Data **LITERACY**

Demonstrating the Distribution of Innovation and Entrepreneurship Using Patent Data and a Mapping Tool: GeoFRED® Marks the Spot

Standards and Benchmarks (see page 13)

Lesson Description

Students learn about innovation, the distribution of innovation across the country, and what can be patented. Working in groups, they examine patents and consider the changes the patents brought. They then use a mapping program and interpret data from that map to consider how local resources promote innovation.

Objectives

Students will be able to

- define innovation,
- define patents as protection of intellectual property,
- explain how patents promote entrepreneurship,
- interpret a map of patents assignments by county, and
- explain the relationship between education, research institutions, and the frequency of patents and innovation.

Essential Question

How do patents, education, research and the law support innovation and entrepreneurship across the United States?

Time Required

30 to 45 minutes

Materials

- Access to a computer lab or instructor with access to a computer projector
- Handout 1: Patent Information, one copy for each student
- Handout 2: GeoFRED Instructions, one copy for each student
- Handout 3: Assessment, one copy for each student

Procedure

OPTIONAL: Begin the lesson with this 1-minute video showing patented items and/or this 1-minute video explaining what a patent is.

1. To begin the lesson, ask the students the following question:
   - Which of these things can be owned as property?
     a. A parcel of land
     b. A pet
     c. An idea about selling things through a website
     d. Newton's law of gravity

   (*a, b, and c. Land, pets, and ideas are all property, but a mathematical formula is not. Students will likely easily identify the physical assets [a and b] but not that intellectual work can be property too [c]. Not all types of intellectual work can be registered as property: New ways of doing things can [e.g., c] but not basic research [e.g., d].*)

2. Ask a student to read aloud Article I, Section 8, Clause 8, of the United States Constitution. ([Congress shall have power] to promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries.)

   NOTE: Legal protection varies by the type of intellectual work protected. For example, music and books can be copyrighted, and a word, symbol, or image representing a brand can be trademarked and registered. This lesson is focused on patents. To learn more about other types of legal protection, watch the 8-minute video "Basic Facts: Trademarks, Patents, and Copyrights" from the United States Patent and Trademark Office.

3. Discuss the following questions and explain the points noted after each:
   - Why do you think the founders of the United States wanted to promote the "progress of science and useful arts"? (*Answers will vary.*)
     - The founders wanted to encourage business because businesses create jobs and promote economic growth.
     - The founders also wanted to create useful arts because they benefit society—new inventions often improve our daily life.

    - The founders also recognized that progress requires innovation. **Innovation is a new product, method, or idea.**
- Why do you think "securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries" promotes invention? (*Answers will vary.*)
    - Providing protection gives the inventor/author the incentive to produce and receive income from their labor.
    - Without protection, inventors would not be able to recoup the value of the time and money invested in making the invention. This is true for individuals and for businesses that invest in developing inventions.
- Why do you think the founders wanted to protect ideas only "for a limited time"? (*Answers will vary.*)
    - Society benefits by having more inventions—more "creative works." But to ensure that society benefits more broadly, the protections expire.
    - Protection for a limited time can also help promote the creation of more inventions and creative works based on previously protected work. That is, limited protection promotes continued innovation.
- In what types of situations might protection in the form of exclusive rights to **intellectual property** be disadvantageous for consumers? (*Answers will vary.*)
    - Society could be harmed if the protection raises the cost of an item beyond the average person's ability to pay (e.g., some patented medicines).
    - Society will not have wide access to a beneficial invention or creative work (other than by buying the protected invention/work) for a number of years.

4. Explain to the students that one way to provide exclusive rights to an invention is to offer patents. **Patents are legal protection for new methods, ideas, and products.** Not everything can be patented.

5. Ask students if they know anyone who has invented something. If a student has an example, discuss the following:
    - What was the idea or product? What did it do?
    - Was it created by a single person or by a group—for example, people working together in a laboratory, research group, or corporation?
    - Did the innovation make money for the inventor(s)?
    - Do you know if the innovation was patented?

6. Distribute *Handout 1: Patent Information* to each student.

7. Ask a student to read aloud the definition of patent at the top of Handout 1. (Patent: A government license conferring a right for a set period, especially the sole right to exclude others from making, using, or selling an invention.)

8. Place students in groups of 2 or 3. Ask the students to review the information on Handout 1. Explain to the students that each group will read parts of an approved U.S. patent application and then answer the questions in Part B of Handout 1. At most, they will need to read the title and abstract of the assigned patent. Assign each group one of the patent applications noted on Handout 1 (A to E and linked below). Tell the students that to access the patents from Google, type "patent" and the assigned patent number in the search engine.

   A. Patent US6285999 (Google Pagerank, the original Google search algorithm); https://www.google.com/patents/US6285999

   B. Patent US8231055 (Square Reader for credit cards); https://www.google.com/patents/US8231055

   C. Patent US6955484 (GoPro camera harness); https://patents.google.com/patent/US6955484

   D. Patent US5194299 (Post-It Notes [3M]); https://www.google.com/patents/US5194299

   E. Patent US5184830: (GameBoy [Nintendo]); https://www.google.com/patents/US5184830

9. Allow time for student to work and then review the groups' answers.

Handout 1—Part B Answer Key

1. What idea or process does the patent protect? *(See A to E above.)*

2. Did the patent address a problem or provide a new good or service? If so, how?

   - *Google Pagerank: It was difficult to find information on the internet (World Wide Web). Google ranked the search results in a manner that more readily answered the searcher's question.*
   - *Square Reader for credit cards: Small businesses had many barriers to accepting credit cards. The Square Reader allows the very smallest businesses to accept credit cards with relatively small fees.*
   - *GoPro camera harness: Daredevils who wanted to record their tricks had to hold their video cameras or strap them to themselves, generally increasing the likelihood that the phone/video camera/themselves would get injured.*
   - *Post-It Notes: Addressed the need to have little notes all around stuck to things as a reminder.*
   - *Game Boy: Addressed the need for mobility of play for gamers, allowing gamers to take their videogames anywhere.*

3. Did the patent lead to other innovations?

   Answers will vary but may include the following: The Game Boy led to the PlayStation. Google Pagerank allowed information to be found easily on the internet, making it possible for businesses and libraries to put information on the internet and be confident that it would be discovered.

4. Were businesses created or changed as a result of the patent?

   Answers will vary but will likely include the following:

   - *Yes, new businesses were formed, old businesses that used an inefficient or outdated product failed, and businesses either licensed the patent or adopted similar innovations to keep up.*
   - *Example for Google Pagerank: Search engines existed before Google's, but Google's innovation crushed the competition at the time.*

10. Explain to the students that new businesses are created by entrepreneurs. **Entrepreneurs are people who take risks to develop new products, methods, or ideas and start new businesses.** Innovation and entrepreneurs go together. And patents protect specific innovations.

11. Distribute *Handout 2: GeoFRED Instructions* to each group. Tell the students that they will use GeoFRED (http://geofred.stlouisfed.org) to create an online map of the number of patents assigned in a given year in either the county the school is in (tell them what the county is), the county they were born in, or another county of interest. After they create the map, they are to complete the tasks in Part B of the handout.

    NOTE: If pressed for time, instead of having students create the map, give them this URL to view the map: http://geof.red/m/8w6.

12. Allow time for students to work. Once students are done, select three or four students to share their findings.

Handout 2—Part B Answer Key

1. Enlarge the map to see county names. Locate your state/county of birth or the county where your school is located. If no patents were assigned in that county, choose another county with significant patent activity (e.g., Silicon Valley in California is largely in Santa Clara County, Chicago is in Cook County, and Minneapolis is in Hennepin County).

2. Once you have found a county with some patents, click on the county name to see the number of patents assigned in that county in the chosen year. How many patents were assigned?

   Answers will vary.

3. Next, click on surrounding counties and compare the number of patent assignments. (Some counties may have zero.)

4. Put forward a reason why patent assignments are higher in some counties.

   Answers will vary, but students should reference business conditions, potential local support for research promoting innovation, including companies and research centers (e.g., universities) within the county that support innovation.

13. Discuss the following:

    - In which areas are there the most patents assigned? (*Answers will vary but should include the urban centers of the United States. Students may also recognize California and the Northeast Corridor as having many patents. Specific areas include the Washington, D.C., area; Cook County, IL; Santa Clara County, CA; and Hennepin County, MN.*)

    NOTE: Given the media coverage of technology innovation in "Silicon Valley," you may want to highlight the number of patents assigned in Santa Clara County, Southwest of San Francisco, CA, relative to neighboring San Mateo County and Alameda County. Santa Clara County includes the corporate headquarters of Google, Apple, and Intel and the campus of Stanford University. For a graph of the number of patents assigned each year in these counties, see this FRED graph.)

14. Explain that areas with the most patents have common features. They are generally urban counties near universities and densely populated. Ask the students to identify counties or states where there are few or no patents. (Coming soon: a video showing the variation of patent assignments across counties.)

15. Explain that states and counties without patent assignments are known as innovation deserts. Discuss the following:

    - What is the effect on communities that do not have support systems, resources, or institutions in place to support innovation? (*Answers will vary, but students may say that few residents and small towns reduce the chances for patentable innovations and that such areas may have difficulty attracting businesses that do research. Patent deserts may also limit the type of jobs available in a particular area.*)

Closure

16. Ask students the following questions as review:

    - How do patents reward creative effort by protecting property rights? (*Patents ensure that original work cannot be used without permission or compensation.*)
    - Name and describe two examples of ideas or items that could be patented or were patented. (*Answers will vary, but the examples should describe an innovation or new product available for purchase and may include some of the patents reviewed in the lesson.*)
    - Summarize the reasons why regulation, education, and research support the work of entrepreneurs. (*A legal structure provides protections to property—both physical and intellectual, the research conducted at universities fosters innovative environments, and entrepreneurship contributes to economic growth.*)

Assessment

17. Distribute *Handout 3: Assessment* to students. Allow time for students to complete in class or assign as homework.

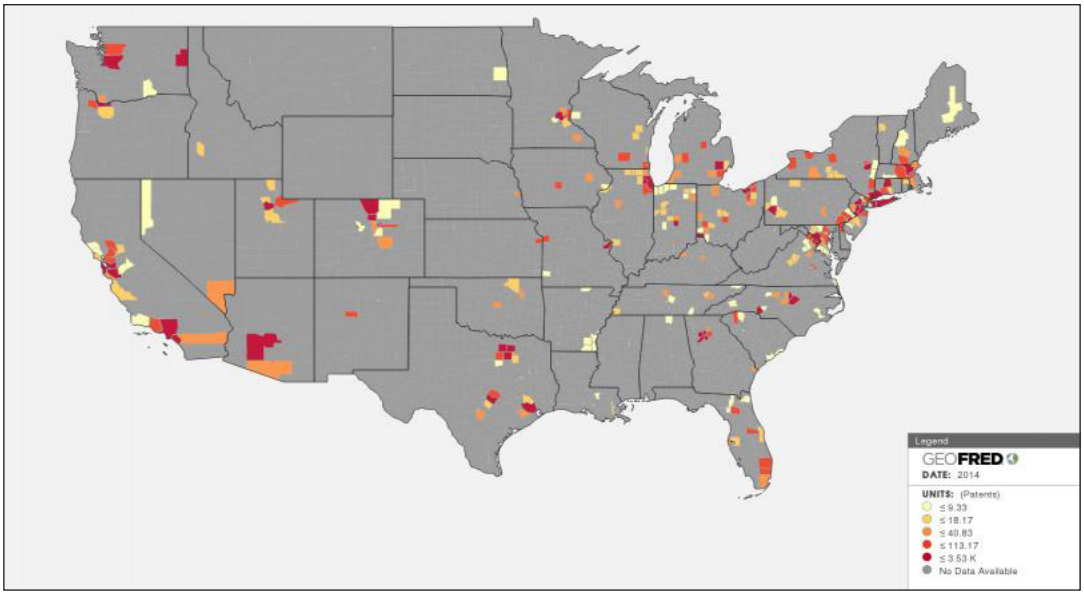
Handout 3: Assessment—Answer Key

1. Which of the following *cannot* be owned as property?
   a. A car
   b. A painting
   c. A newly developed chemical composition that treats a disease
   d. A recipe for making milkshakes

2. Which of these can be patented? (Select all that apply.)
   a. A method for creating adamantium shields
   b. A new dance
   c. A machine to tie your shoes
   d. A new pharmaceutical drug for lowering stress

3. In the map below, the darkest red indicates the counties with the most patents assigned in 2014. What are some commonalities of these counties? (Select all that apply.)
   a. They are near mountains.
   b. They are city centers.
   c. They are concentrated in the west and the northeast.
   d. They are rural areas.

New Patent Assignments, by County (2014)



SOURCE: GeoFRED®, Federal Reserve Bank of St. Louis; http://geof.red/m/atl.

4. Explain the government's role in protecting and managing property rights through patents.

   Answers include that the government protects intellectual property rights through a constitutional provision (Section I, Article 8, Clause 8), patent regulations, and the courts' enforcement of property rights.

5a. Other than inventions protected through patents, give two examples of intellectual property protected by the government.

   Answers will vary but may include copyrighted artistic creations (e.g., books, maps, sound recordings, film, software, photographs, or architectural drawings) and trademarked or registered words, symbols, or images (e.g., the Nike "swoosh" or Snapchat's Ghostface Chillah).

5b. Explain how the intellectual innovations embodied in the examples you gave are different from the intellectual innovations protected through patents.

   Answers should highlight how artistic creations are not inventions but that patentable devices or processes are.

6. Access the GeoFRED® map at http://geof.red/m/8xv, which shows the percentages of people with a bachelor's degree or higher by county. Based on the map, offer some ideas for what a high concentration of people with such education might mean for a region.

   Answers will vary but should include the following: Businesses and industries that require an educated workforce are likely to locate in that region. Intellectual property is likely to be developed/created/produced at a higher level than in regions without a highly educated population. The region's residents likely have higher income on average than similar areas with less education, as educated people often earn higher wages. It is likely that there are colleges and universities in or near the region.

Handout 1: Patent Information

Part A

Definition of a patent: A government license conferring a right for a set period, especially the sole right to exclude others from making, using, or selling an invention.

What is patentable?

A patentable idea has these four characteristics:

- The subject matter must be patentable.
- The invention must be novel.
- The invention must have some utility or usefulness.
- The invention must not be obvious.

A patent cannot protect an abstract idea. Instead, the idea must be embodied in one or more of the following:

- A process or method (such as a new way to manufacture concrete)
- A machine (something with moving parts or circuitry)
- A manufactured article (such as a tool or another object that accomplishes a result with few or no moving parts, such as a pencil)
- A new composition (such as a new pharmaceutical)
- An asexually reproduced and new variety of plant

Even if the invention falls into one of the four above categories, **there are certain subject matters that cannot be patented**. These include mathematical formulas, naturally occurring substances, laws of nature, and processes done entirely with the human body (such as a technique for shooting a free throw in basketball).

Patents generally expire 20 years after their initial filing date. (The date may be extended due to delays at the United States Patent and Trademark Office.)

Part B

Study the patent assigned to your group and answer the following questions:

A. Patent US6285999 B. Patent US8231055 C. Patent US6955484

D. Patent US5194299 E. Patent US5184830

1. What idea or process does the patent protect?
2. Did the patent address a problem? If so, which problem and how?
3. Did the patent lead to other innovations?
4. Were businesses created or changed as a result of the patent?

Handout 2: GeoFRED® Instructions

Part A

Build a GeoFRED map of assigned patents by county as follows:

1. Access https://geofred.stlouisfed.org/ and click on "Build New Map."
2. Click on "Tools." Under "CHOOSE DATA > Region Type," select "County."
3. Under "Data," click on the search box and type "New Patent Assignments." Select that title from the list that appears.
4. Under "Frequency," click the box and select "Annual." Click the box that appears under "Annual" and select "Sum."
5. Under "Date," select the year "2014" or an earlier year. (The patent assignment process takes years, so the data are more accurate when they are a few years old.)
6. Click on "CHOOSE COLORS." Under "Multi Hue," select the last option, the right-most color scheme on the second row (tagged "ylorrd").

Part B

After you build the map, complete the following tasks:

1. Enlarge the map to see county names. Locate your state/county of birth or the county where your school is located. If no patents were assigned in the that county, choose another a county with significant patent activity (e.g., Silicon Valley in California is largely in Santa Clara County, Chicago is in Cook County, and Minneapolis is in Hennepin County).
2. Once you have found a county with some patents, click on the county name to see the number of patents assigned in that county in the chosen year. How many new patents were assigned?
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Handout 3: Assessment (Page 1 of 2)

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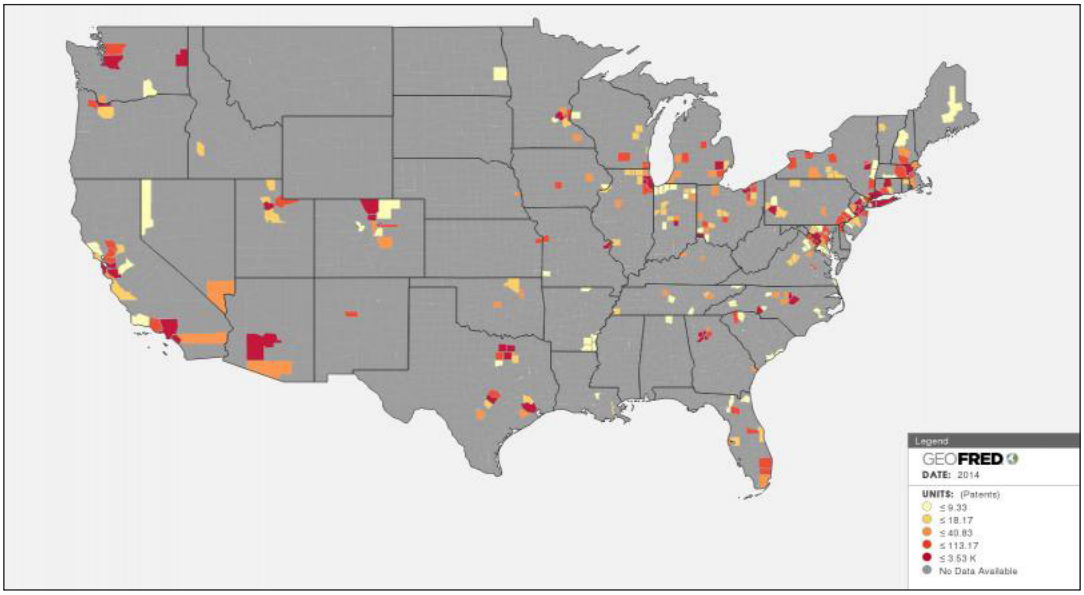

SOURCE: GeoFRED®, Federal Reserve Bank of St. Louis; http://geof.red/m/atl.

Handout 3: Assessment (Page 2 of 2)

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Standards and Benchmarks

ACRL Framework for Information Literacy for Higher Education

- Frame: Information has value.
- Knowledge Practice: Articulate the purpose and distinguishing characteristics of intellectual property and the public domain.

Concepts

Innovation

Intellectual property

Patents

Entrepreneurs

Further Reading

Florida, Richard. "The Geography of Innovation." Citylab blog post, September 2017; https://www.citylab.com/life/2017/08/the-geography-of-innovation/530349/.