

**Mapping Our World to the Past, Present, and Future:**

**Preparing Geo-literate Students with PuzzleMaps**

**Sarah Newcomer**

**Jonah Firestone**

**Washington State University Tri-Cities**

Author Notes

Sarah N. Newcomer is an Associate Professor of Literacy Education in the Department of Teaching and Learning in the College of Education at Washington State University. Jonah B. Firestone is an Associate Professor of Science Education in the Department of Teaching and Learning in the College of Education at Washington State University. Please do not cite without authors' permission. The authors may be contacted at:

[sarah.newcomer@wsu.edu](mailto:sarah.newcomer@wsu.edu)

[jonah.firestone@wsu.edu](mailto:jonah.firestone@wsu.edu)

**Abstract**

Ongoing NAEP geography scores underscore the need to support students' geographic competence. PuzzleMap, an online, interactive learning platform, does just this. We report findings from a pilot and follow-up study showing that PuzzleMap provides a fun and engaging way for students *and* teachers to teach and learn geo-literacy.

*Keywords:* geoliteracy, maps, puzzles, student engagement

### **Study Background, Purpose, and Rationale**

Geographic literacy, or geo-literacy, is defined by National Geographic (2019) as “the ability to reason about Earth systems and interconnections to make far-reaching decisions” (para. #2). Geo-literacy involves the ability to understand the “interactions, interconnections, and implications” (para. 1) between humans and the planet. As environmental destruction and cultural conflicts deepen, these skills and understanding are more important than ever. Yet, many students lack geo-literacy skills. Eighth grade geography scores from the 2018 National Assessment of Educational Progress (NAEP) indicate that only 25% of eighth grade students performed at or above the NAEP Proficient level, a result not significantly different from 2014, however *significantly* lower than in 1994, when 28% of 8<sup>th</sup> graders scored at or above the proficient mark. Rather than making gains, the gap for U.S. students is increasing.

In order to address this gap, we conducted a pilot study in 2017 to investigate the potential for PuzzleMap™ (PM), an innovative online geospatial learning application, created by *SpherAware Geospatial Solutions*, a geospatial consulting and custom development company, to foster student engagement with geography. Results revealed that 5<sup>th</sup> graders who used PM regularly, in conjunction with their social studies curriculum, made significant gains from pre- to post-assessments (Authors, 2018). Building upon our pilot, we designed a follow-up multiyear study to investigate how the use of PM, might foster student *and* teacher engagement with geography, develop students’ geo-literacy skills, and improve learning related to social studies and STEM content. The following questions guided our research:

- 1) How does the use of PM foster student *and* teacher engagement with geography?
- 2) What curricular connections can teachers envision and create for teaching with PM?

## Preparing Geo-literate Students with PuzzleMaps

Due to a hiatus caused by the Covid-19 pandemic, we have thus far completed one full year of data collection. We report the findings from year one (2019-2020), focusing primarily upon teacher professional development and curricular design work.

### **Methodology**

Our study takes a qualitative approach (Merriam & Tisdell, 2016). Research took place as a partnership between a research-intensive university in the Pacific Northwest and local teachers. Data include video recordings of teacher professional development (PD), informal classroom observations of students working with PuzzleMap, and photographs of teacher- and student-created artifacts. Ten teachers (teaching Grades 3-8) began the study, but two withdrew due to schedule conflicts. Eight teachers completed all eight workshops across the 2019-2020 school year. We analyzed data inductively for emergent themes, using open-coding and thematic delineation techniques (Merriam & Tisdell, 2016). We established trustworthiness by cross-checking emergent themes between the researchers and by triangulating data.

### **Review of Literature**

Geography is a subject that has long been neglected in U.S. classrooms, especially after *No Child Left Behind* shifted the focus to the Common Core State Standards (e.g., Knighton et al., 2003; Hinde & Ekiss, 2005). Integrating geography, in particular, and social studies, more broadly, with other content areas, such as language arts and mathematics is one way to ensure that geography is not left behind (Hinde, 2005). By engaging their high school students in interdisciplinary studies of the earth, three teachers (biology, English, social studies) were able to guide their students to recognizing the interconnections between each content area and between themselves and the world (Daken et al, 2011). Studies have also shown that integrating geography and language arts improves reading comprehension (Hinde, 2007) and mathematical

reasoning (Dorn et al., 2005; Hinde & Ekiss, 2005). Learning geography, and the broader geo-literacy skills that connect to so many areas of the curriculum (i.e., civics, history, earth science, environmental science, and more) are vital for students to be able to make “far reaching decisions” with the necessary understandings and critical thinking skills they will need in the future. “In this increasingly complex and interconnected world, students who are equipped with skills of authentic inquiry and who know geography, civics, economics, and history can move forward with the confidence that they are prepared to engage with the world” (Reykdal, 2019).

### **Findings and Discussion**

Findings shared here primarily center upon the teachers’ experiences and the curricular content they created during the workshops. During the workshops, teachers: 1) discussed key concepts related to geo-literacy and the need to strengthen students’ geo-literacy skills; 2) worked with existing PM content; 3) engaged in an inquiry-based project to develop standards-aligned content for new PM material; and 4) shared periodic updates of their experiences observing students working with PM. We also conducted several classroom observations in the spring of 2020 before Covid-19 school closures. Please note that space constraints preclude including figures from the PM application and photographs of artifacts from the workshops and observations. If accepted, our presentation will provide this much-needed visual data.

### **PuzzleMap Provides a Fun and Engaging Way to Learn Geo-Literacy Skills**

The teachers reported that they, themselves, enjoyed working with PM. During our first several workshops, which for most, was the first time they had used PM, the teachers could be observed working intently while also talking and laughing with one another about the challenges they encountered in solving the puzzles. They enjoyed sharing when they correctly placed a puzzle piece and they also had fun racing one another and pointing out discoveries. One fourth

## Preparing Geo-literate Students with PuzzleMaps

grade teacher reflected, “For myself, I find the subtle aspects of the content clues manageable and interesting to investigate.” Teachers also shared their observations of their students while using PM and reported that students also enjoyed the challenges of solving PM. A sixth-grade teacher remarked, “It gives me goosebumps to see 31 students, engaged, helping each other, and navigating to figure out the different clues, and just to look that intently at a map. It’s so much better than the curriculum I’m supposed to use.” Another fourth-grade teacher commented, “Students loved working with PuzzleMap, it was engaging, and they didn't even realize they were learning. They saw it as play, but as a teacher I knew it was so much more than that.”

### **Teacher-Created Curriculum-aligned PuzzleMap Content**

After they became familiar with the existing puzzlemaps, teachers worked in grade level teams to create new content related to their specific curriculum that could be used to create customized puzzlemaps. The fourth-grade team created content aligned with Washington’s Ecoregions. The fifth-grade team researched and created content aligned with colonial America. The 8<sup>th</sup> grade social studies teacher focused on content for a Civil War puzzlemap, while the 3<sup>rd</sup> grade teacher planned a puzzlemap that teaches the various cultural regions within the U.S.

Creating content for each customized PM involved a series of steps. Several places within the PM application provide key information, and teachers needed to research the information they wanted their students to learn, either from their curricular materials and/or online sources. Teachers wrote summaries for each puzzle piece and provided additional information and images for each clue window and clue location. The first feature of a puzzle piece (beyond its shape and color) is the Clue Window. When a puzzle piece is selected, the Clue Window pops up and presents visual and textual information, including a name and an iconic image associate with the geographic area. Point Clues help the puzzle solver figure out where the puzzle piece

## Preparing Geo-literate Students with PuzzleMaps

goes and provide additional information. By clicking on each Point Clue's teaser text, a visual image pops up and points to the area of the base map where the piece belongs. Once the piece is placed, the puzzle solver can click on the Point Clue again and PM's program will zoom into that precise map location with even more information about the location/feature being highlighted, including hyperlinks that lead to external URLs allowing further exploration.

PM solvers learn spatial reasoning skills by studying the features of the base map, zooming in and out, considering the topographical features of the base map and the contours of the puzzle pieces, manipulating each puzzle piece until its correct placement is found. Students can also learn topographical skills by studying land features within the map, such as rivers, lakes, and mountains. Finally, students learn conceptual knowledge related to theme of the map.

### **Educational Significance**

In light of NAEP geography scores and the need for better geographic competence of Americans in general (de Blij, 2005; National Geographic Education, 2019), it is crucial to foster student engagement in geography as well as their geo-literacy skills. Geo-literate citizens need the critical reasoning skills necessary to make careful and informed decisions regarding their communities – local and global. In addition, by supporting students' geo-literacy, this study also promises support for improving students' capabilities in reading and STEM. These fundamental skills prepare students for college and careers in the 21<sup>st</sup> century (Hinde et al., 2007; Hinde, 2014). PM offers a new and promising resource for helping students to develop those skills.

## Preparing Geo-literate Students with PuzzleMaps

Table 1

### *Overview of Professional Development Workshop Content and Outcomes*

Workshop	Content & Outcomes
#1 - 10/8/2019	Self-assessed our own mental world maps; Discussed geoliteracy & why it's important; Explored the USA, South America, and Japan puzzlemaps & shared our discoveries
#2 - 11/12/2019	Explored possible lessons to use with PM; Activities teachers selected and/or created included writing and illustrating post-cards describing their virtual travels, summary writing about a particular region, using text features to locate information efficiently, and creating an "Escape Room"-style PuzzleMap challenge
#3 - 12/10/2019	Worked in grade-range groups to begin brainstorming curricular content for new PuzzleMaps. Ideas included: a U.S. cultural regions puzzlemap (3 <sup>rd</sup> grade), a Washington ecoregions puzzlemap (4 <sup>th</sup> grade), a colonial America map with Native lands basemap (5 <sup>th</sup> grade), and puzzlemaps showing historical periods and concepts, such as WWI alliances or imperialism (middle school); 5 <sup>th</sup> grade teachers shared students' hand-drawn postcards with information from using USA puzzlemap.
#4 – 1/28/2020	Worked in grade-range groups and utilized teachers' guides and other materials to begin creating content for chosen topic; Possible puzzlemap templates for new ideas were shared; 3 <sup>rd</sup> grade teacher shared her students' hand-drawn post cards with visuals and information about each state.
#5 – 2/11/2020	Creating content continued; Process for choosing images and categories for Clue Windows was elaborated; 4 <sup>th</sup> grade teacher brought student-created state cereal boxes featuring new "brands" like "Alabama Poppers" and "Big Sky Country Cereal." Cereal boxes showcased key information that students had learned through USA puzzlemap, such as climate, temperature, and info about Native peoples.
#6 – 3/10/2020	Creating content continued; New focus on finding iconic images for each puzzle piece and on locating data for each of the main informational categories.
#7 – 4/14/2020	Due Covid-19, we met virtually via Zoom. Teachers continued to research and create content, find iconic images, and locate data for each of the main information categories. Some began locating websites for point clues.
#8 – 12/1/2020	Regrouped and worked to complete new puzzlemap content. Washington EcoRegions and American Colonies teams were nearly able to finish their content. We planned to finalize the teacher designs and prepare for a fall 2021 study with students. This plan was put on hold due to ongoing Covid pandemic.

## References

Newcomer, S. N. (February 14, 2018). Can an online puzzle make geography fun and relevant?

*Instruct: EdTech Insights for Educators. EdSurge Newsletter No. 314.*



## Preparing Geo-literate Students with PuzzleMaps

<https://www.edsurge.com/news/2018-02-14-can-an-online-puzzle-make-geography-fun-and-relevant?>

De Blij, H. (2005). *Why geography matters: Three challenges facing America*. New York: Oxford.

Dorn, Ronald I., Douglass, John, Ekiss, Gale Olp, Trapido-Lurie, Barbara, Comeauz, Malcolm, Mings, Robert, . . . Ramakrishna, B. (2005). Learning Geography Promotes Learning Math: Results and Implications of Arizona's GeoMath Grade K-8 Program. *Journal of Geography*, 104(4), 151-160.

Hinde, E. (2014). Geography and the Common Core: Teaching Mathematics and Language Arts from a Spatial Perspective. *Social Studies Review*, 53, 47-51.

Hinde, Elizabeth R., & Ekiss, Gale Olp. (2005). No Child Left Behind...Except in Geography? GeoMath in Arizona Answers a Need. *Social Studies and the Young Learner*, 18(2), 27-29.

Hinde, Elizabeth R., Osborn Popp, Sharon E., Dorn, Ronald I., Ekiss, Gale Olp, Mater, Martha, Smith, Carl B., & Libbee, Michael. (2007). The Integration of Literacy and Geography: The Arizona GeoLiteracy Program's Effect on Reading Comprehension. *Theory and Research in Social Education*, 35(3), 343-365.

Knighton, B., Warren, C., Sharpe, R., Damasio, B. (2003). No Child Left Behind the impact on social studies classrooms. (In Focus). *Social Education*, 67(5), 291-295.

Merriam, S. B., & Tisdell, E. J. (2016). *Qualitative research: a guide to design and implementation* (4<sup>th</sup> ed.). Jossey-Bass.

National Assessment of Educational Progress (2018). See how eighth-grade students performed in geography. *The Nation's Report Card*.

<https://www.nationsreportcard.gov/highlights/geography/2018/>

## Preparing Geo-literate Students with PuzzleMaps

National Geographic (2019). What is geo-literacy? Retrieved from: [www.nationalgeographic.org](http://www.nationalgeographic.org)

Reyk Dahl, C. (2019). Social studies K-12 learning standards for social studies skills, civics, economics, geography, and history adoption statement. *Office of the Superintendent of Public Instruction*. <https://www.k12.wa.us/student-success/resources-subject-area/social-studies/social-studies-learning-standards>