Lifecycle of Bicycle Education: The Missing Link

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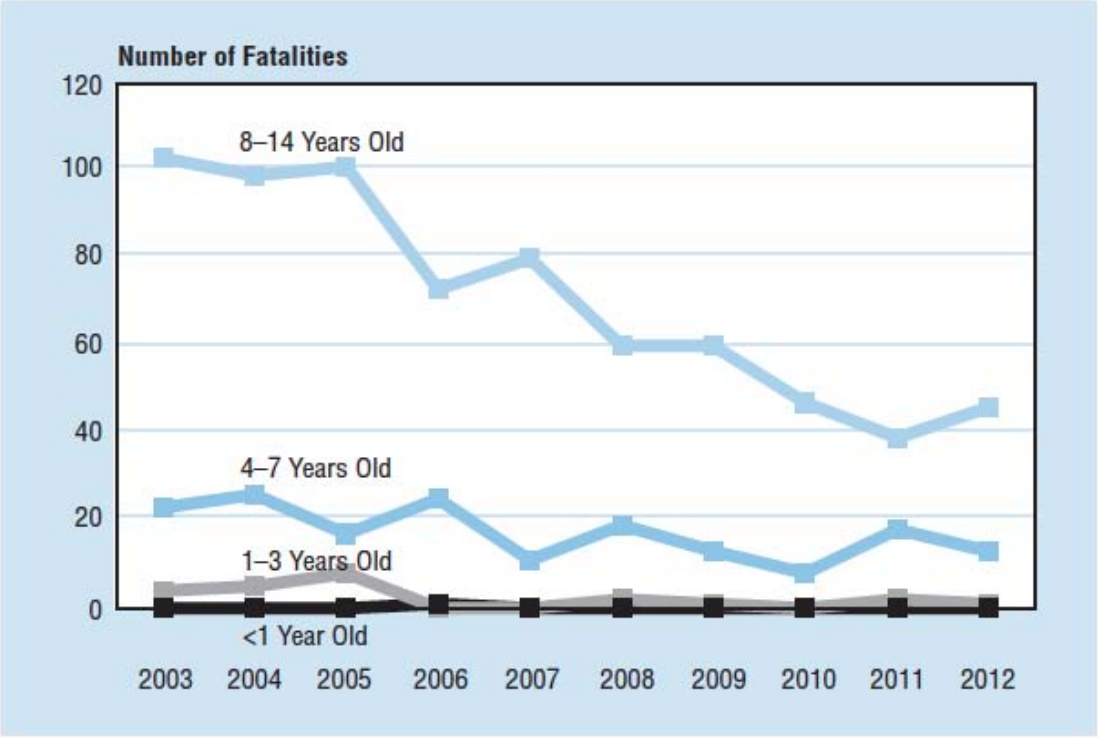
1. Introduction

Biking, for children and adults alike, is a core element of planners' vision of more sustainable travel and complete streets. To accommodate the increase in cycling, cities have built more bike infrastructure and supported policies to increase cycling's safety and usability, like Safe Routes to School. However, there is a missing link. A lack of understanding and training leads cyclists to break the law almost daily. In many situations, cyclists and car drivers do not know how to interact. This confusion can lead to crashes and deaths. In the United States, the leading cause of death for children age 4 through 14 is motor vehicle crashes. While interactions between children cyclists or children pedestrians and cars are low, the data shows that our transportation system has significant impact on the health of children (NHTSA, 2014). In 2012, 8% (58) of the 726 (NHTSA, 2014) cyclists killed were under the age of 14 (Figure 1) (NHTSA, 2014). In Europe, the death rates of cyclists are far lower per capita than in the US (Figure 2) while there are more children (age 5-15) cycling than compared to the US (Figure 3) (Pucher & Buehler, 2008). There are even larger numbers of children cycling age 5-15 in Europe compared to any other age, underscoring the very different relationship between children and cycling among European countries and the US (Figure 3) (Pucher & Buehler, 2008).

While the reasons for differences in safety, usage, and other outcomes are many, in this research I explore the role of education in European approaches to cycling. In many European cities, cycling education takes on a "lifecycle" format.

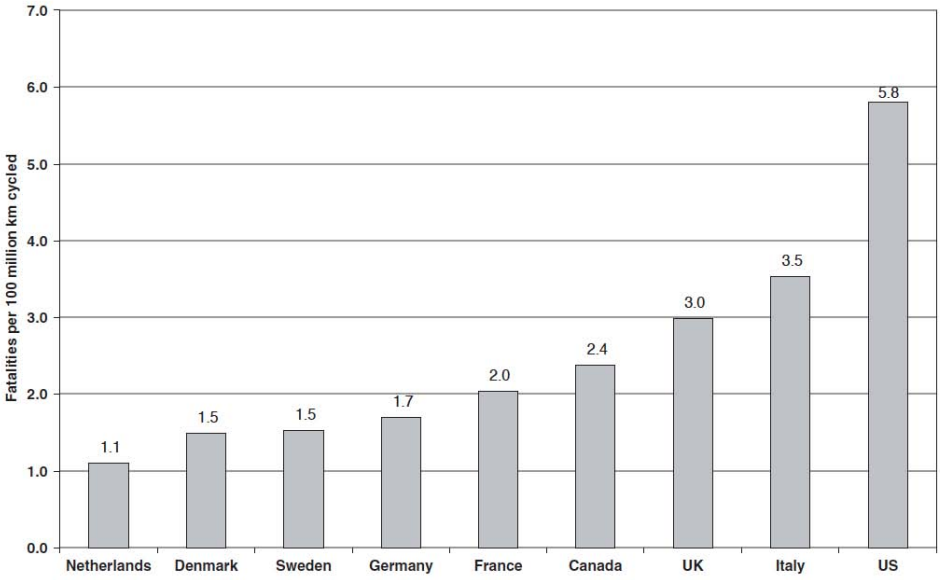
Education begins once a child is born and carries on through the teen years. There are many actors involved in this process, including educators, planners, enforcement agencies, and parents, but all focus on giving children confidence while cycling, the proper knowledge of traffic safety, and a contextual understanding of cycling in their country. This approach continues throughout childhood. Receiving this type of information and experience so young can help to set and reinforce training and acceptance of an active lifestyle for life (Lubans, 2010).

Figure 1: Number of Fatalities by Age



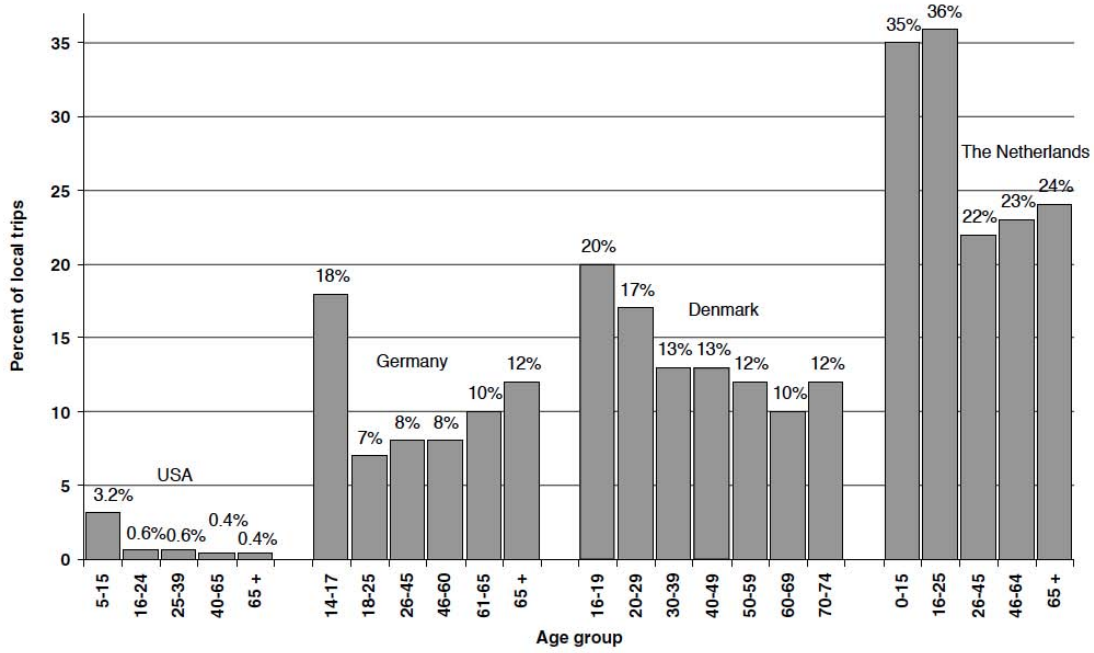
Source: NHTSA (National Highway Traffic Safety Administration) and US Department of Transportation. May 2014. *Quick Facts 2012*. http://www-nrd.nhtsa.dot.gov/Pubs/812006.pdf

Figure 2: Fatalities per 100 km Cycled by Country



Source: Pucher, John and Ralph Buehler. "Cycling for Everyone: Lessons from Europe" *Transportation Research Records: Journal of the Transportation Research Board* No 2074. (2008): 58-65.

Figure 3: Percentage of Local Trips by Age and Country



Source: Pucher, John and Ralph Buehler. "Cycling for Everyone: Lessons from Europe" *Transportation Research Records: Journal of the Transportation Research Board* No 2074. (2008): 58-65.

I argue that the lifecycle approach to bicycle education could help planners and others reach their goals for increasing the numbers of people riding bicycles in the United States. Case studies from the US show that there are education

programs for children and adults but they fall short in a few ways (Pucher et. al., 2011). They are not as comprehensive as European education programs and are offered only in a small percentage of schools that reach a limited number of students (Pucher et. al., 2011).

The primary purpose of this research is to develop a framework for understanding how bicycle education occurs in Europe, which may assist planners and other interested actors to introduce bicycle education to the US in a more effective and complete manner. My research has been conducted through literature review, interviews, and observations. I find that Europe has a lifecycle, or holistic, approach to cycling that starts when the child is born and carries through their teen years. Education is not addressed only by one group but many with overlapping training and education. Once these children are parents, the cycle begins again. My findings also show that while the US is likely less advanced in bicycle education, European countries are beginning to have similar problems to that of the US. These are: lack of time, longer distances between work and home, and lack of funding. While European countries are starting to see some declines in their cycling education programs, many groups are trying to find ways to combat these growing issues and maintain their holistic approach to education.

As part of a comprehensive approach to cycling, including infrastructure and enforcement, bicycle education has the potential to greatly reduce the number of

accidents and deaths of cyclists when both the cyclist and the car driver understand the rules of the road. While one can dream of the US becoming a place like Amsterdam or Copenhagen where there are less car drivers on the street, this is an unlikely situation in the near future. American culture and city design has emphasized the auto for nearly a century, but a comprehensive approach to cycling education can potentially help cyclists, drivers, and others to understand the cycling experience and how to share the road with respect. The European model for bicycle education will not be a direct translation into an American model but we can draw the lifecycle model to develop an approach to bicycle education appropriate for the United States.

2. Literature Review

There are very few studies on cycling education programs in the US. While new research and data continues to come out, very little looks at the overall approach to cycling education. Instead, most of the research is focused on the results of specific programs in specific areas of the country, particularly efforts funded by the Safe Routes to School program. Safe Routes to School is a national partnership that started in 1997 (*Safe Routes*, 2015). The partnership encourages parents and children to find alternative and active modes to school other than the bus or car. These methods are through city improvement of infrastructure, encouragement from schools like “walk- or bike-to-school week,” “walking buses,” or even covered bike racks for children’s bikes. Volunteers in most cities still largely run these programs.

2.1 Putting Education in Context

American bicycle planners and advocates have developed several frameworks for understanding the necessary approaches to making cycling more accepted and safe in US cities. One of the most frequently used frameworks is the "5 Es" ("The 5 E's", 2013). The League of American Bicyclists created the 5 Es to bicycle friendly communities as a type of checklist for creating bicycle friendly communities (see Table 1). Planners and other groups interested in bicycle promotion have worked to promote policies suggested by the "Es," but not all approaches have moved forward at the same speed in American cities ("THE 5 E'S", 2013).

Table 1. 5 Es to Bicycle Friendly Communities

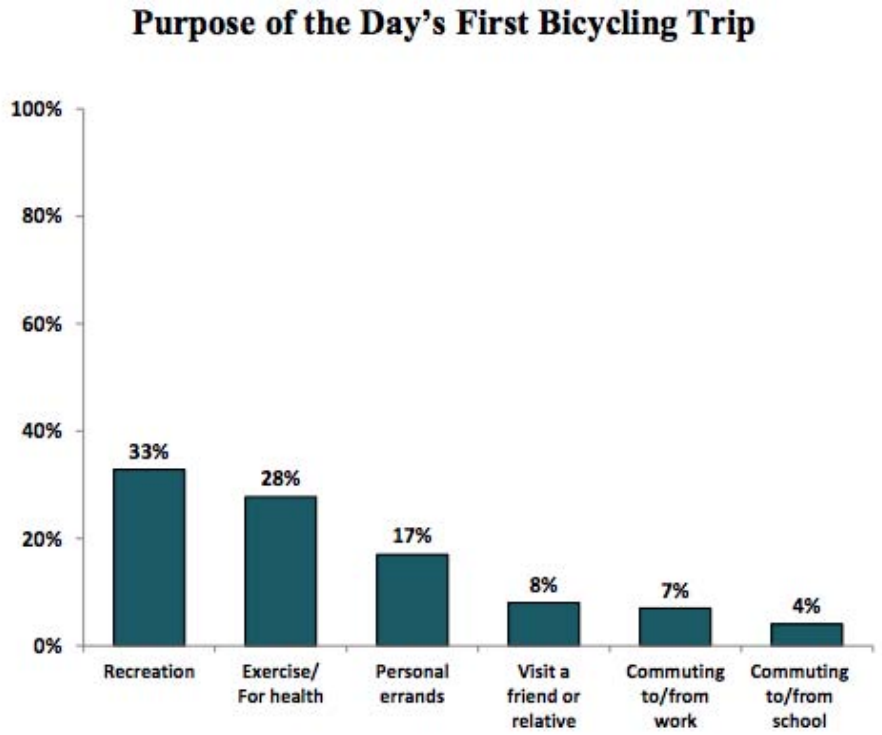
Engineering	This is a focus on infrastructure which includes: sharrows, green bike lanes, bike lights, etc.
Encouragement	This is also seen as inciting people to cycle. This comes in many forms: easy bike parking, covered bike parking, foot rests at stop lights, or even free coffee if you bike to work. This "E" is focused on simple ways that motivate people into using the bike as a form of transportation rather than just recreation, like Open Streets events.
Enforcement	Making sure that all modes of transportation are following the rules of the road.
Evaluation	How is the system working? Do you feel safe? Do you feel that that system makes it easy to cycle not only from work to home but also to other daily needs and events? Planners do need to check in more with not only cyclists but also drivers and pedestrians to make sure that the infrastructure works and makes sense. Cities look at actual before and after counts of riders.
Education	This piece is valuable in making new infrastructure and policy work. Without the knowledge of how to safely use the system there are accidents and preventable deaths. This knowledge is not only for cyclists but also for all modes of transportation. In Chicago bus and cab drivers are required to take a course focusing on driving within the city with cyclists (Pucher, 2011). Some programs are in place, but they are not generally coordinated within or across cities.

Source: "THE 5 E'S." *League of American Bicyclists*. League of American Wheelmen, Inc, 2013. Web. 18 Apr. 2015.

2.2 Cycling Culture & Children's Cycling Culture

As support for cycling has increased over the past several decades in the United States, more infrastructure and supportive policies have been put in place in hopes of creating safer streets. However, the social and cultural framework for cycling has not always kept pace with infrastructure investment and change. Cycling culture in the US is more recreational and health oriented (61%) than transportation focused (36%) (Figure 4) (NTHSA, 2012) making the culture shift to more transportation difficult for most cities.

Figure 4: Purpose of Day's First Bicycling Trip



Source: NHTSA (National Highway Traffic Safety Administration) and US Department of Transportation. October 2013. *2012 National Survey of Bicyclist and Pedestrian Attitudes and Behavior Volume 2: Findings Report.* DOT HS 811 841 B.

A survey completed by People For Bikes found that a total of 8,858 children aged 3-17 cycle at least rode once in the last year (Breakaway Research Group, 2015). Most education programs for children are centered on traffic safety rather than a holistic, multi-faceted approach that European countries tend to use.

Referring back to Figure 3, even in the US, more children between the ages of 5 and 15 (3.2%) are cycling than ages 16 to 65+ (2%) (Pucher & Buehler, 2008). This does not break down the statistics of the meaning of the ride or the length, i.e.: recreation versus transportation or one block versus six miles.

2.3 A Focus on Safety with Few Solutions

Programs that improve safety knowledge and behavior of children and adolescent cyclists need to be part of a comprehensive approach that encompasses legislative and environmental changes like cycling facilities and reduced speed limit in residential areas (Boufous, 2011). Vehicular injuries are the number one killer of children (Roberts, 1995).

Pucher argues that much of the decline in US cycling from 1975-1997 can be attributed to a decrease in children's cycling (Pucher, 2000). This is because of perceived dangers of cycling that lead many parents to stop allowing their children to cycle by themselves (Pucher, 2000). In Europe, if a child walking or biking is in an accident involving a car then the car driver is automatically to blame (Pucher, 2000). In the US children are more likely to be blamed (Roberts, 1994). Over 90% of police find children at fault during car accidents and 51% of children find themselves to blame while the inability to enforce speed limits or other traffic laws are ignored (Roberts, 1995). Children are easier to blame since their mental capacity of understanding certain situations is not fully developed and therefore rely on others for how they should respond (Ferguson, 1991).

Roberts believes that “maintain[ing] the economic interests of the dominant groups in society at the expense and suffering of children” is to blame” (1994).

2.4 Children and Cycling Safety

There is research that shows the longer a child delays the start of cycling, the less injuries for the child (Hansen, 2005). Children under the age of 5 have fewer injuries than children aged 5 to 14 but the injuries are similar and equally severe (Powell, 1997). Children sustain head injuries and trauma more so than adults and so it is suggested they wear helmets (Powell, 1997). Young children, under the age of 5, when compared to children aged 5-14, are less likely to be injured in street (46% vs 81%) and more likely to be injured at home in the yard or driveway (39% vs 9%). 31% of young children and 47% of older children are involved in accidents with cars though the data does not say who was at fault (Powell, 1997).

Some research notes that bicycle safety is important so they suggest the school partner with another organization and the police to teach cycling safety. “Safety City” or “Safety Town” in the US is similar in design to a traffic garden in Europe in that children learn to move through a series of intersections and traffic situations as a pedestrian, cyclist, or a car driver (*Safety Town*, 2007). This is a place where children learn cycling, walking, and driving safety within a miniature version of a city street network. Working with these groups outside of the school allows for children to learn these important skills while not taking away class time

(Graham et all, 2007). As mentioned above, it is of utmost importance to get children cycling young so they build their motor skills and create the habit.

2.5 Development of Motor Skills

Public health researchers have done some work on cycling skills but very few have identified the best approach to incorporating these skills into effective programs (Shim, 2015). In the last five to ten years, the strider bike, or pushbike, has begun to gain momentum. In a short study they noted that children aged three to five who rode striders for 4 weeks compared to those who didn't built more confidence and had increased balance (Shim, 2013). This topic still needs to be explored but is worth noting.

Motor skills are important for functioning in everyday life. Physical education provides the skills and practice needed to refine motor skills. However, age does not have a direct correlation to motor skills (Graham et al, 2007). Adults are good at walking fundamentally because they've been doing it for so long, the same is for cycling. The longer you do it the better you will become. Starting children out on the bike when they are younger would be creating the motor skills and the habit of continual bike usage. However, most physical education guides do not talk about bringing the bike into the classroom. Contrary to arguments sometimes made against including bicycle education in schools, it does not seem like insurance or equipment is the problem since many physical education training programs list rock climbing as an option, likely a far more dangerous and

equipment intensive activity (Graham et al, 2007). As mentioned above, there are large groups of parents who are concerned with letting their children walk or bike to school because of traffic and road safety (Hume, 2009). Programs aimed to increase active commuting throughout childhood and into the teen years can have positive affects on children's overall physical activity (Hume, 2009).

2.6 Independent Mobility

In the United States, 75% of parents are driving their children to school that is less than two miles away because of time saving and convenience (McDonald, 2009). Parents did not allow their children to walk to school without adult supervision if they lived two miles or less away from school and schools also do not allow this even if the parent is willing (McDonald, 2009). Safe Routes to School programs need to keep these considerations of parents in mind so they can create systems to help the parents and need institutional support for the programs to run effectively (McDonald, 2009). The US experienced 35% decrease of children walking and biking to school between the years 1969 and 2009. Eugene, OR's Safe Routes To School program showed an increase of walking and biking to school, about 5-20%, offsetting a substantial portion of the decline observed nationally. Creating excitement and awareness of Safe Routes to School interventions helps to make the program more effective. Analysis showed that creating covered bike parking helped to also increase walking, children were excited about the changes happening at the school, making any non-motorized means of travel more enticing (McDonald, 2013).

In Silver Spring, Maryland in 2015, a brother and sister aged 10 and 6 respectively were walking home from a park a mile away. The cops were called and the children were picked up and taken home. The parents later received a phone call from child protective services requesting that the children not be left unattended until the following Monday when they would follow up with the family. If the parents did not comply then their children would be taken away (Alder, 2015). All of this is to show that concerns with safety are intimately related to perceptions, in the US, of children's ability to bike and walk. Independent mobility of children in the US is hampered by these perceptions of danger. This also has an effect on the parents and how they move around since they will need to take their child to dance or soccer or some other event rather than allowing them to go on their own or with friends.

While freedom can help with the development of the child, parents are too afraid to let them walking or bike alone. There is irrational fear surrounding children cycling and biking. Have parents in the US become too protective, inhibiting their children from enjoying freedom, in turn hindering the parents' freedom? Growing up in a suburban development, it is not easy to walk to the grocery store, school, play fields, or the library (Pucher, 2000). Children must rely either on their parents or an older sibling for them to get around which can add stress to each other's lives (Fotel, 2003). Interestingly, children's independent mobility can be also linked to companionship. Most of the trips taken by children in a study conducted in Amsterdam, Netherlands and Jutland, Denmark show that

children's independent mobility is focused around social interactions (Mikkelsen, 2009).

2.7 The Need for Further Research on Cycling Education

The way planners, advocates, and other potential actors think about cycling in the US is disjointed. Educators in schools do not typically take a role in bike education, police don't have the knowledge or responsibility to promote safe cycling, and planners want to have a cycling city but don't know how to make it safe other than through engineering or enforcement. While programs certainly exist, they are not comprehensive or overlapping. The literature reviewed does not address what it means to have a comprehensive or holistic approach to cycling education, especially in the US. There is little knowledge about the potential outcomes of having such a program as well. There is a fear that children will get hurt or kidnapped, but those are only perceived fears. In order for the US to move forward with complete streets, planners can no longer ignore that education is needed for the streets to function. My study begins to examine how comprehensive, lifecycle education relates to cycling in several Northern European cities.

3. Data and Methods

3.1 Case Study Approach

In order to understand how cycling education functions in Europe, my research takes a case study approach, focused on several cities across northern Europe. I conduct interviews with professionals, educators, and parents engaged in

cycling education, in addition to a review of documented policies and programs and observation of cycling-related behaviors and cultures in my selected cities. I have chosen this multi-method case study approach, emphasizing participant input, in order to understand how a wide range of actors contribute to a relatively complex system of bicycle education and training. This largely qualitative approach has been used frequently in research, particularly in cases where basic knowledge of a complex system is still needed. Below are two examples.

Table 2. Examples of Qualitative Interview Research

Authors	*Title*	*Method*
Richard A. Fuller, Katherine N. Irvine, Patrick Devine-Wright, Philip H. Warren, and Kevin J. Gaston	"Psychological Benefits of Greenspace Increase with Biodiversity."	Semi-constructed, closed-ended question interviews of 312 greenspace users that analyzed the psychological well-being of respondents and their perceptions of greenspace species richness.
Patrik Grahn and Ulrika K. Stigsdotter	" The Relation Between Perceived Sensory Dimensions of Urban Green Space and Stress Restoration."	953 randomly selected citizens from 9 Swedish cities answered a mailed questionnaire with pre-coded questions.

John Gaber in his paper "Reasserting the Importance of Qualitative Methods in Planning" also points out that without this type of field research, the researcher loses a link between themselves and the people they are researching for (2002). Through conducting mixed quantitative and qualitative research methods together, the researcher can fully capture information on the problem for the people who are being affected (2002).

To select my case cities, I identified three countries that are known to have high rates of cycling among children and adults, as well as improved safety outcomes (Pucher & Buehler, 2008). The countries in Europe selected were: the Netherlands, Germany, and Denmark. Within these countries, I selected the following cities: Amsterdam and Utrecht in the Netherlands, Münster in Germany, and Copenhagen in Denmark. In these cities, I went about finding planners, educators, and experts in the cycling world within the city through Internet searches and networking with other professionals and academics in the US.

3.2 Interviews

I took hand written notes and audio recorded all interviews with participants and then transcribed them. The questions and prompts used for these interviews are below, in Table 3.

I interviewed eleven people in total: two in Denmark, two in the Netherlands, and seven in Germany. My intent was to speak with professionals within the field of bicycle education or those who have some connection to it. I also wanted to speak with parents who had or have children between the ages of 0-14 who have experienced bicycle education. This was harder to come by. If there was more time I would have worked to contact schools and parents of students who are going through bicycle education.

Here is the sample email used to recruit interviewees:

Dear _____,

I am a graduate student at the University of Virginia in the Urban and Environmental Planning department. My master thesis is on creating a framework for bicycle education in the United States, which focusing on education for children aged 8-12. I am using the Netherlands, Denmark, and Germany as case studies.

I recently received funding to travel to Europe over winter break to speak with educators, planners, parents or anyone else concerned/connected with bicycle education. Would you be able to speak with me about bicycle education in your country?

I look forward to speaking with you more.

All the best,
Mary

The following questions are prompts that were used in the open-ended interviews, focused on individuals' and their families' bicycle training and education experiences. Though not all these questions were asked at the interview, they were prompts leading to further questions about bicycle education.

Table 3. Interview Guide	
Category	**Questions**
Personal Bike Education Experiences	
	At what age do you remember learning how to bike?
	What do you remember about the experience of learning how to bike?
	When did you start biking on your own?
	Who taught you how to bike?
	Was there a biking education program at your school?
	Did you attend a biking education school separately from school?
Children's Bike Education Experiences	
	Do you have children of your own?
	If yes, are they learning how to bike or have they already?
	If yes, who taught them/will teach them/is teaching them?
	When will you/when did you let them bike alone or with friends but without an adult supervisor?
Current Biking Behavior and Attitudes	
	Do you bike today as your main mode of transportation?
	If yes, how comfortable do you feel biking?
	If no, how do you feel about cyclists where you live and what is your main mode of transportation? What are your interactions like with cyclists?
	What do you think about biking culture in [local country]? What impact does it have on transportation mode choice?
Questions for Bicycle Education Professionals	
	What age groups do you work with?
	How many hours of bicycle education in the classroom do students receive?
	Is there a suggested age for allowing children to ride alone?
	Do you consider children when planning or rebuilding roads?
	How involved are parents with their children's bicycle education?
	Are there events that the city puts on for bicycled education?
	Are there traffic gardens within the city?

Table 4. Interview Respondents		
Country	*Who I spoke with*	*Connection to Topic*
United States	Professor Noreen McDonald	Professor focusing on children travel modes and habits
	Professor Ralph Buehler	Professor focusing on bicycle transportation in the US. Wrote *City Cycling.*
	Shane MacRhodes	Eugene, OR SRTS Program Manager and creator or Kidical Mass
Denmark	Mai-Britt Aagaard Kristensen	Coordinator with Danish Cycling Federation
	Charlotte Basiliadis	Educator at Hylet København kindergarden in Copenhagen
The Netherlands	Ronald Tamse	Transportation Planner-City of Utrecht Old Transportation Planner-City of Amsterdam
	Professor Leonie Janssen-Jansen	Professor in urban planning at the University of Amsterdam
Germany	Officer Christoph Becker	Head police for bicycle education
	Stephan Böhme	City Bike Planner-City of Münster

Ideally I would have spoken with a wider range of people while in Europe. If time had allowed, once gaining permission from the school, I would have sent a survey to schools for parents of children age 0-14. If at all possible, I would have also interviewed the children themselves. They are a group that is largely spoken for on many topics, but I believe they have the right to talk about their own means of transportation, their feelings on it, and anything else they would like to say.

It would also have been beneficial to speak with adults who went through bicycle education and/or had children going through this same experience. While I was able to ask the professionals about their own experiences and those of their children, a larger sample of responses would reinforce the findings I present here.

3.3 Observations

I also attached a digital video camera to my bike and filmed while cycling through cities. This helped to understand the cycling characteristics of the different countries.

4. Case Study Findings

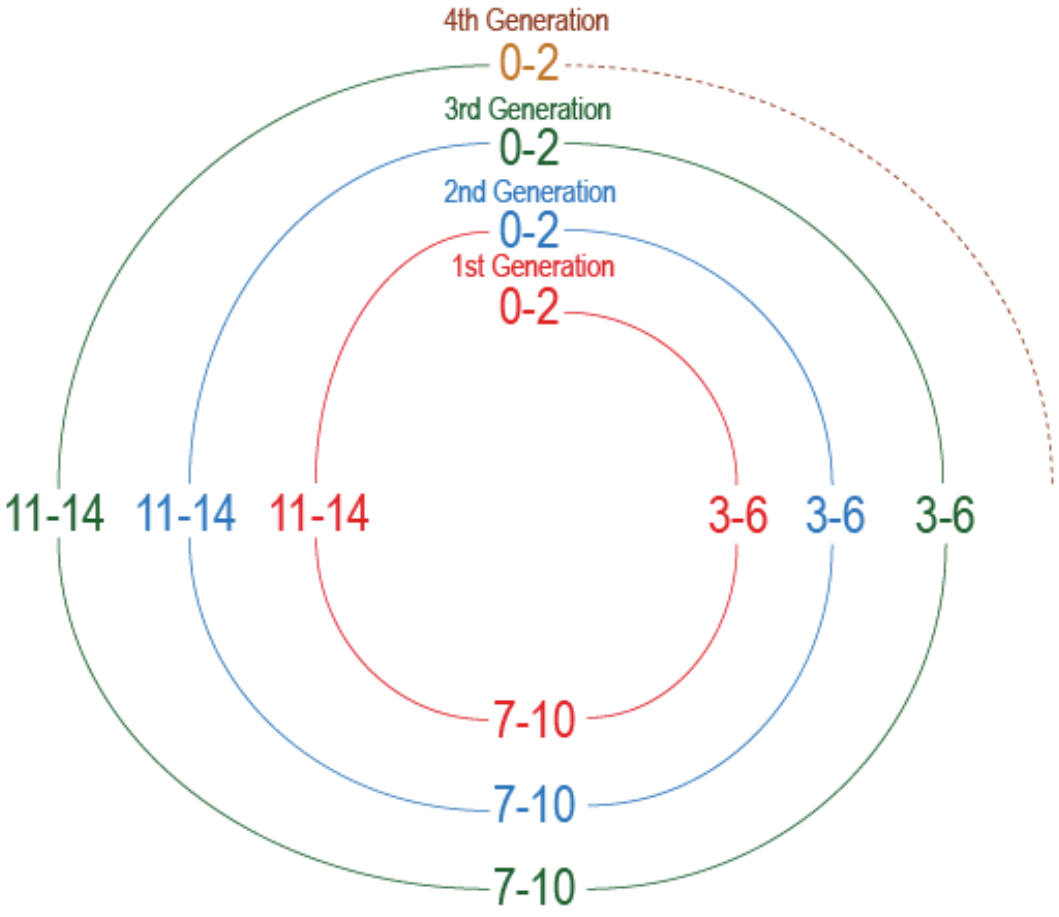
The interviews and observations were conducted across cities and countries, but several themes stand out as significant across location. I have organized my findings by these themes, reporting on interview results and observations that support these distinctive findings.

4.1 A Lifecycle Approach in Europe

In northern European countries, like the Netherlands, Denmark, and Germany, you can see many cyclists of all ages making their way through the towns. This behavior did not start overnight and was not only for exercise (Tamse, 2015). Interview respondents nearly universally describe a respect that is inherent between cyclists, drivers, and pedestrians. This comfort between the groups is not only because of adult bike culture but also, according to the interviews, due to the comprehensive education style that is prevalent throughout these countries. While there are issues with their education system, these countries have been successful in fostering a respect, making the roads safer for all users. Issues include funding loss or lack of funds in general, jobs being located further

from the home making bike travel not as easy, the schools are no longer located conveniently on the route to work, and more parents are finding it convenient to place the child in the backseat of the car rather than cycling. The chart below shows how this form of education continues with each generation, a concept expressed by many of those interviewed. Education begins once the child is born and then continues through their teens. Once they have children, the cycle continues through the 2nd generation and so on, and so on.

Figure 5: Lifecycle of Bicycle Education



4.2 Europe

Age 0-2

In the beginning stages of life, children are already cycling. Their parents strap them to either the bike or themselves when traveling to and from places. Parents can use special seats that allow children to ride in front of them or use a cargo bike for transporting kids.

Age 3-6

Parents begin to introduce their children to bikes at this age via the strider bike. This is a bike that does not have pedals but allows the child to walk while riding and practice balance. They are highly popular in Europe. From the Danish Cycling Federation:

> "They [children] get all these other little tractor things and what not, why not give them just the small training bike and they an play around on it? And it's just something that's fun for them to play with and I think that's maybe one of the challenges that we think the bicycle that's traffic and of course it is, but at this age it's also really a plaything" (Kristensen, 2015).

These striders, or pushbikes, can have a large effect on children's balance (Shim, 2015). Most parents do not start their children on these bikes so soon simply because they do not realize their children can learn so early in life (Kristensen, 2015). By never having training wheels on the bike, there is a

chance that injuries for children at a younger age cycling could disappear or at least decrease.

Parents normally teach their children to cycle—teachers do not believe that it should be part of their job to teach children how to cycle. The Hylet-school in Copenhagen is the only school currently in Denmark that focuses on teaching cycle safety. They require students, aged 2.5-6, to come to school with their own bike; being the strider bikes or regular pedal bikes. Every Friday the students have one hour of cycle safety training. Students are taught using games so to make cycling fun rather than a chore (Kristensen, 2015). The Danish Cycling Federation is attempting to make this type of education in schools the norm because they are seeing a decrease in children cycling (Ruby et al., 2010).

The Danish Cycling Federation created a mobile bicycle park that allows children to cycle around a changing terrain to learn basic cycling safety, which includes balance, breaking, and simple turns. The bike parks allow children of all ages to experiencing cycling in a safe and fun way rather than looking at it as a chore. There was an eight year old who's mother brought him to the park to learn how to cycle. She knew he was starting off late but did not know what else to do. The educators started him on a strider, showing him cycling wasn't meant to be a chore but something fun. He came back every day to continue cycling in the park (Kristensen, 2015). These parks have been highly successful leading the Danish

government to give a grant to the Federation for eight permanent parks throughout the country. They will be built in 2015 (Kristensen, 2015).

During the early years, in all three countries, parents are still a large part of the education process. Part of the European culture is to begin teaching their child how to cycle. At this age they may not be cycling to school on the street but maybe on the sidewalk. Parents are also taking them to school via bike in a carrier or a cart. They think this could be from parents working outside of the city where they live, having to travel further distances. Parents can also become worn out by attempting to teach their children how to cycle.

Age 7-10

In all the countries, students are starting to cycle to school either with parents or within a group. They have begun to handle the bike properly however they are unable to cycle alone. This could be because they do not know the route, don't fully understand breaking, or are still a little shaky on the bike (Kristensen, 2015).

In Münster, Germany the police are a large part of cycling education. The teachers are expected to teach their children a little bit about cycling on the streets to prepare them for the visit. Mr. Becker of the police department in Münster said about 90% of teachers adequately prepare their students for the visit of police officers (Becker, 2015). This preparation includes basic teaching of road signs, right-of-ways, and other simple traffic navigation. The police only have one day with students and it is mandatory in this part of Germany for

students to receive this day of training. Two police officers come in for about an hour and work with a class of about 8 to 9 students in the 4th grade (Becker, 2015). The police check the bikes for lights, brakes, and other things to make sure the bike is in proper working condition. If it is not, the teacher is required to check up with the parents to make sure the problems were fixed. Later the police will take the students on a bike ride to watch them cycle. This is like a test but there is no official test for cycling in Germany. The police do not bring bikes for children and if a child does not have one, they may not cycle. Mr. Becker stated that they are able to guess where they will not be doing bikes rides depending on the socio-economic status of families in a certain area of the city. Becker said there are groups that help children with bikes who cannot afford one but he did not know of any offhand (Becker, 2015).

Age 11-14

At this point most of the children in these countries have experienced some form of formal training either from school, the police, or an outside organization, like the Jugendverkehrsschule in Münster (Image 1-3). This school is a traffic garden where students can learn to bike, walk, and drive a foot pedaled car safely through types of streets you would see throughout Germany. Image 1 shows the layout of the traffic garden and image 2 and 3 show the actual garden. At this point, most parents believe their children have become mobility-independent (Kristensen, 2015).

> "It's a combination of factors but generally we say that your brain is usually developed at the age of 12 providing that you

have the proper training both in terms of the skills for cycling but also that you're practiced the route really well and that sort of thing" (Kristensen, 2015).

Image 1: Traffic Garden Layout

Source: Butcher, Mary. *Jugendverkehrsschule in Münster*. 2015. Photograph.

Image 2: Traffic Garden Münster

Source: Butcher, Mary. *Jugendverkehrsschule in Münster.* 2015. Photograph.

Image 3: Traffic Garden Course in Münster

Source: Butcher, Mary. *Jugendverkehrsschule in Münster.* 2015. Photograph.

Literature

From observation, books on cycling are easy to access in these countries. There are many different cycling topics covered for many different ages. Some of the books are in series of books, each covering different topics, while others were written by the city (Böhme, 2015).

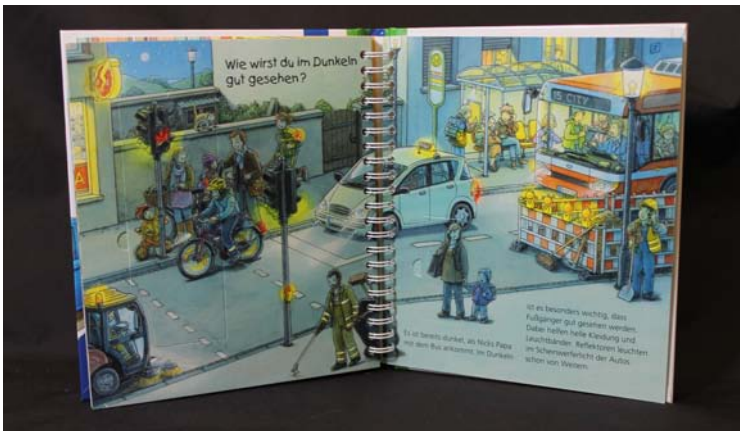
Table 5. (Europe) Book Topics Covered, Country, Image #

Country	*Book*	*Translation*	*Estimation of Age*	*Topic*	*Image #*
Germany	"Ampel, Staße und Verkehr"	"Traffic Lights, Roads and Traffic"	2-4	How to safety move on the street either by bike or walking. Also how to read signals, how to travel at night, and how to travel through different types of weather.	4, 5, 6
	"Hugo aus Münster"	"Hugo from Münster"	5-10	A tale of a boy, Hugo, and his dad traveling through Münster on bike. There is a map at the back of the book showing the trip. This is produced by the city.	7, 8
	"Der Kunterbrunte Fauberesel"	"The Kunterbrunte Fauberesel"	3-6	A story about two friends, a frog and a rabbit. They discover a bike in a pond, fix it, and ride it. Frog cannot ride and so Rabbit goes out in search of a bike for him—a tricycle.	9, 10
	"Kasimir hat einen Platten"	"Kasimir has a flat tire"	3-8	This story is about a father and son beaver heading out for a bicycle ride picnic. The son gets a flat and the father teaches him how to fix it.	11, 12
The Netherlands	"Kaatje op de fiets"	"Kaatje on Bike"	2-6	Kaatje introduces new cyclists to helmets, lights, safety vests, and the rules of the road when it comes to cyclists. She does use training wheels.	13
	"nijntje op de fiets"	Miffy's Bicycle	2-5	Miffy is a bunny who dreams of riding their bike. Miffy travels to visit their grandmother, has an accident, rides through the rain, rides through flower fields and woods, and eventually arrives home safety and cleans their bike.	14, 15

Image 4: “Ampel, Straße und Verkehr” Cover

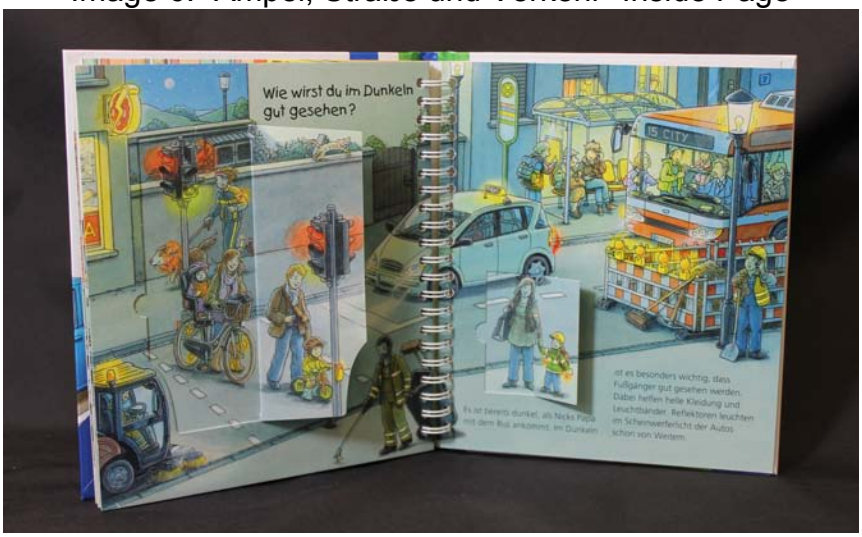
Source: Butcher, Mary. *Jugendverkehrsschule in Münster*. 2015. Photograph.

Image 5: “Ampel, Straße und Verkehr” Inside Page



Source: Butcher, Mary. *Jugendverkehrsschule in Münster*. 2015. Photograph.

Image 6: “Ampel, Straße und Verkehr” Inside Page



Source: Butcher, Mary. *Jugendverkehrsschule in Münster*. 2015. Photograph.

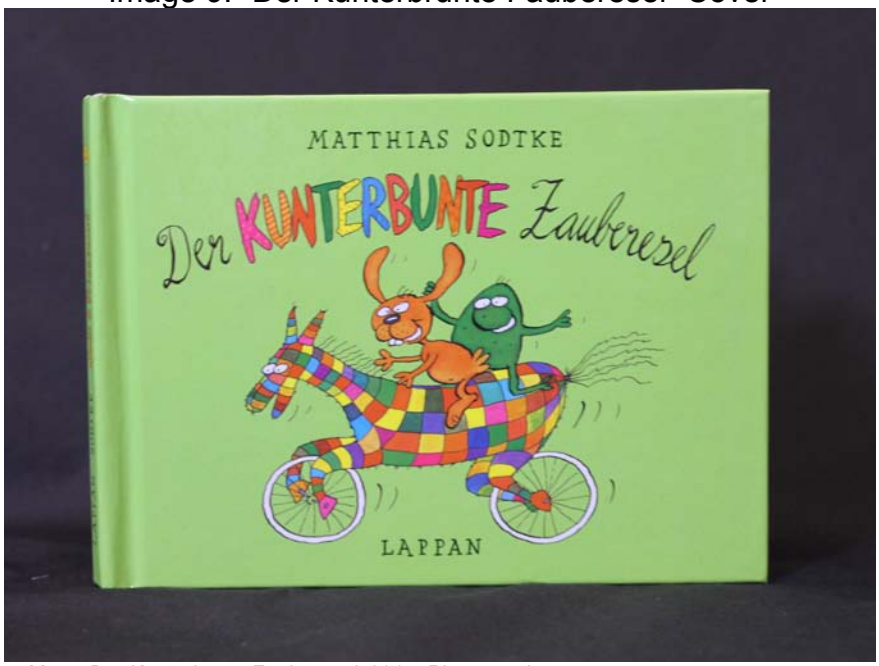
Image 7: “Hugo aus Münster” Cover

Source: Butcher, Mary. *Huge aus Münster*. 2015. Photograph.

Image 8: “Hugo aus Münster” Inside Page

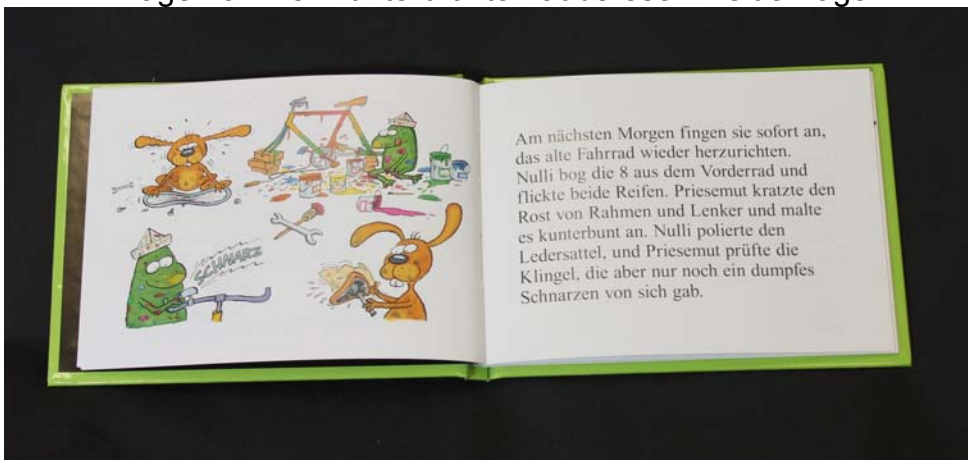
Source: Butcher, Mary. *Huge aus Münster*. 2015. Photograph.

Image 9: “Der Kunterbrunte Fauberesel” Cover



Source: Butcher, Mary. *Der Kunterbrunte Fauberesel.* 2015. Photograph.

Image 10: “Der Kunterbrunte Fauberesel” Inside Page

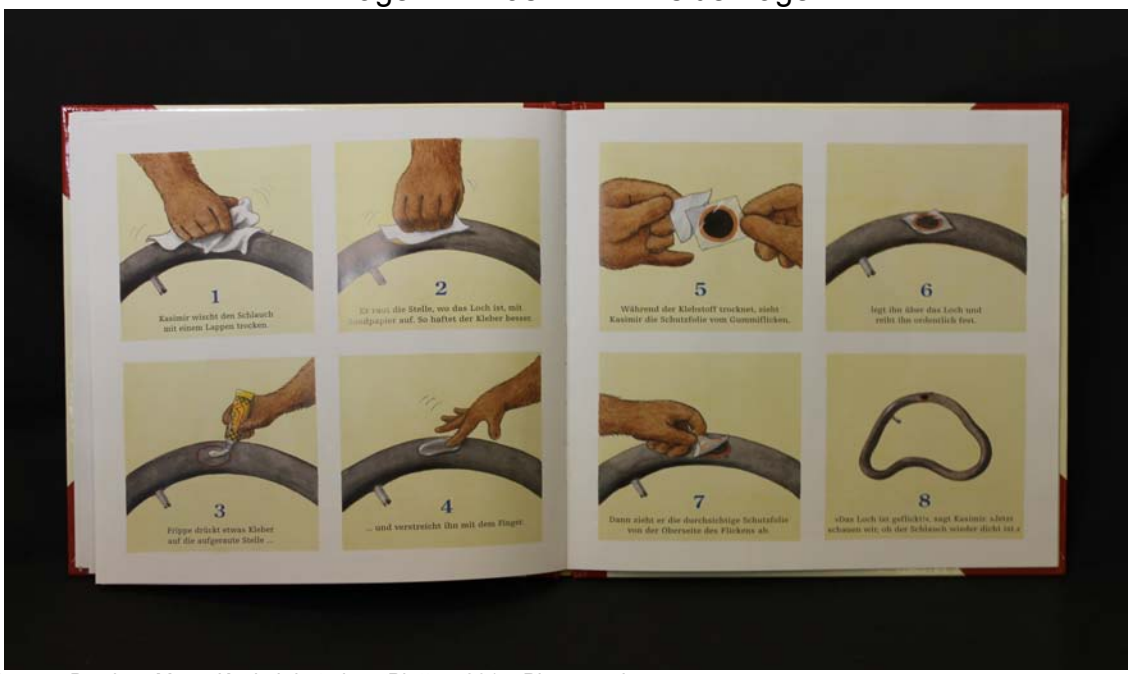


Source: Butcher, Mary. *Der Kunterbrunte Fauberesel.* 2015. Photograph.

Image 11: “Kasimir hat einen Platten” Cover

Source: Butcher, Mary. *Kasimir hat einen Platten*. 2015. Photograph.

Image 12: “Kasimir…” Inside Page



Source: Butcher, Mary. *Kasimir hat einen Platten*. 2015. Photograph.

Image 13: “Kaatje op de fiets” Cover

Source: Butcher, Mary. *Kaatje op de fiets*. 2015. Photograph.

Image 14: “nijntje op de fiets” Cover

Source: Butcher, Mary. *Nijntje op de fiets*. 2015. Photograph.

Image 15: “nijntje op…” Inside Page

Source: Butcher, Mary. *Nijntje op de fiets*. 2015. Photograph.

Table 6. Bicycle Education in Europe				
Note: many of these are observations from various interviews and observing the cycling culture.				
	Age			
	0-2	3-6	7-10	11-14
Parents	Cycle with child on parents' bike.	Purchase strider or other bike for child. The child would cycle on sidewalk, teaching them how to ride.	Buy next bike for child. Cycle with child to and from school.	Purchase child adult bike. No longer cycle to school with child.
School	n/a	Facilities for parking bikes at school.	Facilities for parking at school. Lessons for children in traffic safety for walking and biking.	Facilities for parking at school. Students take exam for cycle safety knowledge.
Police	n/a	Some education.	Some education.	Some education and administer exam.
Planner	Thinking of cycling as part of a larger transportation network. Think about families and different age riders when designing networks and infrastructure.			
Other	n/a	Traffic garden where children can learn to bike, walk, and drive on streets.	Traffic garden where children can learn to bike, walk, and drive on streets.	Traffic garden where children can learn to bike, walk, and drive on streets.
Literature	Parents reading to children about cycling.	Books available about bike safety.	Books available about bike safety.	Unknown

All Ages

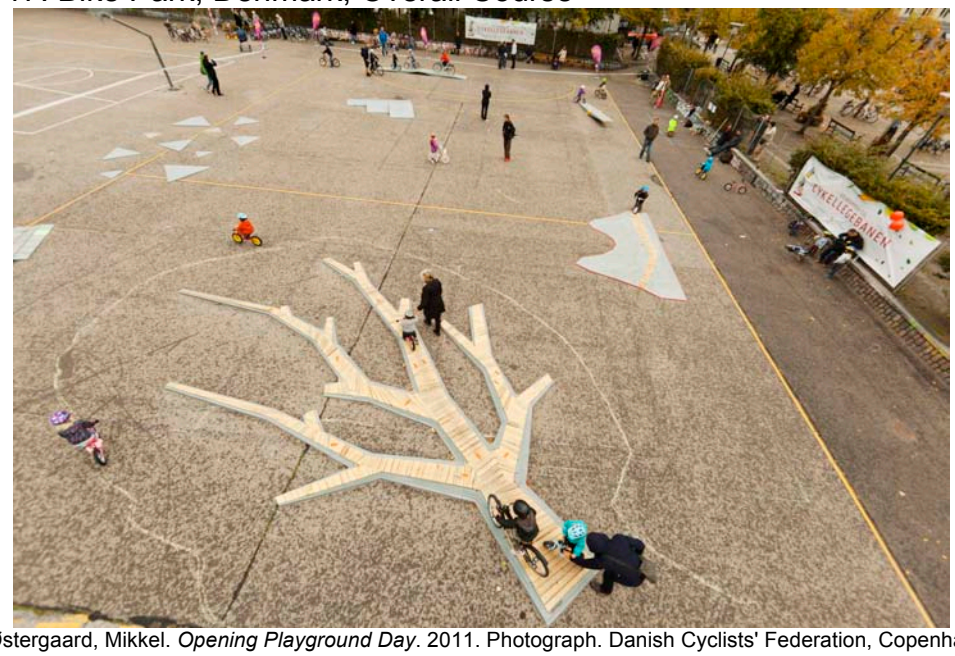
In Copenhagen, the Danish Cycling Federation created a portable bike park (Image 16-20) for children to practice their cycling safety skills. These parks are safe places for parents to bring their children to practice skills they either learned at home or school. The children are working to one-day cycle on the street but this can be a lot to ask of a small child who does not have full control of their motor skills. The parks have different terrains to help children learn to cycle in

different environments and also with other children around them (Kristensen, 2015).

Image 16: Bike Park, Denmark, Child Biking on Tree Course

Source: Østergaard, Mikkel. *Opening Playground Day*. 2011. Photograph. Danish Cyclists' Federation, Copenhagen.

Image 17: Bike Park, Denmark, Overall Course



Source: Østergaard, Mikkel. *Opening Playground Day*. 2011. Photograph. Danish Cyclists' Federation, Copenhagen.

Image 18: Bike Park, Denmark, Child Biking

Source: Østergaard, Mikkel. *Opening Playground Day*. 2011. Photograph. Danish Cyclists' Federation, Copenhagen.

Image 19: Bike Park, Denmark, Seesaw

Source: Østergaard, Mikkel. *Opening Playground Day*. 2011. Photograph. Danish Cyclists' Federation, Copenhagen.

Image 20: Bike Park, Denmark, Tree Course

Source: Østergaard, Mikkel. *Opening Playground Day*. 2011. Photograph. Danish Cyclists' Federation, Copenhagen.

Problems—Europe

While in these Northern European countries there is a stronger support for cycling there are still problems. They are as follows:

- Funding—Lack of funding makes it hard for programs to function and even stay alive. In Utrecht the famous traffic garden might be closing due to lack of funds (Tamse, 2015).

- Home-to-Work Commuting—In Denmark they are starting to see a decline in children cycling (Kristensen, 2015). They think this could be from parents working outside of the city where they live, having to travel further distances. Parents can also become worn out by attempting to teach their children how to cycle.

  > "The worst thing that could happen, we get a generation of kids who are raised in the backseat of the car and then when they become old enough to bike on their own they won't want to because they won't know how, they won't have the proper skills of the bicycle and they don't know how to behave in traffic either. Plus it will be difficult to break a habit so we really want to encourage this as early as possible" (Kristensen, 2015).

- Parents' Responsibility—Many teachers do not like the idea of being told they must introduce bicycle education into their classroom. They already

have enough work to do with the current lessons. They also believe it is the parents responsibility to introduce their children to cycling.

> "But it's often a barrier that they [teachers] think cycling is not what we have to teach them, this is the parents' responsibility" (Kristensen, 2015).

- Frustration—Kristensen comments on bicycle education and the frustration parents can face when teaching their child.

> "You know some parents will experience that whole cycling training process as a frustration and sometimes it can be. We've had examples if you don't get to learn until a little bit late, as a parent you're maybe get a little bit embarrassed. 'Oh my god, maybe I should have taught Peter two years ago and he's six and he can't bike.' And you're like 'get on with it' and he can't really figure out and it becomes a frustration but over here [on the bike playground], it's a game" (Kristensen, 2015).

4.3 United States

Importantly, this research does not focus on the US, but an initial exploration of US bicycle education programs shows that while efforts to educate children in cycling safety and habits are underway, comprehensive systems of bicycle education where multiple partners engage children across age groups are not evident. In Europe, practitioners described a relatively comprehensive approach

to cycling that engaged educators, planners, police, and parents, in the United States, cycling education experts generally describe a fragmented system that is not comprehensive in terms of the ages or the groups engaged in the process. Shawn MacRhodes, executive director of Safe Routes to School in Eugene, OR, pointed out that cycling culture was originally young men racing through the city. But now those men have become parents and the bike scene is shifting more towards the family (2014). In this Section, I describe what has been accomplished in the United States to react to that shift.

From initial research, there is not much focus on children beginning to learn to cycle before the age of 2 or 3. Some parents do cycle with their children at this age but are sometimes chastised for cycling with children because it is perceived to be dangerous (Garrard, 2012). There are “safety towns” or “safety Cities” where children can go to learn about traffic and fire safety. As mentioned before, these are very similar to the traffic gardens found in many European countries in terms of their layout.

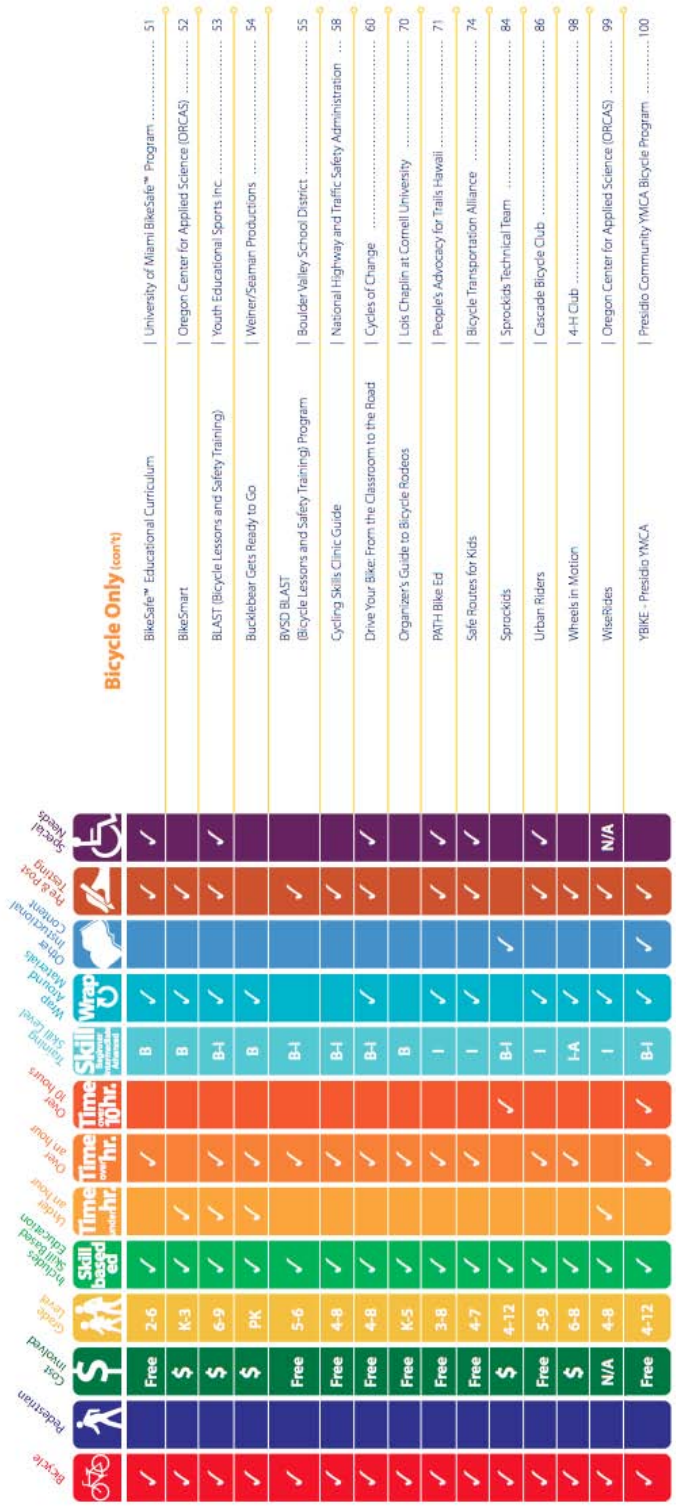
Some Safe Routes to School programs, like the one in Eugene, Oregon, do 10 hours of cycling training in the school. They bring their own fleet of bikes and give kids their own helmets (MacRhodes, 2014). Other SRTS programs focus on walk or bike to school week to encourage children to live near the school to arrive by means other than bus and auto. If the children live further away some schools have walking buses where children will meet, along with some supervisors, and

walk together from a location closer to school than their home (National Safe Routes, 2015). Age 11-14 in the US, some children are cycling to school but not like the numbers seen in Europe (Pucher and Buehler, 2008).

Throughout the US there are many programs that are working with children to teach bicycle education. These programs vary in what skills are trained and for what ages, but the programs do exist and can be very beneficial. However, there is no holistic lifecycle approach occurring in the US—none of the programs are overlapping starting from birth through teens. However, the programs that do exist can serve as a solid foundation to a lifecycle approach to bicycle education in the US. The League of American Bicyclists have quick guides and curriculum for bicycle education but they are generally not free (League, 2015). SRTS put out a guide in 2011 that nicely lays out programs and curriculum available for teaching children pedestrian and bicycling skills (Cowan et. al., 2011). The guide breaks down into: Pedestrian Only, Pedestrian and Bicycle, and Bicycle Only. The categories the programs are ranked in are: bicycle, pedestrian, cost involved, grade level, includes skill based education, under an hour, over an hour, over 10 hours, training skill level, wrap around materials, other instructional content, pre and post testing, and special needs. The guide then describes each program in detail which includes: the creator, program summary, challenges of running the program, and contact for ordering the program or getting more information. Below are examples of the information from the booklet. It is intended to be used as an online guide that allows you the hyperlink to other

sections of the booklet with information on individual programs. The guide is easy to use and informative of programs available in different states (Cowan et. al., 2011).

Figure 6: Example of Guide for Bicycle Education Programs in US



Source: Cowan, David and Robert Ping. *Bicycle and Pedestrian Curricula Guide: Making the Case for Bicycle and Pedestrian Youth Education.* Safe Routes to School National Partnership. Feb. 2011.

Figure 7: Sample Page from Guide Explaining a Program (Sprockids)

Sprockids

Doug Detwiller, (604)886-0772 , ddetwiller@dccnet.com
Contact for Ordering/More Information: **www.sprockids.com**

Creator: Sprockids Technical Team

Program Summary: While different from many of the other bicycle safety programs represented in this report, Sprockids was originally developed as a Self Esteem /Anger Management Program to help students succeed in school. Since then, Sprockids has evolved into a multi-faceted program engaging thousands of young people in the life long activity of mountain biking while teaching them the skills, values and strategies to succeed in life.

The Sprockids introduction to bicycling program teaches four skills areas of cycling: safety and etiquette, riding skills (1st and 2nd gear) and bicycle maintenance. The program allows participants to progress in all areas at their own pace and promotes values, respect for others, empathy, appreciation and responsibility for the environment.

As participants gain the skills demonstrated in the class they record their personal progress in their "Passport".

This program is intended to be led by trained individuals so that they can adequately pass on the program's life skills while helping students develop a healthy, positive philosophy toward bicycling and learning as lifelong activities.

Example of Success Story: Sprockids is now used in 19 countries by teachers, coaches, cycling clubs, youth organizations, law enforcement agencies and parents.

Challenges: The Sprockids program was designed to allow the organization delivering the program to be able to utilize the instructional material in a manner to best suit the needs of their clientele.

Contact for Ordering/More Information:
Doug Detwiller, Program Director
P.O. Box 1456
Gibsons, B.C. V0N1V0 Canada
ddetwiller@dccnet.com
(604)886-0772
www.sprockids.com

Subject: Bicycle

Skill Based Education: Yes

Grades: 4th - 12th

Type of Instruction: Train-the-trainer (two Sprockids instructional manuals); Teacher-led (participant "Passport")

Program Duration: 20 plus hours. Train-the-trainer (optional one day, on-site course)

Other Instructional Content: Language arts, social studies, math, science, and art.

Requires Equipment: Yes

Cost: $225 per leader for instructional manuals and training

Intended Skill Level Trained: Beginner/ intermediate

Meets State Education Standards: No

Measures Student Learning Through Pre/Post Testing: No, however as each participant masters the 55 skills covered in the program their results are recorded in their individual "Passport."

Wrap Around Materials (i.e. materials that are sent home and support in classroom lessons): No

Adaptations for Special Needs Students (or scalable to various skill levels): No

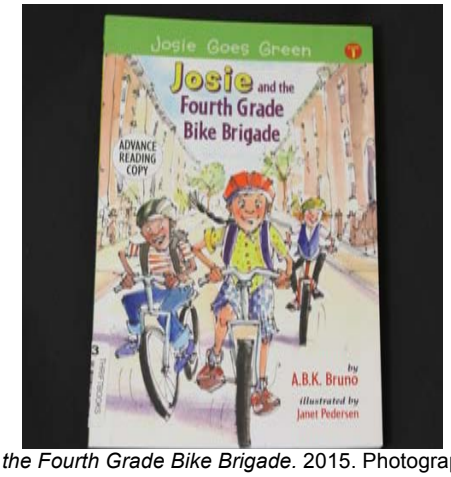
Source: Cowan, David and Robert Ping. *Bicycle and Pedestrian Curricula Guide: Making the Case for Bicycle and Pedestrian Youth Education.* Safe Routes to School National Partnership. Feb. 2011.

From observation, literature on biking in the US is mainly focused on how to ride a bike without training wheels. Ralph Buehler stated his surprise of not being

able to find any books in English in the US for his children on the topic of riding a bike (Buehler, 2014).

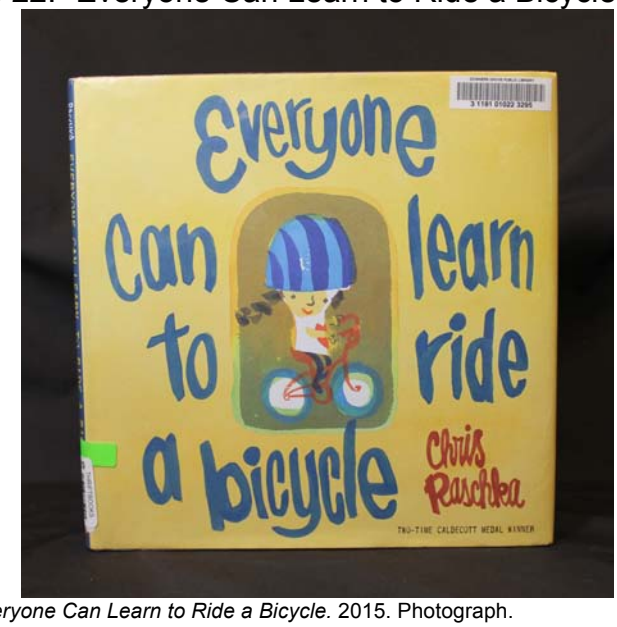
Table 7. (US) Book Topics Covered, Image #			
Book	*Estimation of Age*	*Topic*	*Image #*
"Josie and the Fourth Grade Bike Brigade"	8-10	Josie and her friends form a bike brigade to help bring awareness of climate change to their home in Park Slope, Brooklyn, NY.	21
"Everyone Can Learn to Ride a Bicycle"	2-5	A girl shows children that everyone can ride a bike. She buys a bike and her dad teaches her to ride. A large part of the book is her trying to learn riding without training wheels.	22, 23
"The Bicycle Man"	4-6	Two American soldiers show their cycling skills to a schoolyard of Japanese students during their sportsmanship day shortly after WWII.	24
"Franklin Rides a Bike"	4-7	Franklin wants to ride without training wheels because all his friends are but he is afraid. Eventually he learns to ride without them. The book also talks briefly about independent mobility.	25, 26
"Curious George Rides a Bike"	5-8	Curious George is given his own bike. He already knows how to ride and goes on an adventure through town that leads him to the circus and eventually home.	27

Image 21: Josie and the Fourth Grade Bike Brigade" Cover



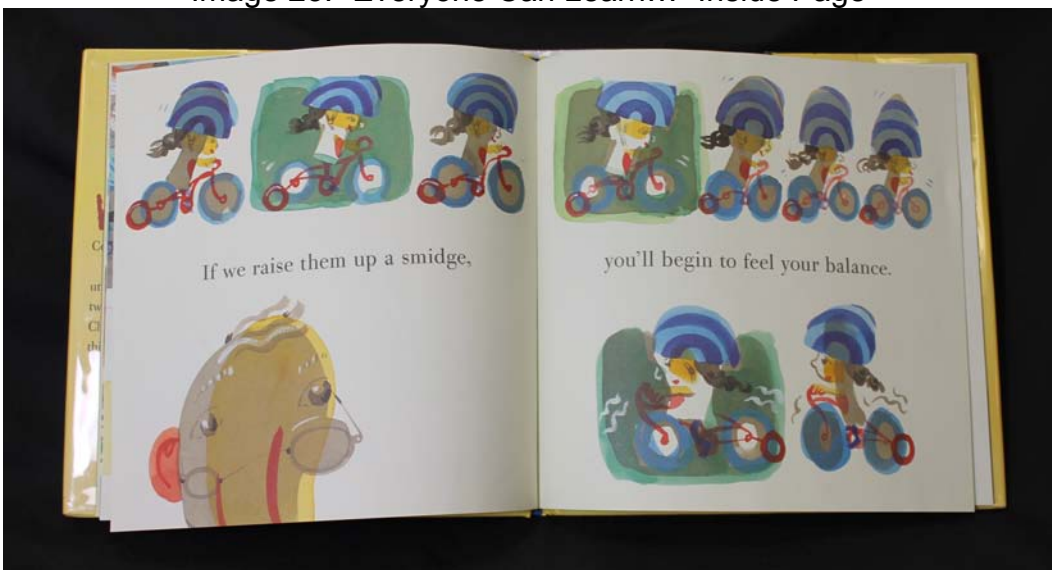
Source: Butcher, Mary. *Josie and the Fourth Grade Bike Brigade*. 2015. Photograph.

Image 22: “Everyone Can Learn to Ride a Bicycle” Cover



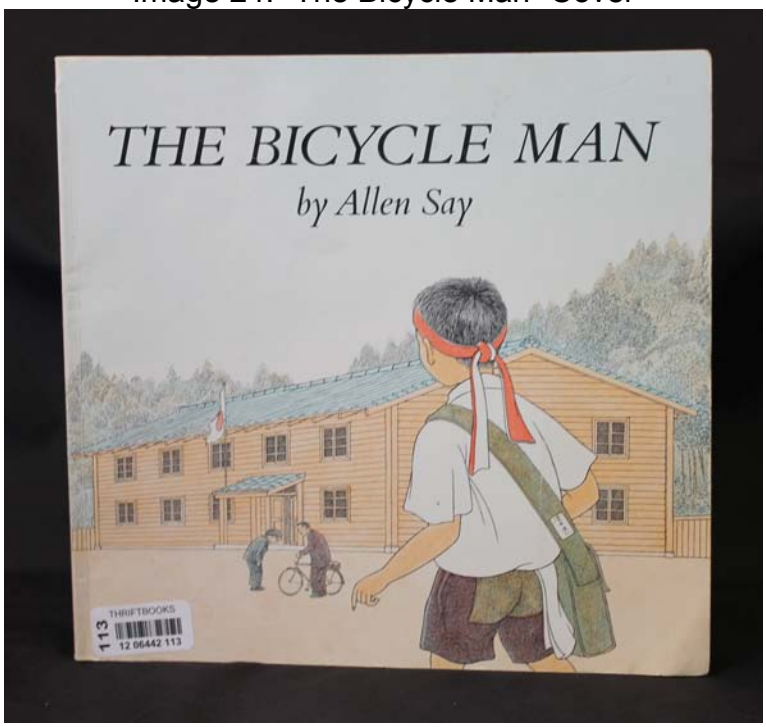
Source: Butcher, Mary. *Everyone Can Learn to Ride a Bicycle.* 2015. Photograph.

Image 23: “Everyone Can Learn…” Inside Page



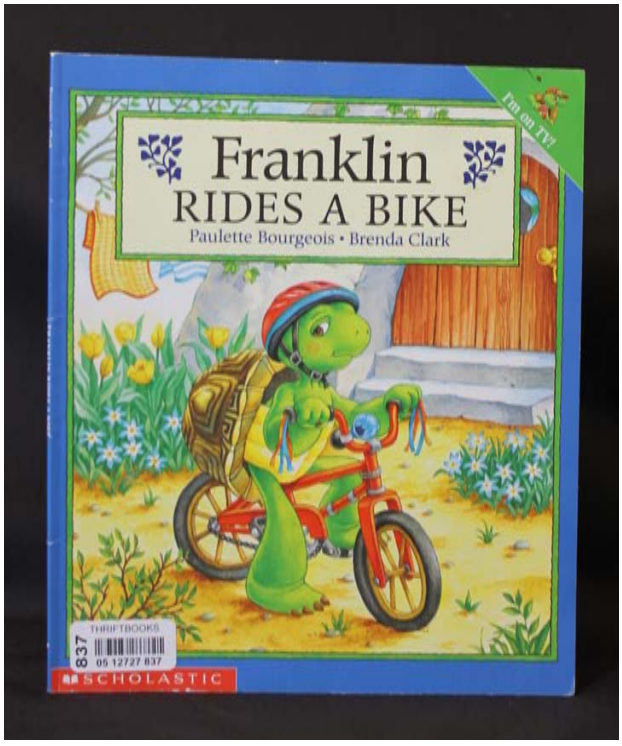
Source: Butcher, Mary. *Everyone Can Learn to Ride a Bicycle.* 2015. Photograph.

Image 24: “The Bicycle Man” Cover



Source: Butcher, Mary. *The Bicycle Man.* 2015. Photograph.

Image 25: “Franklin Rides a Bike” Cover

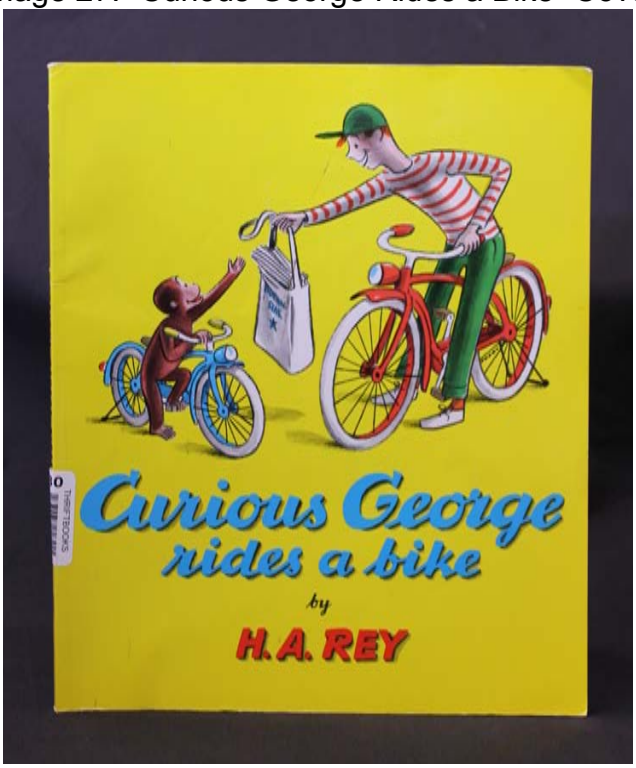


Source: Butcher, Mary. *Franklin Rides a Bike*. 2015. Photograph.

Image 26: “Franklin…” Inside Page

Source: Butcher, Mary. *Franklin Rides a Bike*. 2015. Photograph.

Image 27: “Curious George Rides a Bike” Cover



Source: Butcher, Mary. *Curious George Rides a Bike*. 2015. Photograph.

Table 8. Bicycle Education in United States				
Note: many of these are observations from various interviews and observing the cycling culture. This listing appears to be more the exception rather than the rule for most Americans and the US. This is not a complete listing of all programs available but a basis for what is going on. More thorough research is needed.				
	Age			
	0-2	3-6	7-10	11-14
Parents	Some might ride with children on the parents' bike.	Buy child first bike, ride around school grounds or parking lots.	Buy child first bike, ride around school grounds or parking lots.	Parents may take children on cycling trips and on trails within their city. Mountain Bike clubs are also becoming popular.
School	Unknown	Safe Routes to School programs focusing on walking and biking. Most of these programs are volunteer run. Guide from 2011 that explains successful programs across the country that teach bicycle education. Some have infrastructure in place such as bike racks and bike lockers.		
Police	Unknown	Unknown	Unknown	Bike Rodeos: a clinic teaching children bicycle safety skills.
Planner	The term "8-80" is used frequently by planners when talking about complete streets and how to design by all. If there is a complete street policy for the city or town, planners would generally consider the needs of family.			
Other	Unknown	Unknown	Safety Town, which is similar to a traffic garden but also has a focus on fire safety. There are few of these in the US.	Some children are riding to school. Bike clubs and bike tours.
Literature	Unknown	Focus on training wheels and riding without training wheels.	Unknown	Unknown

Problems—United States

There are many barriers to introducing cycling into school programs in the United States. First is cost. In order for Physical Education courses to use bikes as a way to increase physical activity in the classroom they must have access to a fleet of bikes that are well-maintained and appropriately fit the children. This cost is not only large on the front end but you must continue to raise funds to replace parts and maintain the bikes (Margo Pedroso, 2015).

The teachers also have to be comfortable with fitting helmets to children, know the rules of the road, and have basic bike maintenance skills. To get around this, some schools partner with local bike advocacy groups. These groups come in with their own fleet for a one or multi-day bike education class(es). This method does not allow the children more practice since they take the fleet of bikes back with them (Margo Pedroso, 2015).

Storage and security can be limiting factors when deciding to introduce bikes into the classroom. If the school is overcrowded, finding room for a fleet of bikes may turn out to be too difficult. Ensuring that the bikes are locked and secured from vandalism is an additional problem for schools who already may be struggling with finances and lack of space (Margo Pedroso, 2015).

4.4 Findings

At every point in the lifecycle there is a comprehensive approach to bicycle education. While there is this holistic approach, European countries are starting to see similar barriers the US deals with for education of this sort.

Difference Between Cycling Safety and Traffic Safety

While speaking with Mai-Britt Aagaard of the Danish Cycling Federation I was introduced to a new way of viewing cycling education. Rather than seeing it as a focus on traffic safety, she showed me to see it as two different training types that were needed: cycling safety and then traffic safety. Cycling safety is the focus on simply learning how to ride a bike. Children would normally start at a

young age and then transition to traffic safety. Cycling safety is about learning to cycle with proper balance, how to slow down and know when, cycle with one hand, and other useful tools to help when learning traffic safety.

Early Culture of Cycling

In Europe, children are immediately introduced to cycling simply because it is all around them. Their parents are also most likely cyclists and will take them along. This immediate introduction to cycling helps to foster an understanding that cycling is not just for recreation but also for transportation. It is a tool, as Ronald Tamse said (2015). They do not consider it anything else than a way to get around safely, cheaply, and effectively. Literature is also a large part of this early culture of cycling. There are many books available not only to parents but also educators that teach children to read but also about the rules of cycling and even how to maintain their bike.

Children are beginning to ride at a younger age in Europe while also being given independent mobility. This freedom on the bike shapes how children interact with the world and grows their responsibility. This independence is an important part of how the world is framed for the child via the bike.

Role of Parents

Parents play a very important part in a child's understanding of the bike in Europe. They ride with their child when they are young, teach them how to bike,

and even give them their first introduction to traffic safety. This involvement from the parents is going down throughout Europe for reasons mentioned above, but they still are expected to do their part to help create a functioning bicycle transportation system by educating their children. It places a lot of responsibility on the parent, ensuring their involvement with their child's life at a greater level than just speaking with them or making sure they are eating healthy foods. They are really introducing their children to freedom and independence.

Institutional Commitment to Cycling Education

Schools and the police in Europe are active in the child's education of bicycle safety. They do not teach cycling safety but traffic safety, which is just as important. In the US, this form of involvement varies from school to school and city to city.

5. Discussion

In Europe, the comprehensiveness of bicycle education, and the presence of overlapping cycling programs that continue throughout a child's development, are what I have termed "a lifecycle" approach to cycling education. While the origins of the lifecycle approach, and the necessary policies to make it function are not clear even to cycling educators and planners in Europe, the system as it functions today still manages to provide large groups of children with early and repeated experiences of cycling skills and habits that does not end until they are in their teens. In the United States, current bicycle education programs are

simply not extensive enough, nor are they supported by a cultural context that prioritizes the development and cycling skills and awareness.

There are several key factors separating how cycling education occurs in Europe and the United States. One may be culture. The initial advocates for biking in the US were young men, speeding through traffic (MacRhodes, 2014). These men have started to have families and are now advocating for safer streets for all ages. But this is not enough. Programs in the US do not yet overlap with each other to create a holistic approach.

As mentioned, the US faces many challenges when it comes to introducing bicycle education. There is not a strong cycling culture that runs throughout the US, but rather in pockets within cities or communities. The US also lacks funds for these types of transportation goals. It is not only a focus on education but must start there and feed into a change in infrastructure, policies, and goals for transportation planners and designers.

Using the successes and downfalls of the European lifecycle model of cycling education we can begin to create a more holistic and comprehensive approach to bicycle education in the United States. Not everything will translate directly but there are lessons that will help direct how we engage children in a way that creates safer streets into the future.

5.1 Current Situation at a Federal Level

In May of this year, 2015, MAP-21, the Moving Ahead for Progress in the 21st Century Act (P.L. 112-141), will be ending. This means that Congress must make decisions on the funding and policy for the transportation bill. There are many groups and individuals who believe that pedestrian, bicycle, and transit should be taken out of the bill because the deficit is so large. By removing these users, they argue that transportation funding will become more economically sustainable (Whitaker, 2014). They claim that these three modes do not pay into the highway fund and therefore should not gain access to the funds. However, if bicycle-related funding is cut from the bill and ceases to receive funds, many schools will be unable to fund the programs that even exist today, much less expand cycling education. This type of awareness of federal, state, and local government policies and decisions is important. These decisions can greatly effect the outcomes of bicycle education that is already in place and what could be.

5.2 Localities

Planning departments can work through a bicycle and pedestrian coordinator and/or their transportation planner to create traffic gardens and bike parks. These facilities have proven to work in Europe and can work in the US as well. These parks give parents and educators a safe space to teach children bicycle skills.

5.3 Parents

In Europe, parents are engaged. They did not just demand a policy shift, but they also cycle and know what the problems are. Their approach is part of a larger

cultural context on cycling in their countries. In the US, this cultural context for parents to work within is lacking. Parents are not already cycling to work or the grocery store or even for recreation. How can they demand that their be a policy change for safer cycling or education or encourage their children to ride? Most may not even think that their children should be cycling because of perceived dangers for cyclists.

There are ways for parents to get around these situations if they do want their child to experience independent mobility. The first step is simple—begin to ride a bike. Children will copy what their parents do. The next step is to help them practice. This could be in a local park or parking lot. Maybe there is a schoolyard nearby. If the parents are lucky enough to live in a city where they have a bike park or a traffic garden, they can take their children there to practice. Families can also participate in Kidical Mass events if they are in their city. If not, they can create a Kidical Mass ride. It would be wise to plan this with a Safe Routes to School program to help create some form of regularity. Parents, if possible, should also become involved with the political scene surrounding the issues of biking and walking in their city.

5.4 Children's Literature

From observation, children's literature on bicycling in the US mostly focuses on training wheels—either how to ride with them or learn to ride without. In the US there are also very few books to be found on the topic of riding a bike. It is simply

not considered a major form of transportation. Bikes are no longer for only recreational riding in the US but they are becoming a viable mode of transportation. However, the literature for children is not reflecting this.

From observation in Europe, their books mostly focus on routes, how to maintain a bike, street safety, and basic understanding of riding a bike. This helps to prepare the children for their classes in school and riding with parents. Seeing literature that shows bikes are something other than recreational also helps to inform the children that they can be used for transportation and should be. Literature can be thought of as cherry on top to the cycling culture cake. It is a small piece that can really bring the lifecycle of bicycle education together.

5.5 Curriculum Building

Through this research, I have focused my attention on documenting how European countries approached bicycle education rather than developing a curriculum for the United States. Based on what I have seen and read, I have some suggestions on what might be appropriate for the US curricula. If the US was to adopt the European model it could be that everything they do is shifted later in ages because the US is delayed in cycling experience. This would mean that the 11-14 age group in US is more active on the cycle than say the same group in Europe while the opposite is true for age 0-2 or 3-6. This may change over time, but not until the US catches up with European standards for bicycle travel and children mobility independence.

5.6 Database

One major finding from my examination of cycling programs in the US is simply the fragmentation of exiting programs. So far, cycling advocates and educators do not have a centralized recourse for learning about what programs are in operation, how different groups can be involved, and what opportunities there are for providing a child with a childhood-long holistic education sequence. Creating a database for parents and educators to find bicycle education training programs in their area using a zip code would elevate this problem. This would enable parents to take control of their children's bicycle education and help to create a European lifecycle approach. The database could be linked to Congressional districts making it easier to take exciting news or concerns to your local representative and to get the issues to a higher level of power.

The database would be divided into the age groups used in this report (0-2, 3-6, 7-10, 11-14). The parents would be able to see where they can bike safety with children, buy bikes and parts, where classes are held, what schools have Safe Routes to School programs, what issues are happening at the local level with cycling in their area, meet-ups, and other important programs and events. The database would also be a way for government and advocates with few or no program to learn what they may be able to accomplish in their own areas.

5.7 Impact on Future Generations

The aim is for the education to continue through generations like seen in Europe. Children would learn how to move through the urban environment not only as pedestrians, but also as a cyclist and car driver. The goal is for that child to grow up and have a holistic understanding of transportation. When that child becomes an adult, they will teach their children the same lessons on transportation, adding to the palimpsest of learning and experience.

The aim is for everyone to have respect for other modes of travel because they have been a cyclist or a pedestrian. They know what it is like to ride next to a car or walk past a busy intersection. This type of training will only get better over time. It is not a quick solution but rather a long-term goal with more concrete solutions. If policies are changed on a national level and the US continues to see a shift of people moving into urban setting, not wanting to drive a car, then this form of education will be invaluable to that lifestyle and the safety of all users.

5.8 Independent Mobility

Children need this type of mobility to enrich their lives. Being able to decide where to go and when creates a sense of responsibility. As mentioned before, independent mobility also adds to a child's social interactions since most children cycle with friends.

Mobility freedom is not just for the children but also their parents and older siblings. Once a child is able to move on their own or with friends, parents will be able to take more time for themselves or other things they find important. While bicycle education is a part of creating a more stable environment for this independent mobility, it is an important part of ensuring children are safe while riding.

5.9 Driver's Education

Driver's education also needs to evolve to include more bicycle education. Currently, each state runs their driver's education program differently. Not all students have access to it through their high schools, for example. These programs should be regulated at a national level. People are no longer sedentary but move from one job to the next, one state to the next. There needs to be more focus on multiple forms of travel. For example, if you are from a suburban or farm area you may never learn how to change lanes in a hectic environment at rush hour. You may also never learn how to parallel park.

These classes also need to focus on cycling more. Again, more people travel than not, these needs to be reflected within the driver's education program. Students should be taught how to drive on the same road as cyclists. This includes passing, parking, opening car doors, driving behind, and looking before turning. In order for this to work, all states must adopt new rules for training and also testing. Even adults who are attempting to obtain their license must go

through this training. Another level would be to require driver's to retake their exam and get a thorough eye test every time they must get their license renewed.

5.10 Enforcement Training

Children cannot be the only ones educated on bicycle education. This type of education needs to reach the enforcers. They must have complete knowledge on how bicyclists, pedestrians, and drivers can move though the space in order to keep everyone safe. There also cannot be a bias towards a specific group. Sympathy for drivers or pedestrians could be an issue since the enforcers are more likely to be drivers and pedestrians themselves over being cyclists.

Enforcers must go through adequate bicycle training in order to be a police officer. Without having full understanding, police and other enforcers can create confusion and ticket for something that may not be an offense. This would make it even harder for bicycle education to work.

Victim blaming is also something that enforcement must have an idea about. It is an interesting fact that in European countries drivers are immediately at fault when there is a crash between a car and a cyclist or pedestrian whereas in the US it tends to be the opposite. There should be research done to look at our legal system and how it deals with these crashes.

5.11 Collaboration

These efforts must be done together. It cannot be only on the school system, the planner, or the police to ensure that bicycle education is working. This also includes parents. Each group must be informed, educated, and prepared to take on the task. These groups may not work together to form a complete curriculum that includes everyone. However, these groups and programs need to be consistent and long-term while covering the ages 0-14, at least.

Infrastructure will eventually have to change. More emphasis will need to be put on the bicycle and walking infrastructure with the 8 to 80 age range in mind (Penalosa, 2015). If you build it for an 8 year old, the system will be functional for an adult in their 30s. A simple study of the country's current infrastructure will have to be undertaken, but simple observation shows that cities are far behind their Northern European counterparts.

5.12 Further Research

More research needs to be done in order to ensure that cycling has a larger potential for children's mobility, balance, and LOS (limits of stability). This information may encourage teachers to introduce cycling into their classroom, especially in Physical Education. This research would be the starting point for creating new ways for educators to bring cycling into other areas other than the aforementioned Physical Education. Strider bikes are a huge part of this research. They have only been around in heavy use for five to ten years in

Europe. Only recently have they started to have a larger presence in the US. There is a little bit of research on the topic but it seems promising. While parents are concerned that children can get concussions from cycling, I believe that the same is true for walking. There should be analysis that compares children's injuries from walking to children's injuries after learning how to bike using the strider and also using training wheels. These types of bikes have the potential to help make cycling a part of their modes of transportation. It should be also noted that there is very little maintenance involved with these bikes. Striders can be introduced into Physical Education curriculum to help with balance and cycling confidence.

While there are education programs in the United States, it is not comparable to European countries. However, are we able to see what is actually missing? The creation of a database would help solve this problem. The initial investigation of academic research indicates that information of the effects of cycling on Children is lacking.

Research needs to review how literature helps with creating a cycling culture and whether it helps to create a stronger cycling culture.

This research opened the door to a highly-understudied area of cycling policy, education. Learning from practitioners and observing cycling education in northern Europe has provided the knowledge to propose a framework to

education, the lifecycle approach, which may have benefits for cycling usability and safety in the long run in the United States. However, much research remains to be done before this approach can be fully understood and well-developed curricula can be established focuses on the lifecycle of bicycle education. As mentioned, the programs already in place can be a starting point for creating this style of education.

5.13 Conclusion

When thinking about bicycle education and the idea of children riding alone or with a group of friends, it might seem impossible. The barriers to bringing bicycle education into the classroom might come off as too large to get around or maybe there just seems like too much push back. While these thoughts are valid, they are wrong. Americans have always dreamed big and attempted to reach “the American Dream.” That dream is changing for large quantities of Americans and part of that is tied to biking. People are moving to the city, there is less car ownership, and bikes are on the rise. Bicycle education in a lifecycle format is necessary for future generation’s safety. The goal is to have holistic bicycle education that leads to multiple generations having a respect for all users of the road.

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Figure 4: NHTSA (National Highway Traffic Safety Administration) and US Department of Transportation. October 2013. *2012 National Survey of Bicyclist*

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Figure 6: Cowan, David and Robert Ping. *Bicycle and Pedestrian Curricula Guide: Making the Case for Bicycle and Pedestrian Youth Education.* Safe Routes to School National Partnership. Feb. 2011. http://saferoutespartnership.org/sites/default/files/pdf/Curr_Guide_2011_lo.pdf

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