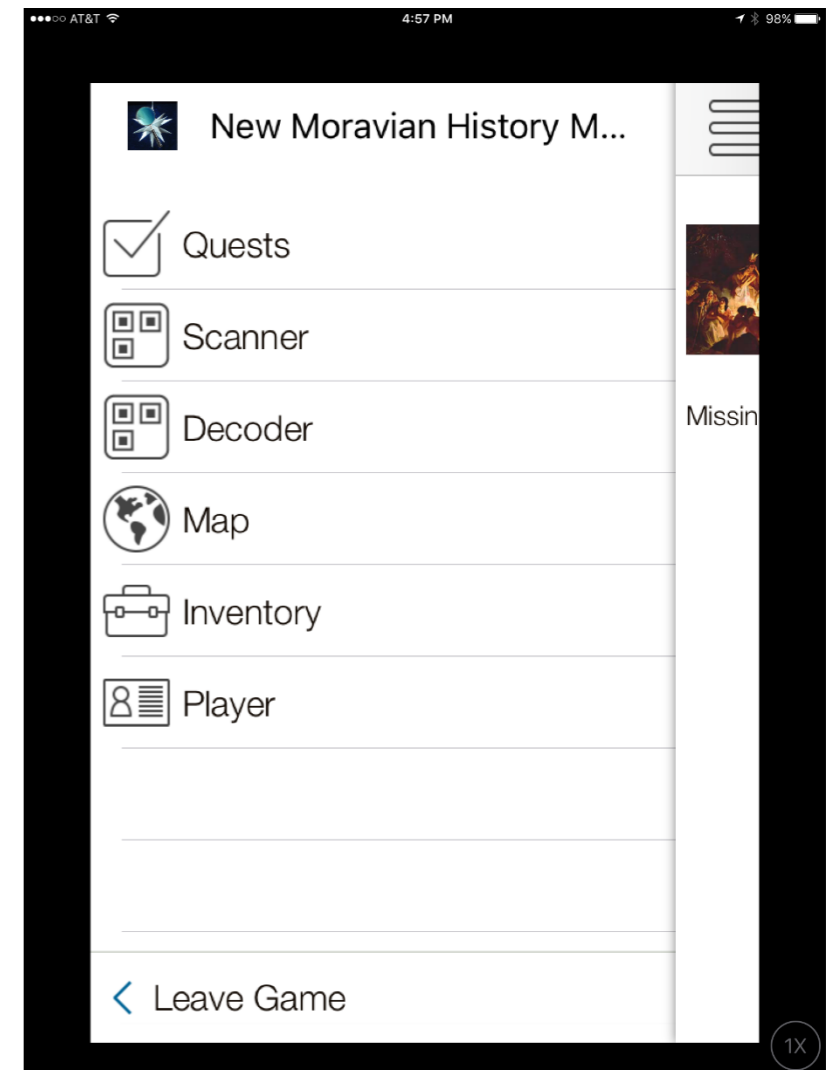
- Utilized ARIS platform
- GPS triggered AR
- Introduction in classroom
- Students played in pairs or triads



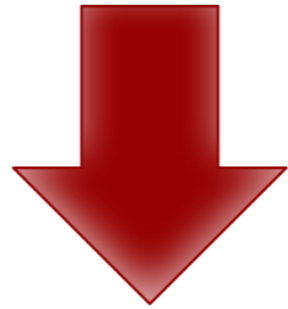
Year 1 Map



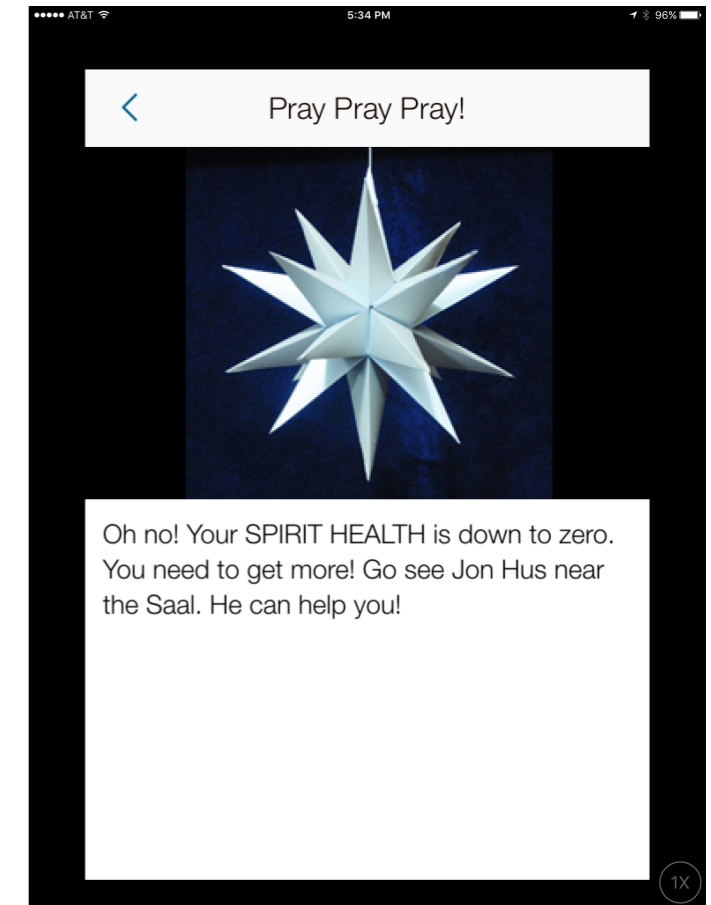
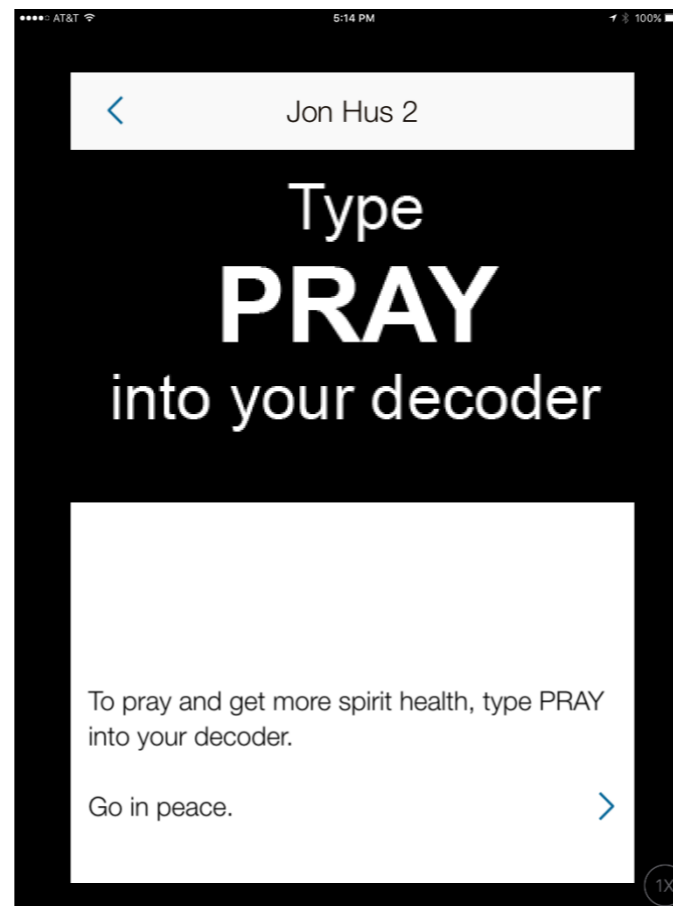
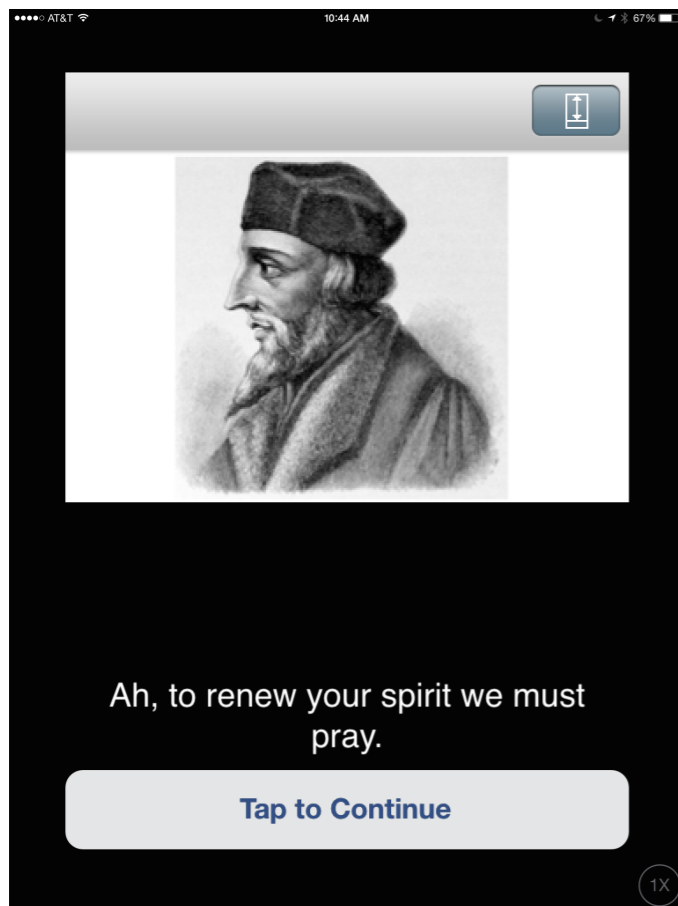
Year 2 Map



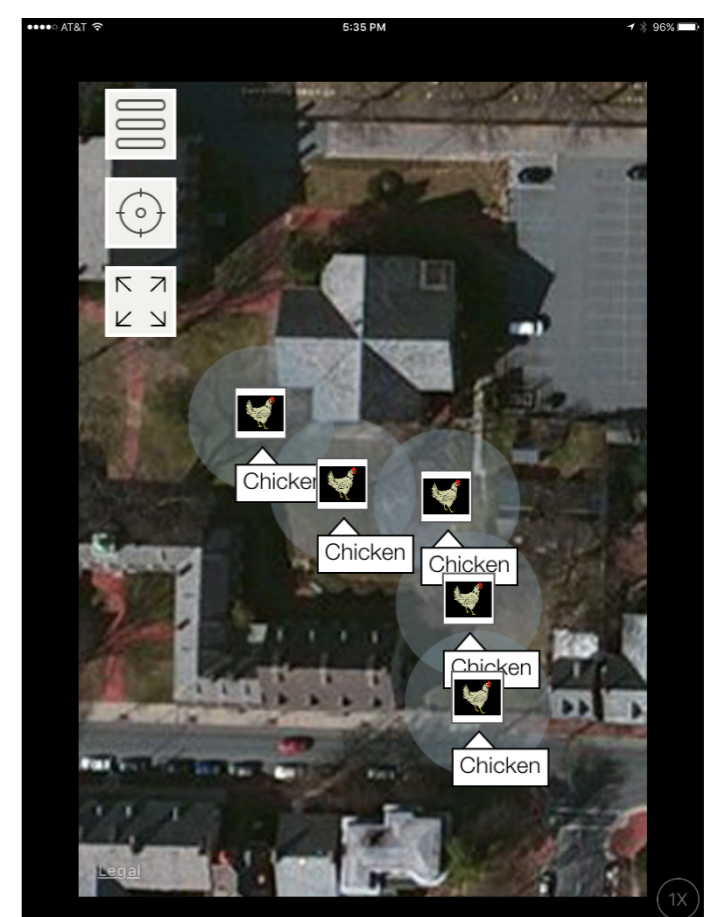
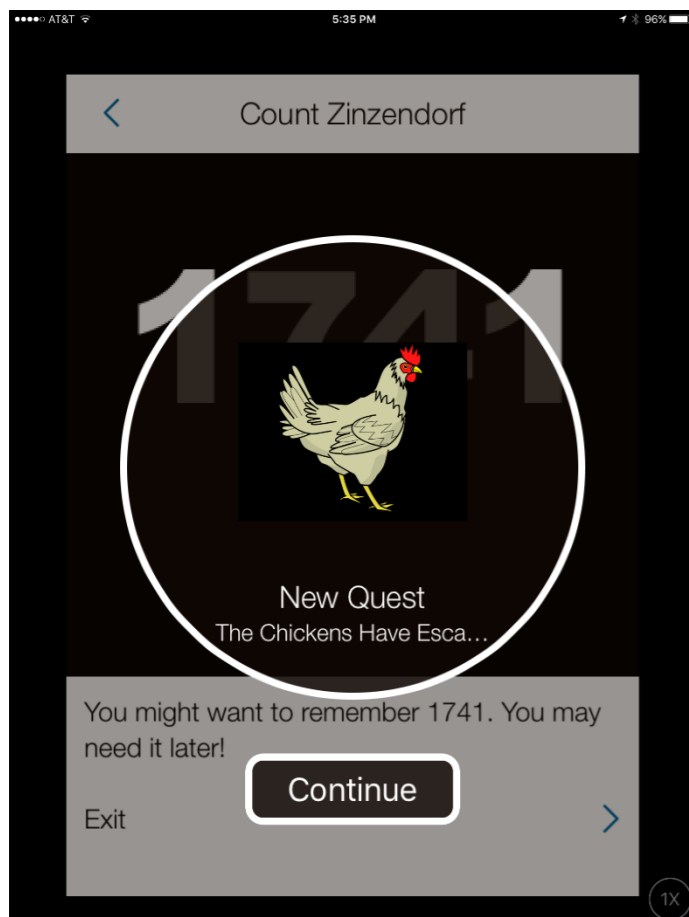
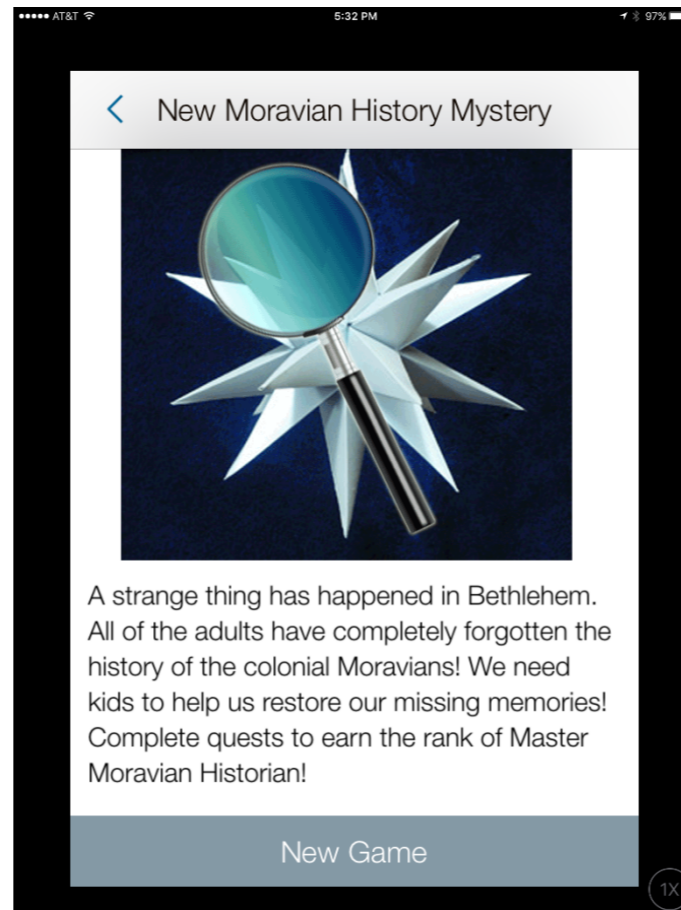
Customs of Society



Action of Game



Feeling like a game...



Data Analysis

Qualitative data was used to triangulate and contextualize **quantitative** findings.

Quantitative sources:

- [Game Attitudes Questionnaire]
- Flow Questionnaire
- Post-unit test scores.

Qualitative sources:

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



Findings: Flow (RQ1)

Students experienced high rates of flow.

Year 1 - Flow questionnaire results.

	N	Mean	Std. Deviation
Class 1	13	4.36	.35
Class 2	13	4.23	1.06*
Class 3	11	4.67	.38
Overall	37	4.41	.70

(*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)

Flow, cont'd

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 (RQ2)

- Almost two-thirds, 61%, of students performed better on game content than non-game content.

Year 1 - Unit test results.

	N	Total Test Avg (SD)	Game related items	Non-game related items	Margin between game and non-game scores
Class 1 ^a	12	67.3% (21.6)	71.0%	63.6%	+7.3%
Class 2 ^b	13	92.2% (10.5)	93.5%	90.9%	+2.6%
Class 3	11	93.5% (9.2)	95.0%	91.9%	+3.1%
Overall	36	84.3% (18.6)	86.5%	82.1%	4.4%

(^a StuNum 7 was absent during the 2nd day of game play and StuNum 12's test score was not made available to the researchers; ^b StuNum 17 had a very poor gaming experience due to partner issues)

Learning, cont'd

- Split students into two groups: above / below the test average
- Lower-achieving students did better than those scoring above the mean. 6.4% vs 3.3%
- Of the 12 students scoring below the mean, only 3 had higher scores on non-game items than game-related items
- Of these 3, 2 had sub-optimal game experiences of either missing a game session due to absence (StuNum 7) or being frustrated by their partner (StuNum 17).
- This concomitant variation again suggests that **the gameplay experience enhanced students' learning**, particularly among students who were less academically successful overall.
- Findings supported by qualitative data

Year 1 - Unit test results: above vs. below mean

	N	Total Test Avg (SD)	Game related items	Non-game related items	Margin between game and non-game scores
Students below mean	12	61.2% (14.9)	64.4%	58.0%	+6.4%
Students above mean	24	95.9% (4.5)	97.5%	94.2%	+3.3%

Learning: Expanding the curriculum

- Qualitative data provided examples of learning beyond the intended curriculum
- At least 5 instances where students expanded the conversation beyond fact recall
- Example: after recalling the fact females were required to wear certain colors to indicate their societal status, one boy remarked that this practice was “sexist, which led to a class discussion regarding sexism.
- Several students expressed empathy for historical characters “It made me feel so happy we helped her.”

"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)

(Design themes)

- 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)

This study & GBL Implications

- Serious games for social studies can be effective with young elementary students
- This game was *integrated* into an existing curriculum. It did not stand on its own as the sole source of instruction.
- This positive **GBL** experience may exist in a **symbiotic relationship** within the **context of a full unit** that includes **other pedagogical approaches** for instruction, including direct instruction.
- Students who may not respond as well to traditional instruction do even better with game-based learning.
- Use of pairs or triads for gameplay accelerates peer scaffolding & this is recognized by both students & teachers.

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?

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