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

Authors:

Charissa Jefferson, Business and Data Librarian, California State University-Northridge

Diego Mendez-Carbajo, Professor of Economics, Illinois Wesleyan University

Katrina Stierholz, Director of Library and Research Information Services, Federal Reserve Bank of St. Louis

Standards and Benchmarks

Voluntary National Content Standard in Economics #14

Grade 12

Benchmark: #2. Entrepreneurial decisions are influenced by tax, regulatory, education, and research support policies

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

Lesson Description

This is a lesson about innovation and the distribution of innovation across the country. In this lesson students will work in groups to examine patents, and then use a mapping program and interpret data from that map. Students will learn what can be patented, map the number of patents at the county level, read a data map and interpret the data presented.
Grade Level

High school - Grade 12

Concepts

Innovation
Intellectual Property
Patents
Entrepreneurship

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.
● Explain the relationship between education, research institutions and the frequency of patents and innovation.

Essential Question

How do patents, regulation, education, and research support innovation and entrepreneurship?

Time Required

45 to 60 minutes.

Materials

Access to a computer lab / Instructor with access to a computer projector
A copy of Handout 1 (patent information) for each student.
A copy of Handout 2 (GeoFRED instructions) for each student
**Procedure**

1. To begin the lesson, ask 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

   *Answer: land, pets, and ideas are all property, but a mathematical formula is not.*

   *Students will easily identify physical assets (answers (a) and (b)) and not immediately recognize that intellectual work can be property too. At the same time, not all types of intellectual work can be registered as property: new ways of doing things can (c), but not basic research (answer (d)).*

2. Have a student read 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 TO INSTRUCTORS**

Different types of intellectual work can receive different types of legal protection. For example: music and books can be copyrighted; 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 intellectual property protection look for a quiet spot and read this book.

3. Ask students the following four questions:
   - Why do you think the founders wanted to promote the “progress of science and the useful arts”? *(Answers will vary).* Discuss the following:
○ The Founders wanted to encourage business because businesses create jobs and promote economic growth.
○ The founders also wanted to create useful arts because this benefits society--new inventions often improve our daily life.
○ Founders recognized that progress requires new ideas. Those new ideas are innovation.

● Why do you think “securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries” promotes inventions? (Answers will vary). Discuss the following:
  ○ Providing protection gives the inventor/author an incentive to produce and receive income from their labors.
  ○ Without protection inventors would not be able to recoup the value of time and money 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). Discuss the following:
  ○ Society benefits by having more inventions, more creative works. But, to ensure that society benefits more broadly, the protections expire.
  ○ The limited time period can also help promote more inventions and creative works as authors and inventors build on previous work. The ability to use/apply these works freely allows continued innovation.

● Can you describe a situation where intellectual property protections (exclusive rights) could be disadvantageous for consumers? (Answers will vary). Discuss the following:
  ○ Society could be harmed when the protection raises the cost of an item beyond a 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 goods) for a number of years.
4. Explain to students that one way to provide exclusive rights to an invention is to offer patents. Patents are a legal protection for ideas and inventions. Not everything can be patented.

5. Ask students if anybody in their family, or someone they know, has invented something. *(Answers will vary)*. If a student volunteers 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 of people working together in a laboratory, a research group, a corporation…?
   - Did the innovation make money for the inventor or inventors?
   - Do you know if the innovation was patented?

6. Distribute Handout 1 to each student.

7. Have a student read aloud the definition of a 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. Assign each group one of the approved U.S. patent applications (linked below*). Ask each group to read the patent documents and answer the questions at the bottom of Handout 1.
   - Google Page Rank (the original Google search algorithm) patent:
     https://www.google.com/patents/US6285999
   - Square credit card reader patent:
     https://www.google.com/patents/US8231055
   - Breakfast cereal (Kellogg’s) patent:
     https://www.google.com/patents/US558393
● Board games (*Life* by Milton Bradley) patent:  https://www.google.com/patents/US53561
● Post-It Notes (3M) patent:  https://www.google.com/patents/US5194299
● GameBoy (Nintendo) patent:  https://www.google.com/patents/US5184830

*Note: To access the patents from Google, type patent and the number at the end (e.g., patent 5184830 for the GameBoy patent)*

8. Next, have the students answer the questions at the bottom of the handout. The questions are presented below for your convenience:

   ● What idea or process does the patent protect?
   ● Is the patent still in force or has it expired? *All patents in the list above have expired.*
   ● Did the patent address a problem? Which problem? And How?
   ● Did the patent lead to other innovations? *Answers will vary.*
      ○ *Definition of innovation: a new method, idea or product.*
      ○ *Example, the Game Boy led to the PlayStation. Or, the original Board games patent led to a variety of games.*
   ● Were businesses created or changed as a result of the patent? *Answers will vary, but would likely include the following:*
      ○ *Yes, new businesses were formed, old businesses that used an inefficient or outdated product failed, businesses either licensed the patent or adopted similar innovations to keep up.*
      ○ *Examples, there were many previous online search engines to Google. But Google’s innovation crushed the competition.*

9. At this point it is useful to inform students that new businesses are created by entrepreneurs. Entrepreneurs take risks to develop new products and start new businesses. These new products or ideas are an innovation and can be a
completely new way of doing things or a entirely new product. More broadly, entrepreneurship is the process of designing, launching, and running a new business. Innovation and entrepreneurs go together. And, patents embody innovation.

10. Now, ask the student to consider where patents are assigned (or filed). Have students go to GeoFRED (http://geofred.stlouisfed.org) and follow the instructions for how to build a map on Handout 2. Students are creating a map of the number of patents assigned by county (the sum total for the year).

11. Ask students to review the map they have created and complete the tasks listed at the bottom of the handout. The tasks are presented below for your convenience. Once students are done, select three or four students to share their findings.

1. Locate your State/county of birth or the county where your school is located (the instructor may need to give some direction here). Report the number of new patents assigned during the year;
   a. If students report that no patents were assigned ask them to locate the county where the most number of patents were assigned in the State;
   b. If students report that no patents were assigned in the State ask them to locate the closest county where patents were assigned.
2. Once you have found a county with some patents, click on the “graph” button to see the yearly change in patents assigned in that county.
3. Put forward a reason why the number may have risen or fallen. (Answers will vary but they should make reference to: changes in business conditions; potential supports for research affecting local innovation; the appearance of new companies supporting innovation; the development of research centers.)
12. Ask students: Where are there the most patents?

(Answers may 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, CA; Hennepin County, MN. Given the media attention received by technology innovation taking place in “Silicon Valley” the instructor may choose to highlight the number of patents assigned in Santa Clara County, Southwest of San Francisco, CA, relative to San Mateo County and Alameda County. Santa Clara County includes the corporate headquarters of Google, Apple, Intel, and the campus of Stanford University. For a graph of the differences in patents assigned each year in these counties, see this FRED graph.)

The instructor should highlight the common features of the areas with the most patents: urban counties; near universities; in densely populated areas.

13. Ask the students to identify counties or states where there are few or no patents. Then, ask the students: What is the effect on those communities that do not have support systems, resources, and institutions in place?

(Answers will vary. Direct student attention to states and counties without patent assignments (known as innovation desert) in order to prompt their arguments. The students will offer a variety of answers, likely including that few residents and small towns reduce the chances for patentable innovation and that it may be difficult to attract businesses that do research. Patent deserts may also limit the type of jobs available in a particular area. Ask -at least rhetorically: are the people there at a disadvantage?)
Closure

Ask students the following questions as review:

14. How do patents reward creative effort by protecting property rights? (*Patents ensure that original work cannot be used without permission or compensation.*)

15. 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 that was sold; could include some of the patents reviewed in the lesson.*)

16. Summarize the reasons why regulation, education and research support the work of entrepreneurs. (*A legal structure provides protections to property -both and physical and intellectual; the research conducted at universities fosters innovative environments; entrepreneurship contribute to economic growth.*)
Assessment for Entrepreneurship Lesson:

Q1. Which of the following cannot be owned as property?
- A car
- A painting
- A procedure to alter a plant’s genes
- A recipe for making milkshakes

Q2. Which of these can be patented? (Select all that apply)
- A method for creating adamantium shields
- A new dance
- A machine to tie your shoes
- A new pharmaceutical drug for lowering stress

Q3. This is a map showing counties that have had patents assigned in the last year (darker red indicates more patents in that county). What are some commonalities in those counties? (Select all that apply)
- They are near mountains
- They are city centers
- They are concentrated in the West and the Northeast
- They are rural areas
Q4. Explain the government’s role in protecting/managing property rights through patents.

Answers include protecting intellectual property rights with the constitutional provision, patent regulations, the courts enforcing property rights.

Q5. This question has two parts:

1. Give two examples of intellectual property, other than inventions protected through patents, protected by the government;

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

Answers to (1) will vary but will include copyrighted artistic creations (books, maps, sound recordings, film, software, photographs, and architectural drawings) and trademarks (sign/design that identifies a product or service such as the Nike “swoosh” or Snapchat’s “Ghostface Chillah”)

Answers to (2) should highlight how artistic creations are not inventions -as patentable devices or processes are. Answers could highlight the fact that the legal protection offered by patents, copyright and trademarks extends over different amounts of time.

Q6. Using this map (http://geof.red/m/8xv) of the percentage of people with post-secondary education, offer some ideas for what a high concentration of people with a post-secondary degree might mean for a region.

Answers will vary but should include that businesses and industries that require an educated workforce are likely to locate in that area; that intellectual property is likely to be developed/created/produced at a higher level than areas without a highly education population; it could also mean that the residents have higher income on average than similar areas with less education as educated people often receive higher wages; it could mean that higher ed institutions are closer to most residents.
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 USPTO).

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

- What idea or process does the patent protect?
- Is the patent still in force or has it expired?
- Did the patent address a problem? Which problem? And how?
- Did the patent lead to other innovations?
- Were businesses created or changed as a result of the patent?
Instructions for building a GeoFRED map of assigned patents by county

Steps to Search for and Transform the Data.

1. Access https://geofred.stlouisfed.org and click on "Build New Map."
2. Click on "Tools" and under "CHOOSE DATA > Region Type:" select "County."
3. Click on "Data:" and select "New Patent Assignment" and "Not Seasonally Adjusted, Monthly."
4. Click on “Frequency:" and select “Annual” and “Sum.”
5. Under “Date:" select the year “2014.”
6. Click on "CHOOSE COLORS" and select from "Multi Hue," the right-most color scheme from the second row (tagged "ylorrd").

Note: If pressed for time, use this URL to get to the map: http://geof.red/m/8w6

After you build the GeoFRED map, complete the following tasks

1. Locate your State/county of birth or the county where your school is located (ask your instructor for help if you need some direction). Report the number of new patents assigned during the year;
   ■ If you find that no patents were assigned, locate the county where the most number of patents were assigned in the State;
   ■ If you find that no patents were assigned in the State, locate the closest county where patents were assigned.
2. Once you have found a county with some patents, click on the “graph” button to see the yearly change in patents assigned in that county.
3. Put forward a reason why the number may have risen or fallen.
Idea Parking Lot

Additional Activities: Making it Personal

- Think of inventions in your family and share them with the class.
- Think of your own personal device (i.e., cell phone, or tablet). Imagine what inventions were required to make that function.
  - (There are over 100 patents on the iPhone. New version are on the market, reflecting the continuous improvements on the previous iterations.)
- What inventions have you seen that made you think, “wow, that’s brilliant!”? (examples; sports top water bottles, kleenex in the cupholder, one click online shopping, etc.).
- Have students think of a design idea by asking a question: “Wouldn’t it be great if…” (example: possible new wallet that’s more functional, better package design for potato chips, etc.). The purpose here is to generate ideas that could inspire new ventures or inspire better products or services.
- Have the students pair up. One student will be the patent owner (Manufacturer A) of an amazing new way of interacting with a cell phone (you think it, and it does it!). The other student will be a different cell phone manufacturer (Manufacturer B). Have the students discuss the options for managing this situation. Possible topics include: discussing an agreement with Manufacturer A to get access to the technology in return for payment for each cell phone sold from manufacturer B; or Manufacturer B inventing yet another way to interact with their cell phone; or selling rights for that technology for a certain amount over a certain time period (e.g., $1 million dollars every month).
- Imagine how this applies not just to patents but intellectual property such as copyrighted music, videos and photography or literary work where either you are the author. This is why we pay attention to the permissions required by the creator by either citing them or paying a fee to use their work.
- Ask students why do people invent things and patent them?
For Parking Lot assignment, a possible formative assessment: Ask students to name some things they use/eat that have patented materials in them. Some possible answers include cell phones (it is estimated that an iPhone represents over a hundred thousand patents, cars (individual items), various food items (foods with GMO plants are likely to have patented materials as most GMO plants are patented), etc.

2nd Parking Lot idea
Have the students use GeoFRED to map the counties' educational attainment; specifically, have them map out the county-level data of percent of the population with bachelor's degree or higher. I modified a graph to have equal-intervals and 7 levels: http://geof.red/m/8xy This would give them a chance to see a correlation between patent-producing areas and those with a high percentage of people with post-secondary education.