

# Teaching the History of Technology

## *A Cooperative Learning Activity*

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**W**hen we consider technology as a way of adapting to human needs, the importance of historical context seems obvious. Often textbooks of science and technology provide vignettes of notable inventors. These biographical inserts seem to do little to promote a better understanding of the nature of technology in that they often fail to address the social, economic, and physical constraints associated with technological development. In North America we have a rich history of growth in technology which includes contributions made by minority groups. The study of their struggles (Wharton, 1992; Jenkins, 1991; Karwatka, 1996) to promote technology is worthwhile and relevant for all students because it enables students to better understand our diverse history and the contributions of minorities to technological development.

### **Cooperative Learning as a Solution**

In technology education, how can we provide more emphasis on the process of technology as opposed to the product? Cooperative learning settings (Johnson, Johnson & Holubec, 1994) can be used to involve students in "technology learning experiences" (Ortega, 1995). The cooperative approach developed below, not only allows for a refreshing change in how we learn about the history of technology, but builds on the well-established benefits of cooperative learning which include better academic achievement, improved ethnic relations, and social development (Kagan, 1994).

The following cooperative learning activity highlights the life of Elijah McCoy (1844-1929). It allows students to investigate the hardships this black inventor overcame to become a notable contributor to technological development in the late 1800s. Elijah McCoy was born in Colchester, Ontario, Canada. His par-

**G R E G O R Y   R .   M A C K I N N O N**

ents, George and Emily McCoy, were slaves who had fled from Kentucky via the underground railway. They managed to eke out a living in Canada and provide Elijah with the opportunity for schooling in mechanical engineering. Elijah, with a natural talent for mechanical problems, went on to become a significant inventor in North America. Among his many patents was an automatic oiler for locomotives. His design was very reliable and difficult to copy. As a result, engineers in need of a locomotive oiler often requested the "Real McCoy!"

### The Task and Responsibilities of the Cooperative Group

A series of questions regarding the life and contributions of Elijah McCoy are supplied to groups of four students. The overall task of the group is to answer the questions (Table 1) using 36 clues supplied by the teacher (Table 2). Each individual in the group has a particular role in reaching this goal. The individual roles established by the teacher should fall into the following categories: maintenance of group conduct, maintenance of group function, and formulation and integration of group ideas (Johnson et al, 1994). The roles of individual group members may be defined as follows:

- The student acting as chairperson maintains order in the group by insisting that only one person speaks at any one time.

The chairperson also ensures that all members fulfill their roles.

- The reader reads the question to be answered.
- The summarizer assimilates the group's reasoning and restates its approach in arriving at a sound conclusion, and
- The recorder records the group conclusions on the single question sheet supplied.

### The Process of Investigating the History

The teacher places the clues (Table 2) on individual cards. Each group of four is given the 36 clues, nine to each member at random. Students are not to look at the clue cards given to other students. The reader reads the first question on the group question sheet (Table 1). The first student reads one of nine clues, which is seen to be relevant to the question posed by the reader. In turn, the other students in the group read a single clue, which they see as related. When a consensus is reached that the clues have supplied the necessary information, the summarizer restates the combination of clues which has led to the group conclusion. With approval of the group, the recorder then records the accepted response to the reader's question.

The fact that participants cannot speak out of turn forces the entire group to listen carefully to the supplied clues as each group member contributes to the effort. Students will have an uncontrollable urge to spread their clues

out before the group. This should be avoided because it diminishes the individual responsibility of each student to access the relevance of his or her clues to the question being posed. Random distribution of the clues helps to ensure that students rely on each other for supporting evidence.

Students generally complete their answer sheets in 45 minutes or less. Depending on the length of class periods, the teacher may wish to complete the activity in the next class meeting. In a closure session, the reader reports the group answers and the supporting logic to the class. The teacher then leads a discussion on the implications of this inventor's work, as well as the hardships he encountered as a result of his race. Towle (1993) and Haber (1970) have published a more complete account of the life of Elijah McCoy.

### Design Considerations for Extending the Model

This type of lesson may be incorporated at a variety of grade levels, though junior high school seems most appropriate. Teachers may find it useful to apply this overall instructional strategy to study notable figures relevant to their community of students. To promote the objective that students are engaged to cooperate, the teacher should carefully link the clues in such a way that all students need to be involved in order to answer the group questions posed. Productive closure discussions are more likely if the questions set by the teacher seek

**TABLE 1**

**Questions Regarding The Life and Times of Elijah McCoy** (supply to the reader)

1. When and where was Elijah McCoy born? Date \_\_\_\_\_ Location \_\_\_\_\_
2. Prior to his birth, Elijah's parents had been living in \_\_\_\_\_
3. What were the circumstances that brought the McCoy family to live in Canada? \_\_\_\_\_  
\_\_\_\_\_
4. In the early 1800s, schooling opportunities for black children were different in the United States and Canada. Why was Elijah able to attend school and develop his mechanical aptitude? \_\_\_\_\_  
\_\_\_\_\_
5. Through his parents' hard work and after his public schooling, Elijah was afforded the opportunity to study abroad. Where did he study? City \_\_\_\_\_ Country \_\_\_\_\_  
What subject did he study? \_\_\_\_\_
6. During his time spent studying in Europe, a major change was underway in the United States which encouraged him to return there for employment. What important historical advances were being made in the United States? \_\_\_\_\_  
\_\_\_\_\_
- Where did Elijah take up employment in the United States?  
Town/City \_\_\_\_\_ State \_\_\_\_\_
7. Though Elijah was a trained professional, he was unable to work in his chosen field. Why? \_\_\_\_\_  
What did Elijah's job entail? \_\_\_\_\_
8. Elijah ingeniously designed an important device for the railroad. What was this device and why was it a technological breakthrough? \_\_\_\_\_  
\_\_\_\_\_
- When was this invention patented? \_\_\_\_\_
9. Elijah married a second time after his first wife Ann died. What was his second wife's name? \_\_\_\_\_ What did her parents have in common with Elijah's parents? \_\_\_\_\_  
Elijah's second wife was actively involved in an important movement. What was this movement and why was it significant? \_\_\_\_\_  
\_\_\_\_\_
10. What is the likely origin of the term "The Real McCoy?" \_\_\_\_\_
11. When did Elijah invent the "Graphite Lubricator?" Date \_\_\_\_\_  
What was the technological problem that spurred its development? \_\_\_\_\_
12. What were three of his other inventions outside of his obvious expertise in lubricants?  
1. \_\_\_\_\_  
2. \_\_\_\_\_  
3. \_\_\_\_\_  
Why did you think Elijah embarked on these projects? \_\_\_\_\_
13. The McCoy family was very active in community life. Elijah made significant contributions to technology. As a result the city of Detroit paid him tribute in 1975 by erecting a monument in his honor. In Detroit you will also find a street called Elijah McCoy Drive, named in his honour. When did Elijah McCoy die? \_\_\_\_\_

TABLE 2

**Clues** (to appear unnumbered, one on each card, preferably with a graphic)

1. George McCoy joined the Canadian Army and fought in the 1837 Rebel War.
2. Emilia McCoy and her husband were slaves in Kentucky in the early 1800s.
3. Elijah McCoy was born on May 2nd, seven years after his father fought in the Rebel War.
4. George McCoy and his wife fled the United States via the underground railway to find freedom in Canada.
5. Emilia McCoy gave birth to a son, Elijah, in Ontario, Canada.
6. Elijah McCoy's father was given 160 acres of farmland in the town of Colchester for his efforts in the 1837 Rebel War.
7. In the United States in the early 1800s, it was illegal for slaves to learn to read and write.
8. As a Canadian landowner, George McCoy had the right to send his children to public school in their little town of Colchester.
9. In public school, Elijah McCoy was very interested in mechanical devices.
10. After some public schooling, Elijah McCoy was able to pursue studies in mechanical engineering in Edinburgh.
11. At sixteen years of age, Elijah McCoy traveled to Europe to study in a country beginning with the letter "S."
12. Elijah McCoy studied mechanical engineering in one of the following countries: Spain, Scotland or Switzerland.
13. A United States president issued the "Emancipation Proclamation" while Elijah was studying in Europe during the American Civil War.
14. During the American Civil War, Abraham Lincoln began a campaign that allowed for Elijah to settle in the United States as a free man.
15. Following the American Civil War, Elijah McCoy settled in a town called Ypsilanti.
16. Elijah McCoy found it difficult to find an engineering job at his new home in Michigan.
17. In Ypsilanti, Michigan, in the late 1800s, it was not common for black persons to be educated, much less employed as engineers.
18. Because of his race, Elijah could only find work in a lesser capacity: the dangerous job of a fireman/oilman for the Michigan Central Railroad.
19. The Michigan steam engines of the late 1860s were fueled with coal, which the fireman would shovel at a rate of two tons per hour.
20. The moving parts of early steam engine-powered trains required frequent and regular manual oiling by the oilman. Elijah McCoy invented and patented an automatic oiling cup for machinery/steam engines at the age of 28. This was one of fifty patents he would hold in his lifetime.
22. Though Elijah McCoy's automatic locomotive oil cup was not the first of its kind, in practice its performance was far superior to other designs.
23. Imitations of McCoy's oiler were not successful and his design became the industry standard. Locomotive engineers were only interested in using oilers of his authentic design.
24. Elijah McCoy sold part of his oil cup patent to help finance his research into other inventions.
25. Four years before inventing his oiler, Elijah McCoy married Ann Elizabeth Stewart.
26. In 1872, Elijah's wife died at the age of twenty-five.
27. Mary Eleanora Delaney, also a child of runaway slaves, married Elijah McCoy when he was twenty-nine years of age.
28. In 1882 Elijah and Mary McCoy moved to Detroit, Michigan, where Elijah was employed as a mechanical consultant in several companies. Mary became very active in the women's suffrage movement. This was an organization established to gain voting rights for women.
29. In the 1880s, Elijah and Mary McCoy were actively involved with the young people in the Detroit community. At that time, Mary was the only black charter member of the exclusive Twentieth Century Club, which was comprised of prominent women in Detroit.
30. Among Elijah McCoy's inventions was one of the first portable ironing boards. As with many of his inventions, this idea arose out of a household need for such a device.
31. Elijah McCoy, dismayed with the lack of durability of his shoe soles, developed a better rubber heel. His study of rubber extended to tire designs.
32. A lawn sprinkler was a patented invention that Elijah McCoy had to his credit.
33. Forty-four years after his first wife died, Elijah McCoy invented the graphite lubricator for the new locomotive called the "Superheater." His invention was in response to the need for an effective lubrication system for the locomotive air brake pistons and cylinders.
34. In 1920, Elijah began building/marketing the McCoy graphite lubricator based in his own factory, the "Elijah McCoy Manufacturing Company." Shortly thereafter he and his wife were involved in a serious automobile accident. Mary's health failed steadily until her death in 1923.
35. Having expended his assets developing inventions, Elijah McCoy died destitute in the Eloise Infirmary, five years after the death of his wife Mary.
36. Variations of Elijah McCoy's automatic oiler are still in use, applied in industries such as mining, construction, manufacturing, and space exploration.

to probe the context of technological development. The societal conditions, which allow for, or deter technological advance, are very worthy of our students' consideration if they are to impact progress in their own futures as technologically literate citizens. The nature of man's adaptation to the needs of society is a study in problem solving. Activities that highlight this process serve to better prepare our students for the technological challenges they will face. This is to complement, not to diminish the motivational benefits associated with studying a "neat" invention. ☞

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