# The Bicycle: Appropriate Technology for Technology Education

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I am always amazed at the end of the spring semester on this college campus to see bicycles abandoned at bicycle racks. Often they are missing components or have flat tires or both. Probably their technologically challenged owners have forgotten them in dreams of some new automobile for which they will be indebted for years to come. Eventually these abandoned bicycles, thrifty wonders of efficiency, will be freed from their racks by campus police and sold to new owners at a university auction. In regards to bicycles and schools, I am also amazed that the bicycle has not been used more in technology education. In other subject areas, such as physics, the bicycle is a favorite among instructors because it serves as such a relevant topic for the study of energy and power.

Shields and Rogers recent editorial in the *Journal of Industrial Teacher Education* entitled "Incorporating Experimental Technologies in the Middle Level Technology Education Classroom" suggested as curriculum "innovative energy technologies, such as those used in hybrid vehicles" (2005, p.73). From my perspective, a hybrid vehicle seems far removed from the interests of a typical middle school student. Beyond the classroom, why would a middle level student find anything relevant about a hybrid engine? On the other hand, how many middle school students could you find that at least own a bicycle and use it for some form of transportation?

The bicycle evolved during a seventy-year period in the nineteenth century from the hobby horse to the boneshaker to the high wheeler and finally to the safety bicycle. By 1890, the safety

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bicycle, with same size wheels, a chain, and pneumatic tires, provided an independent form of transportation for many Americans and Europeans. During the first half of the twentieth century, the development of the derailleur provided the user with the convenience of multiple gears to enhance both speed and mechanical advantage. Over the last half of the twentieth century the bicycle continued to evolve as transmission and brake systems improved, and lighter weight materials were used. In the beginning, bicycles were made from iron and wood. Today, manufacturers are using titanium, aluminum, chromium-molybdenum steel, and composite materials such as carbon fiber. The beauty of this highly efficient vehicle is that over its evolutionary process, the bicycle has remained low-tech in terms of repair and maintenance, especially when compared to today's automobile. With a few general shop sockets and wrenches, a repair stand, some specialty tools, and a bit of synthetic oil, you are good to go.

Sadly, in recent years, fewer students are taking advantage of the simple means of transportation a bicycle provides. According to the Bicycle Alliance of Washington State, today "about 13% of American children bike or walk to school, yet more than 30 years ago 66% did." Moreover, "20-25% of morning traffic is the result of parents driving their children to school" (Safe Routes to School, n.d.). What is wrong with this picture? At the end of the nineteenth century the bicycle was the rage in America because it provided the common man and woman with an independent form of transportation. Don't today's middle school students want that same means of independence?

The goal of the New National Safe Routes to School Program is to reverse this trend away from biking and walking. Through a $612 million dollar congressional appropriation, the program offers benefits to all 50 states. "Communities will use this funding to construct new bike lanes, pathways and sidewalks as well as launch Safe Routes education and promotion campaigns in elementary and middle schools" (Bikes Belong Coalition, n.d.).

Not only do bicycles furnish students an independent mode of transportation, bicycle maintenance provides an ideal topic for technology education. Some schools have already

incorporated bicycle technology into their curricula. One of the more interesting examples is the Recycle-a-Bicycle program in New York City. This project takes teens and pre-teens between the ages of 10 and 18 and puts them to work refurbishing used bicycles. The program began in 1994 and was "incorporated into the school's curriculum and offered by the NYC Board of Education as an industrial arts class" (Recycle-A-Bicycle, n.d.). In addition to bicycle maintenance, the participating students learn business concepts, customer service, marketing, and inventory management. As a result of the program, two retail shops have opened, one in Manhattan and one in Brooklyn, where former students of the program are employed.

Another school, Harbor High School in Santa Cruz, California, is piloting a Bike Shop class during the fall of 2006. The goals of the class are to teach bicycle maintenance and repair, mechanical safety check-ups, off-road riding rules, and safe bicycle practices including helmet use and anti-theft skills. Additionally, through a variety of community organizations, instructors will use the bicycle as a vehicle to teach environmental, economic, health, and community participation skills (Bicycle Trip, n.d.).

According to Wicklein and Kachmar, "The appropriate technology movement has at its philosophical heart the desire to capacitate people of all walks of life to create (1) *Meaningful Employment,* (2) *Comprehension of Technology,* (3) *Self-Reliance,* (4) *Reduced Environment Impacts*" (2001, p. 6). The Recycle-a-Bicycle program in New York and the Harbor High Bike Shop class in Santa Cruz do exactly that. Bicycle technology has minimal impact on the environment. Additionally, students participating in these and similar programs learn all aspects of the technology of the bicycle system and in the process gain self-reliance. Several students have obtained meaningful employment through the New York Recycle-A-Bicycle Program. The results of these programs satisfy all four principles of the appropriate technology movement's philosophy.

While there are a number of obvious limitations to using bicycles for common transportation—such as cycling during harsh or inclement weather or when carrying a load—biking does offer a partial solution to our transportation problems that is simple,

inexpensive, and immediately available. At the same time, there are few limitations in term of using the bicycle for educational purposes. It is a vehicle for developing technological literacy for a specific technology. Topics that lend themselves to study in a course based on bicycle technology include the history and invention of the bicycle, what makes a good bike in terms of materials and design, repair and maintenance of a bicycle, and safe riding practices. Also easily incorporated are topics in math and science such as calculating mechanical advantage, power, speed, and aerodynamic efficiency.

In a summer workshop covering these and other topics taught recently at the University of Nebraska, bicycle maintenance and repair comprised a good portion of the course. It included teams of students tearing down and reassembling a ten speed bicycle. The goal was not to turn the students into bicycle mechanics, but to give them the confidence to tackle repair problems that might occur with their own two-wheelers. The initial feedback on this course was positive, but what a number of the students wanted more of was the hands-on mechanical know-how.

If more students ride their bicycles to school nationwide, I would expect a rising demand for local purchases and repair of bicycles. In regards to technological literacy, it is comforting to know that even in the present world, complicated technological approaches are not always superior. The bicycle in its simplicity is easy to comprehend, maintain, and repair by the majority of its users. As the students who participated in bicycle technology programs can attest, a bicycle does not require highly trained technicians using sophisticated equipment for maintenance and repair. You can do it yourself!

As we look to others means of transportation beyond the automobile, surely the bicycle should be part of the solution. I would argue that the target student audience to help solve our transportation problems could be middle school students, because a bicycle is likely the most relevant means of transportation in a middle school student's life. So my challenge goes out to technology educators who want to make a change: When you see students riding to your school on their bikes and parking them in the racks, what will you do to assist and encourage them? Will

these middle school students become lifelong bicyclists, or will they abandon their bicycles and fill their high school parking lots with automobiles?

## References

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