

Mapping E-Commerce Locally and Beyond: CITT K12 Special Investigation Project

Thomas O'Brien, PhD

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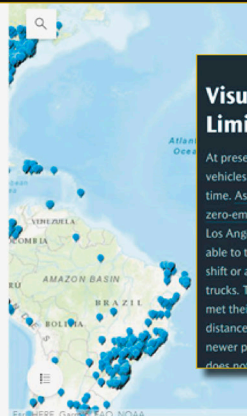


Who made my clothes?

The map to the right displays garment facilities worldwide. Scroll and click on blue icons to identify a facility.

The data was gathered from Open Apparel Registry (OAR), a neutral, non-profit organization. OAR created an open-source tool that maps garment facilities worldwide.

OAR assigns a unique ID number to each facility; this is to ensure that facilities are not double counted due to their inventory being voluntary by industry stakeholders. Industry stakeholders include multistakeholder initiatives (MSIs), brand and retailer



Visualizing Range Limitations

At present, the main limitations of the vehicles themselves is range and charging time. As part of a feasibility assessment of zero-emissions vehicles in 2018, the Port of Los Angeles set a threshold of needing to be able to travel a maximum of 600 miles in a shift or a maximum of 800 miles in a day for trucks. They found no HDEVs at the time met their requirements for maximum shift distance or daily mileage and based on newer published vehicle specifications this does not seem to have changed. Charging



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Executive Summary

As all aspects of the American workplace become automated or digitally enhanced to some degree, K12 educators have an increasing responsibility to help their students acquire the technical skills necessary to organize and interpret information. Increasingly, this is done through Geographic Information Systems (GIS), especially in careers related to transportation and logistics. Therefore, CITT has developed this K12 Special Investigation Project to introduce ArcGIS StoryMaps, an engaging, accessible and sophisticated web-based GIS application. With this project, CITT will provide professional development using technology that is readily accessible to both teachers and students. In addition, ArcGIS StoryMaps do not require licenses or fees and can be used with a primary browser.

The lessons developed center on e-commerce and its accompanying global environmental and economic impact, although the activities can be easily adapted to projects in any subject area, such as humanities, science, math, or language arts. This teacher blueprint includes a teacher training guide with ten detailed lesson plans and activities. With the guidance of a National Board-Certified Teacher in Early Adolescence Math as lead instructor, the curriculum is designed to align with Next Generation Science Standards (NGSS).¹ The lesson plans also incorporate exploration of STEM and GIS-related careers.

The K12 Special Investigation Project was developed in collaboration with teachers from the El Rancho Unified School District (ERUSD); California State University, Long Beach (CSULB); student leaders from MAES (Latinos In Engineering and Science); and, in an unanticipated development, with Career and Technical Education (CTE) and Geographic Information Science (GIS) staff from the Rio Hondo College (RHC).

ERUSD serves the city of Pico Rivera and is located in Southeastern Los Angeles County. Twenty percent of the city's population is involved in the goods movement industry; 12% of residents have a four-year college degree, and 91% are Latinx.² CITT's intention was for the blueprint to be piloted in this district once funding was secured. This was done so that middle school students could learn the foundations of using GIS to visualize, analyze, and present data through maps and stories. Teachers across disciplines could also effectively learn how to incorporate GIS and project-based learning methods in their curricula.

Another outcome not anticipated in CITT's original proposal is a pilot rollout of the teacher blueprint. This outcome came at the request of RHC. The participants in the project rollout include RHC students and certificated teacher-mentors participating in a U.S. Department of Education (USDOE) Supporting Effective Educator Development (SEED) grant as well as middle school teachers from Unified School Districts surrounding RHC, including East Whittier, El Rancho, Little Lake, El Monte, and South El Monte. The SEED grant participants are also

part of RHC's STEM-Career and Technical Education (CTE)/TEACH Teacher Preparation Pipeline Program which focuses on supporting community college students interested in becoming STEM and CTE teachers. The STEM-CTE/TEACH program addresses the critical current and future nationwide shortage of CTE and STEM instructors.³ An increased pool of CTE and STEM teachers will expand job education and training opportunities to meet local, regional, state, and national employment needs in various industries.

1. Introduction

The last twenty years have seen a rapid acceleration in integrating digital technology into the American workplace. This trend has affected job availability, level of pay, and potential for certain occupations to be automated in their entirety. According to one study, between 2002 and 2016, the share of jobs requiring medium or high levels of digital skill increased from 45% to 71% while experiencing wage growth of 0.3% and 0.8%, respectively.⁴ At the same time, jobs with low digital skill requirements dropped from 56% to 30% of occupations and saw a 0.2% decline in wages.⁵ This trend is increasingly relevant to logistics and transportation. Middle skill workers in supply chain management, for example, now encounter technologies such as blockchain, e-platforms like Uber Freight, and data analytics.^{6 7}

Accordingly, K12 educators must now shoulder increasing responsibilities for equipping their students with digital skills. One promising and engaging approach to doing this is the use of Geographical Information Systems (GIS).

Spatial thinking must be recognized as a fundamental part of K–12 education and as an integrator and a facilitator for problem-solving across the curriculum. Moreover, with advances in computing technologies and the increasing availability of geospatial data, spatial thinking will play a significant role in the information-based economy of the twenty-first century.⁸

GIS enables students and teachers to practice and apply spatial thinking in many areas of the curriculum. In short, lessons resonate more deeply when students are presented with map-based material.⁹ Professor Warren Roberts, CITT's new GIS partner at RHC, created a StoryMap entitled, "See What Others Can't See." He writes that

Spatial analysis allows you to solve complex location-oriented problems and better understand where and what is occurring in your world. It goes beyond mere mapping to let you study the characteristics of places and the relationships between them. Spatial analysis lends new perspectives to your decision-making and classroom discussions involving locating, filtering and extracting the correct data to address spatial problems... much of that data is available online.¹⁰

Roberts also notes that more community and four-year colleges are investigating GIS as general education, foundational classes such as Quantitative Thinking at RHC and Critical Thinking at CSULB.

With these recommendations in mind, CITT developed the K12 Special Investigation Project to help middle school teachers incorporate GIS into their curriculum and enhance students' digital skills and spatial reasoning. The project uses ArcGIS StoryMaps, a free browser-based application that can be accessed on a Chromebook. StoryMaps provide relatively simple tools for organizing text and visuals with geographic information. Since public schools are supplied with Google Chromebooks, teachers are often more accustomed to using Google applications than Microsoft

Windows.¹¹ For ease of use and accessibility, the CITT research team used Google applications such as Docs, Slides, and Sites to present and house the curricular resources.

In developing this project proposal, the CITT research team also incorporated best practices from a National Center for Sustainable Transportation white paper focusing on building a GIS workshop for high school students. Recommendations include strategies for developing both instructor and administrator buy-in and incorporating industry collaborations while developing curricula.¹² Accordingly, the project focuses on e-commerce and its environmental and economic impact. However, the StoryMap tools introduced in the project can be used in virtually all subject areas. The materials lend themselves easily to assignments in humanities, language arts, science and math.

The project provides teachers with the following resources:

- Google Slide presentations introducing GIS and StoryMaps
- Step-by-step guides to creating an account and navigating StoryMap's tools and options
- Ten lesson plans that guide teachers and students through the creation of a StoryMap from choosing a topic to conducting research and presenting the finished Map
- Several short videos where college students and graduates share their use of GIS and encourage interest in related STEM occupations
- A repository of additional curricular resources recommended by GIS subject matter experts from RHC

2. Deliverables

2.1 Student- and Teacher-Ready Resources, Curricula, and Teacher Training Guide

This project research team met bimonthly for three months to collaboratively design and complete the blueprint. The blueprint includes a teacher training guide, ten lesson plans with activities, sample StoryMaps, and an assessment rubric, among other resources. All of the necessary resources for the teacher training workshop are included on a Google Site. Teachers increasingly use Google Sites as a learning management system (LMS), especially with the COVID-19 pandemic when learning has been 100% virtual.

The lesson plans and Google Site design were also evaluated by a veteran teacher, administrator, and instructional coach for ease of use by instructors. As project-based learning (PBL) is not often successfully introduced to students in the classroom, the instructional coach advised that lesson plans include explicit directions and strategies to incorporate effective techniques.¹³ Frequently encountered barriers to PBL are problems in group dynamics, students not being accustomed to active learning, and lack of student engagement.¹⁴ The lead instructors embedded collaborative strategies into the lesson plans as a model for teachers to follow when planning lessons using PBL.

CSULB MAES student leaders stressed the importance of incorporating sustainability and environmental justice issues in the lesson plans. For example, one lesson plan includes maps, origins, and mileage (miles per transportation mode) to provide a rough calculation of the carbon footprint required for students to receive their e-commerce products. This assignment is based on a lesson plan from the Mineta Transportation Institute's Garrett Morgan Sustainable Transportation Competition Teachers' Guide.¹⁵ Also, based on MAES students' recommendations, CITT GIS researchers developed StoryMaps on lithium battery development and fast fashion and their effects on the environment. Included in the Google Site is also a link to ArcGIS StoryMaps related to causes and advocacy, with many focusing on environmental justice and other humanitarian issues, both national and international in scope.

2.2 Google Slides for Easy-to-Follow Directions on Creating StoryMaps

The CITT research team created Google Slides for teachers to learn how to create an ArcGIS StoryMap account. This included detailed directions (with graphics) on making a StoryMap; and a brief presentation on a comparison of Google Earth capabilities, ArcGIS StoryMaps, and QGIS – all free, easily accessible online web-based applications.

2.3 Student Videos

Also included on the Google Site are one-minute videos created expressly for this project that showcase CSULB and RHC students and graduates who tell their own stories about their journeys leading them to STEM education and careers. Examples include a GIS analyst for an electric vehicle charging infrastructure outfit, a GIS Manager working with the Los Angeles County Fire Department, and a student who is interested in wastewater treatment systems. These videos are embedded in lesson plans on career exploration.

2.4 Maps and Additional Resources for Teachers

CITT's GIS Research Coordinator developed a curated data catalog of maps that can be used to make StoryMaps and are incorporated into the Google Site. Curation was based on the location of the school districts surrounding RHC, as staff from these districts are the potential pilot participants. Additional GIS sources for teachers recommended by our technical subject matter experts at RHC are also uploaded onto the site.

2.5 CSULB College of Professional and International Education (CPIE) Digital Badge for K12 teachers in GIS Applications

One of this project's deliverables was the creation of a digital badge developed with the Director of the Office of Professional and Workforce Development at CSULB's College of Professional and International Education (CPIE). Most digital badges created at CPIE require a minimum of 30 class hours. As a further comparison, the National Education Association (NEA), the nation's largest labor union representing public sector teaching professionals, offers micro-credential badges with each micro-credential requiring, on average, 15 hours.¹⁶

CITT-partnering teachers advised that four hours is estimated to be an in-demand length for teacher professional development sessions, particularly during the COVID-19 pandemic. This is because teachers are currently working overtime, struggling to retain students and create and deliver content online. Because this session is substantially shorter than comparable micro-credentials targeted to teaching professionals, CITT did not pursue developing a digital badge.

3. Pipelines to Post-Secondary Educational Institutions

Proven best practices to reinforce the pipeline to post-secondary education include participation in STEM programs from an early age. This proposal comprises partnerships that include planning and curriculum advisement with regional educational partners. These partners include the 7th and 8th grade staff at the STEAM Academy at Burke Middle School (El Rancho USD); Project Lead the Way (PLTW)¹⁷ lead instructors at El Rancho USD; Rio Hondo College's Career Technical Education (CTE) Career Exploration Summer Academy (for middle school students); and CSULB's Latinos In Engineering and Sciences (MAES) Student Association.

All organizations identified in the proposal participated in this project. In addition, El Rancho Unified STEAM Academy/Project Lead the Way lead instructors met with the CITT research team and CSULB MAES leadership twice monthly for three months to design and create the curriculum.

Because of COVID-19, the CTE Career Exploration Academy at RHC was cancelled. However, Claudia Romo, CTE/StrongWorkforce Counselor, recommended that CITT partner with staff from the CTE Teacher Preparation Pipeline Program and GIS Department to roll out the pilot. These partnerships significantly strengthened this project, providing a platform for pilot project rollout, robust GIS and drone resources for teachers, and a CTE pathway for K12 students to four-year universities. These institutional partnerships include the STEM-CTE/TEACH Teacher Preparation Pipeline Program for students and working professionals to explore a career in teaching. This pipeline addresses the STEM and CTE teacher shortage while diversifying the teaching workforce and comprises ten California Community Colleges.¹⁸ The program also increases student matriculation rates to four-year institutions by providing a variety of wraparound student services. Pilot rollout participants also are participants in the U.S. Department of Education (USDOE) Supporting Effective Educator Development (SEED) grant at RHC.

3.1 Letters of Support

Letters of Support from Tor Ormseth, Project Lead the Way Lead Instructor at the STEAM Academy at Burke Middle School, El Rancho Unified School District and Claudia Romo, CTE/StrongWorkforce Counselor at RHC are included in the Appendix.

3.2 Budget for Future Project Rollouts

Table 1. Budget for Future Project Rollouts

Instructional Staff	Rate	Total Hours	Total Costs
Honorarium for Lead Instructor			\$517
CITT GIS Research Coordinator	\$42.42	9	\$382
CITT GIS Research Associate	\$19.10	9	\$172
Total			\$1,071

3.3 Timeline for Pilot Project Rollout

The timeline for project rollout includes six weeks to market, recruit, and register participants. A follow-up session will be held the day following the instructional session. A reflective session will follow in the fall of 2021.

4. Technical Transfer/Contributions to Practice

CITT GIS Research Associate Angelina Carballo delivered an online poster presentation at the Women In Transportation Seminar (WTS) International Conference in May 2021 entitled, “Make Way for the Next Generation: Attracting and Training the Transportation Workforce of the Future”, featuring this SB1 K12 project.¹⁹ CITT also plans to present this project at the National Center for Sustainable Transportation Student Summit in the fall. Other contributions to practice may include presentations at the 2022 Esri User Conference (Esri UC), the 2022 Esri Educator’s Conference, and the 2022 Urban and Regional Information Systems Association (URISA) Conference. In addition, RHC partners stated they would like to participate in future presentations showcasing this SB1 K12 project.

5. Summary & Conclusions

CSULB MAES student leadership members provided valuable insight into what students would like to see in the classroom. They strongly recommended that sustainability and environmental justice concerns be front and center in examining the effects of e-commerce locally, regionally, nationally, and internationally; CITT's project deliverables reflect these recommendations. This Gen Z cohort of students will comprise the workforce of the future and have the potential to lead in jobs associated with a carbon pollution-free power sector by 2035 and net-zero emissions economy by 2050, goals set by the Biden Administration in 2021.²⁰

This SB1 K12 Special Investigation Project also allows for the development of GIS skills for both STEM and non-STEM teachers. As the world relies more on data and spatial analysis for problem-solving, teachers of all subject matters can not only use StoryMaps as new curricular resources for content and data, but they also have the opportunity to create their material. Furthermore, GIS is increasingly evolving into foundational, general education courses at community colleges and universities. K12 students who have familiarity with its concepts and applications will be at an advantage upon entering post-secondary institutions. RHC is planning to develop GIS as the foundation for a CTE Pathway working with partners from K12, the California Community Colleges, California State Universities and the University of California system. This SB1 K12 Special Investigation Project served as a basis for this collaboration. Future partnership opportunities will be discussed with RHC following the pilot rollout in July 2021.

Endnotes

- ¹ A Next Generation Science Standard (NGSS) in Engineering Design (MS-ETS1-1) supports student learning outcomes for this project: Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.¹
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- ¹⁴ “3 Common PBL Problems—and Solutions,” Edutopia, accessed June 11, 2021, <https://www.edutopia.org/article/3-common-pbl-problems-and-solutions>.
- ¹⁵ “Garrett Morgan Sustainable Transportation Competition Teachers' Guide 2020_Final2.Pdf,” accessed March 22, 2021, https://transweb.sjsu.edu/sites/default/files/GM_Teacher%27s%20Guide%202020_Final2.pdf.
- ¹⁶ “Micro-Credentials | NEA,” accessed June 11, 2021, <https://www.nea.org/professional-excellence/professional-learning/micro-credentials>.
- ¹⁷ Project Lead the Way is a national nonprofit organization dedicated to developing STEM curricula in K12 classrooms.
- ¹⁸ “Teacher Preparation Program,” accessed May 3, 2021, <http://teacherprepprogram.org>.
- ¹⁹ “CITT’s Women Researchers Present at the 2021 WTS Virtual Annual Conference | CSULB,” accessed June 11, 2021, <https://www.cpie.csulb.edu/news/article/citt-s-women-researchers-present-at-the-2021-wts-virtual-annual-conference>.

²⁰ “FACT SHEET: President Biden Sets 2030 Greenhouse Gas Pollution Reduction Target Aimed at Creating Good-Paying Union Jobs and Securing U.S. Leadership on Clean Energy Technologies,” The White House, April 22, 2021, <https://www.whitehouse.gov/briefing-room/statements-releases/2021/04/22/fact-sheet-president-biden-sets-2030-greenhouse-gas-pollution-reduction-target-aimed-at-creating-good-paying-union-jobs-and-securing-u-s-leadership-on-clean-energy-technologies/>.

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Appendix A

Rio Hondo College Letter of Support, June 15th 2021

Dear Dr. O'Brien,

On behalf of the Career Technical Education Division faculty, staff, and administration, I submit this letter of support for the SB1 K-12 Special Investigation Project: Mapping E-Commerce and Beyond as organized by The Center for International Trade and Transportation (CITT), California State University Long Beach (CSULB), College of Professional and International Education (CPIE).

We are excited to partner with CITT CSULB in the endeavor of exposing middle school students to Geographic Information Systems. We believe that introducing students to the skills of developing their own story maps while also drawing upon the data gathered from their local communities through GIS is an invaluable resource that can impact their career pathways as they transition to high school and beyond.

We are committed to this partnership by offering a space on our campus to facilitate trainings, build a connection with GIS professionals and middle school teachers from our local K-8 districts and coordinate a summer experience for middle school students that participate in the project over the next academic year.

We look forward to building and expanding this partnership to develop a solid pathway from middle school to high school and Rio Hondo College to CSULB that exposes all students to important skills within GIS.

Please let me know if you need additional assistance.

Sincerely,



Mike Slavich
Career Technical Education Division/
Instructional Operations, Dean
562-908-3460
mslavich@riohondo.edu

The STEAM Academy @ Burke letter of support, June 14th 2021

To Whom it May Concern,

This letter is to verify that Project Lead the Way and technology teachers at the STEAM Academy will be participating in and contributing to the work of the SB1 Special Investigation Project as organized by the Center for International Trade and Transportation (CITT) at CSU Long Beach

We believe the project has tremendous potential for helping our students acquire digital skills in the area of geographic information systems (GIS), and we look forward to involving our classes in using ArcGIS StoryMap applications. Our involvement will encompass:

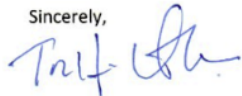
Participating in designing and writing lesson plans to promote the use of GIS.

Implementing professional development on those lessons for colleagues within the El Rancho Unified School District as well as surrounding areas, and

Using the lessons with our own students as projects in our project Lead the Way pre-engineering classes as well as other technology-based courses.

Please let us know if we can provide any further information on our involvement. We look forward to this exciting opportunity to collaborate with CITT!

Sincerely,



Tor H. Ormseth
PLTW, Math & Robotics Teacher



The STEAM Academy @ Burke

8101 Orange Ave. Pico Rivera, CA 90660
(562)801-7059

June 14, 2021

To Whom It May Concern:

This letter is to verify that Project Lead the Way and technology teachers at The STEAM Academy will be participating in and contributing to the work of the SB1 Special Investigations Project as organized by the Center for International Trade and Transportation (CITT) at CSU Long Beach.

We believe the project has tremendous potential for helping our students acquire digital skills in the area of geographic information systems (GIS), and we look forward to involving our classes in using ArcGIS StoryMap applications. Our involvement will encompass:

- Participating in designing and writing lesson plans to promote the use of GIS,
- Implementing professional development on those lessons for colleagues within the El Rancho Unified School District as well as surrounding areas, and
- Using the lessons with our own students as projects in our Project Lead the Way pre-engineering classes as well as other technology-based courses.

Please let us know if we can provide any further information on our involvement. We look forward to this exciting opportunity to collaborate with CITT!

Sincerely,

Tor H. Ormseth
PLTW, Math & Robotics Teacher

A Magnet Middle School for the 21st Century

Lorin Yannarella
Principal

Ana Fisher
Assistant Principal

Monique Gavilanes
Counselor

About the Authors

Deanna Matsumoto

As Education and Workforce Program Developer, Ms. Matsumoto supports CITT's programmatic efforts in K12 initiatives, workforce development, project management, curricular and instructional development, and white paper development. With over 20 years of teaching and curriculum design experience, she has served on the leadership teams of two K12 Western Association of Schools and Colleges (WASC) accreditation committees and as Subject Matter Expert for the Los Angeles Regional Adult Education Consortium (LARAEC), focusing on curricular design, standards, and collaborative partnerships. Ms. Matsumoto is a state and regional recipient of the California Council of Adult Education Excellence (CCAE) in Teaching award and national recipient of the Edward McClure Award from the Association of Collegiate Schools of Planning and the History Research Prize from the Society for American City and Regional Planning. She has served as both program developer and manager for the California Sustainable Freight Action Plan Workforce Development Pilot Certificate Project created in partnership with the California Energy Commission and the Governor's Office of Business and Economic Development. Her recent publications include research on critical trucking and logistics workforce development. Ms. Matsumoto received her bachelor's degree from Yale University and her master's degree in Architecture and Urban Planning from the University of California, Los Angeles.

Dr. Thomas O'Brien

Dr. Thomas O'Brien is the Executive Director of the Center for International Trade and Transportation (CITT) at California State University, Long Beach (CSULB) and the Deputy Director of the METTRANS Transportation Consortium, a partnership of CSULB and the University of Southern California. He also serves as the Director of the Southwest Transportation Workforce Center (SWTWC), one of five regional workforce centers originally funded by the US DOT Federal Highway Administration. He previously served as CITT's Director of Research. Dr. O'Brien is Chair of the oversight committee of the National Science Foundation's National Center for Supply Chain Automation and a member of the Transportation Research Board's Intermodal Freight Transport Committee, where he serves as Vice Chair, and Urban Freight Committee. He also serves on the Boards of the Los Angeles Transportation Club, Harbor Association of Industry and Commerce and National Transit Institute. Dr. O'Brien has a Master's degree in Urban Planning and Development and a Ph.D. in Policy, Planning, and Development from the University of Southern California. He is both a former Eno and Eisenhower Transportation Fellow.

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