

Inventory of Youth Bicycle Education Programs

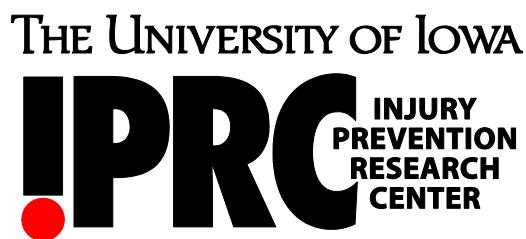
Final Report



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16. Abstract Bicycling comes with physical and environmental benefits and is an activity that is well-suited for children. Bicycling also has inherent risks and bicycling injuries pose a large health burden among school-age children. Increasing child bicycle safety education is an important piece to increasing child bicycle safety. There are numerous child bicycle education programs taught throughout the United States and beyond. However, there is no gold standard education program and program content and durations vary widely from program to program. In order to better understand the variations in approaches and content, this project aimed to create an inventory of child bicycle education programs within the context of age and developmental considerations. Programs were identified through web and database searches, personal lists, and an online survey. Ninety-six programs were included in this inventory. Common program components were compiled by age group.			
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Introduction

The physical and environmental benefits of bicycling generally outweigh the risks, making cycling an activity well-suited for children.¹⁻³ However, youth bicycling in the United States had stark declines starting in the 1970s, but has been increasing slowly and steadily in recent years.⁴ These recent growths can be partially attributed to the Safe Routes to School movement to increase bicycling and walking among school-aged children, which started in the mid-2000s.⁵

Despite the inherent benefits and recent increases in bicycling, youth bicycling injuries pose a large burden to child health and safety. Each year there are over 270,000 emergency department visits, 8,000 hospitalizations, and 100 deaths among children aged 19 or younger in the United States.⁶⁻⁹ Bicycling is also the most common cause of sport-related traumatic brain injury.¹⁰ Increasing bicycling safety requires a multipronged approach. For example, the Safe Routes to School program addresses the “Five E’s”: education, engineering, encouragement, enforcement, and evaluation.⁵

In the education domain, children need basic bicycle handling and traffic safety skills to be safe bicyclists and these skills can be carried into adulthood as they continue to walk, bike, and eventually drive. There are a large number of youth bicycle safety curricula available, but evidence-based bicycle interventions are sparse. Few existing bicycle safety education programs/curricula have been evaluated and a set of core riding competencies/skills has yet to be defined.^{11, 12} The Safe Routes to School National Partnership released a Bicycle and Pedestrian Curricula Guide⁵ in 2011, which contains a list of 50 programs and basic information (e.g., cost, grade-level, time required, skill-level), but does not contain information on specific program content or evaluations of effectiveness.

Children often receive either very little or inconsistent instruction from parents, teachers, or other adults related to proper bicycling behavior. For example, some school-based programs advocate for children to ride strictly on bicycle paths or sidewalks, while others instruct children to ride in the road, without any consideration for age appropriateness. Instructions may also vary by a parent’s bicycling experience and practices (role modeling) or the overall merit of the bicycle education safety curricula being taught.¹³⁻¹⁵ There are relevant child development factors and learning theories that should be incorporated into child bicycle education.^{11, 16} These include cognitive, perceptual, and motor skills needed for riding a bicycle and navigating through traffic.¹¹

The aim of this project is to create an inventory of child bicycle education curricula and systematically compile their components and practices, including child age and development appropriateness, requisite time and resources, and evaluations of effectiveness. The main objective of this report is to provide a resource for educators looking for best practices and age-appropriate components for teaching children bicycle safety. We anticipate that educators will be able to immediately use information from this inventory to guide selection of appropriate education programs and identify key elements to include in their bicycle safety education curricula.

A secondary objective of this project is to identify key components for the development of youth bicycle safety program standards. The long-term goal of this project is to decrease crashes, injuries, and fatalities among bicyclists through improved traffic safety knowledge, skills, and navigation and riding behaviors. Bicycle education is important for overall child safety and has the potential to bridge the gap between the time children learn to be safe pedestrians and learn to be safe drivers.

We created an inventory of bicycle education programs from local, national, and international sources, such as Safe Routes to School, state bicycle coalitions, and schools. We then systematically inventoried each program competency/skill included, the approach used (community-based, in-school, one session, multiple sessions, hands-on practice, knowledge-based, etc.), and reviewed published

program formative (acceptability, feasibility) and outcome (knowledge, attitude, or behavior change) evaluations.

Methods

Technical Advisory Committee

A technical advisory committee (TAC) was formed for this project, consisting of experts in content, theory, child development, injury prevention, and practice (program delivery). A kickoff meeting was held at the start of the project to gather input from the committee on the proposed method for creating the education inventory and to receive feedback on preliminary work completed. The TAC was convened on a quarterly basis for input and feedback on project deliverables.

Technical Advisory Committee Members:

- Troy Carter, Iowa Safe Routes to School
- Pam Hoogerwerf, University of Iowa Stead Family Children's Hospital
- Jessica LaCroix, Blank Children's Hospital, SafeKids
- Elizabeth O'Neal, University of Iowa, Psychological and Brain Sciences
- Milly Ortiz-Pagan, Iowa Department of Transportation
- Corinne Peek-Asa, University of Iowa Injury Prevention Research Center
- Jodie Plumert, University of Iowa, Psychological and Brain Sciences
- Sarah Taylor-Watts, Iowa Department of Public Health
- Kristel Wetjen, University of Iowa Stead Family Children's Hospital

Data Collection

To create the inventory, we collected program information from local, national, and international sources, via web and database searches, word of mouth, an online survey, and personal lists. For each included program in the inventory, we collected and assessed the following items: program name, location, instructor type (school teacher, trained instructor, volunteer, other), delivery method (school-based, other in-person), target age, number of sessions, number of hours, age considerations, hand-on components, equipment requirements, equipment provided, wrap-around materials (take-home materials), knowledge tests, skills tests, special needs considerations, and whether the program fulfills education standards for that district/region.

From the subset of age-specific programs to which we also had the full curriculum available for review, we compiled a list of program content areas. From this information, we created a list of common program components by age group and content category.

Web and Database Searches

Our primary web search platform was the Google internet search engine. This strategy revealed youth bicycle education programs with the strongest online presences. The following search terms were used: youth, bicycle, cycling, education, program, Safe Routes to School, pedestrian, safety, lessons, effective, teacher toolkits, results, traffic, kids, children, curriculum, activity kit, course, and evaluation.

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We also searched PubMed for evaluations of existing programs. PubMed searches were aimed toward finding programs that had been evaluated. Search terms in PubMed included: bicycle, cycling, education, program, evaluation, youth, and child. Both the Google and PubMed search terms were used in multiple combinations with Boolean operators (AND, OR, NOT) and search strategies.

Additional programs were added to this inventory via reference lists in the evaluations or references to programs from which a current program had been adapted. Approximately half of the programs in the inventory were collected using searches on Google and PubMed.

Online Survey

An online survey was created to collect information on programs that may not be available online or were not readily found via other search methods (Figure 1). The survey was developed using Qualtrics. This software allowed us to create “skip logic”, so only relevant questions were shown to each respondent. It also allowed for several types of responses to questions, such as short answer, yes/no, multiple selections, etc. The survey was open from June 13, 2017 to September 30, 2017. The average time it took a respondent to complete the survey was just over 16 minutes. The survey included specific questions about the program duration, target ages, and content. See Appendix A for a full copy of the survey questionnaire.

Figure 1. Screenshots of the first two pages of the online survey

The survey was emailed to 126 email addresses (individuals and organizations). The survey contacts included representatives from each state’s Safe Routes to School Program, contacts within the Association of Pedestrian and Bicycle Professionals, Safe Kids Worldwide, League of American Bicyclists, other non-profit bicycle organizations, school districts, national and local bicycle organizations, and others identified by our research team and technical advisory committee. These contacts were encouraged to forward the survey onto other educators and content area specialists, allowing increased dissemination and a wider scope of possible responses. We were not able to track the number of forwards of the survey link.

Inclusion and Exclusion Criteria

Specific inclusion and exclusion criteria were applied to each program identified in our searches. To be included in our inventory, the programs had to meet the following criteria:

- 1) Bicycle education programs intended for youth only (age 18 or under)
- 2) Program content available for assessment
- 3) If bicycle rodeo, program must also include an additional component (e.g. an assembly or in-school lesson)
- 4) Must not be entirely self-guided/self-taught by child
- 5) Must be bicycle only or bicycle and pedestrian program (i.e., not pedestrian only or general traffic safety without bicycle-specific content)
- 6) Must be in current use or actively available for use
- 7) Program information must be publicly available via web site, download, or receivable via a contact person free of charge

For the purposes of this project, bicycle rodeos were defined as a one-time short bicycle safety and skills event (generally, 1-3 hours), which provides an opportunity for children to bring their bicycles and practice handling and safety skills (often on a practice course set up in school parking lot using cones or chalk). Other common components of bicycle rodeos are stations, such as helmet fit and bicycle maintenance.

Results

Online Survey Response

The online survey was accessed nearly 200 times in the four months that it was open. However, only 85 people entered information and 56 (66%) of those responses were complete and met criteria for inclusion in the final inventory (Figure 2). The blank surveys ($n = 112$) had no responses in any field, indicating that someone opened the survey and closed it before entering information. Some incomplete responses had some fields filled in ($n = 11$), but not enough information for the program to be entered into the inventory. Finally, 18 of the responses were ineligible because they did not meet our inclusion criteria. The programs gained from the online survey made up over half of the final inventory.

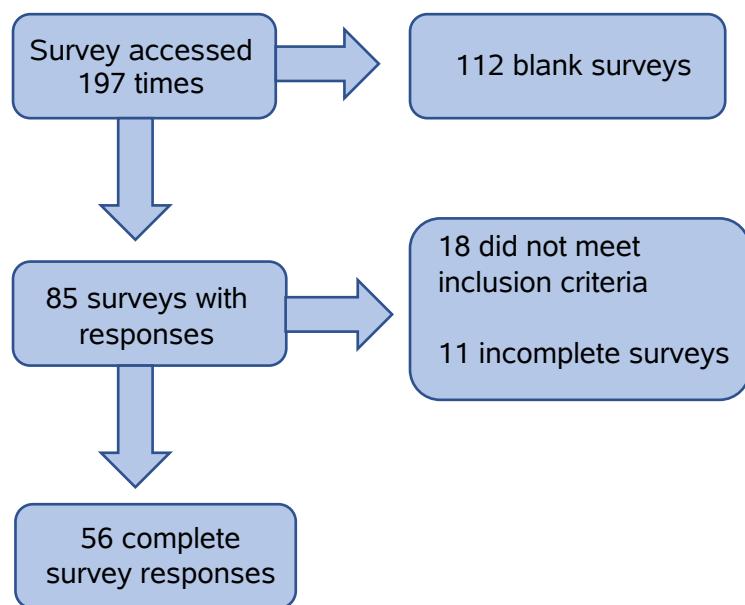


Figure 2. Flow chart of survey responses

The survey significantly contributed to the inventory by giving us access to programs that do not have a strong web presence or any web presence at all. Less than half of the programs gained from the survey provided a web site with more information, primarily because they did not have one.

Overall Inventory Results

The completed inventory includes 96 programs, primarily representing programs in use within the United States (see Appendix B for the inventory summary matrix). There was a fairly even split between program type, with 53% having bicycle-only content and 47% including both pedestrian and bicycle content (Figure 3).

The inventory includes programs from 34 states, which were unique to that state (Figure 4). The other 16 states either used a nationwide program or did not have any state-specific programs identified via our search techniques. The inventory includes three nationwide programs in the United States, six programs from Canada, two from Australia, one from Germany, one from Ireland, and two from New Zealand.

Over two-thirds of all programs in the inventory were school-based, with all others being community-based (Figure 5). A third (34.4%) of the included programs were bicycle rodeos that had an additional component. These programs are listed separately in the inventory summary (Appendix B) because they represent a unique program type. These programs are generally short in duration, with a bicycle rodeo plus a one-time classroom lesson or school assembly. They are commonly targeted to elementary-school age children. The bicycle rodeos are typically held in a protected area (parking lot, playground, gymnasium) with stations (manned by volunteers) for children to rotate through. Common rodeo stations include registration, bike and helmet fitting, bicycle safety check/inspection, and an activity course to practice bicycle handling, hand signals, scanning, avoiding hazards.¹⁷ Bicycle rodeos are

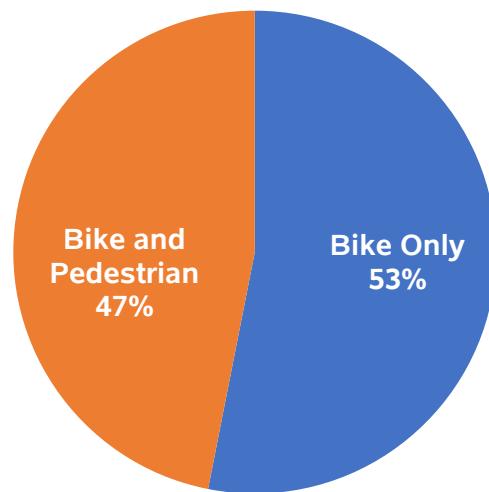


Figure 3. Percentage of programs by content included

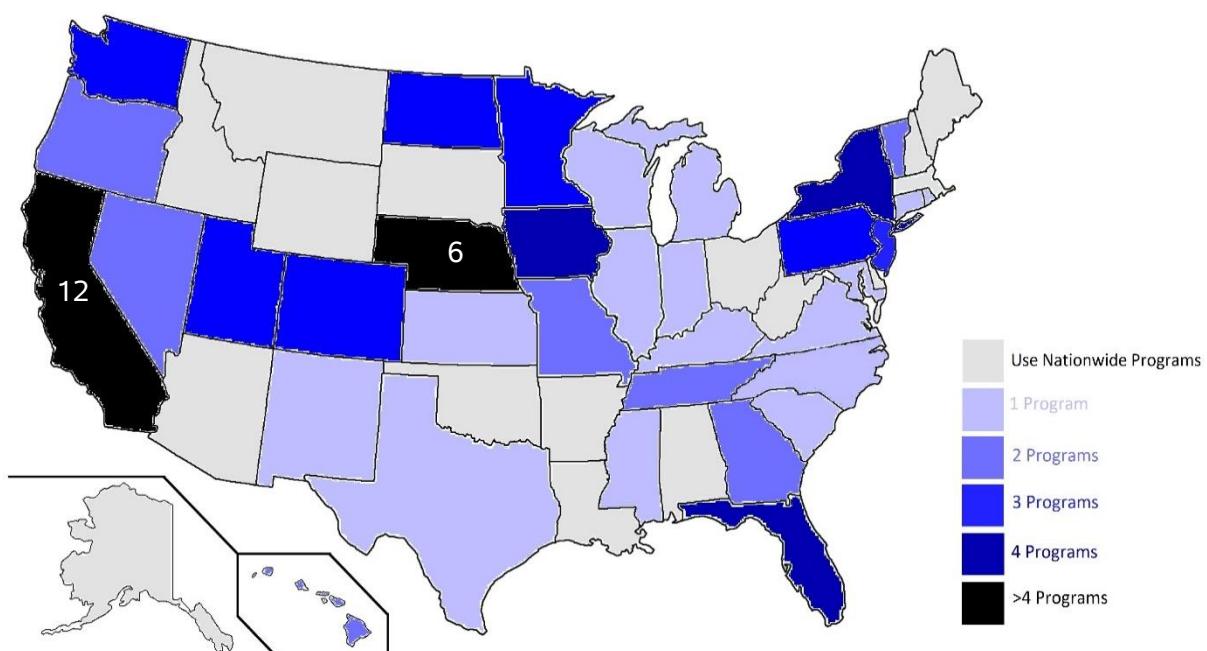


Figure 4. Programs included in inventory by state

often set up as community or after school events, which means a child typically attends with a parent or caregiver.

The remainder (65.6%) of non-rodeo programs are either school or community-based, generally consisting of multiple sessions of lecture and/or on-bicycle practice. Although many non-rodeo programs have on-bicycle practice sessions that involve the same components as rodeos (helmet and bike fit, bike inspection, handling and traffic safety skills practice), they are generally conducted with smaller groups (e.g., ≤ 20 students in a physical education class), by a teacher or trained instructor, and without parent supervision. Rodeos also involve minimal time for teaching and practice of multiple on-bicycle components in one session, whereas other programs more commonly have multiple individual lessons for different components.

Informal program evaluation primarily occurred via knowledge and skills assessments. Forty percent of programs included knowledge tests and 36.5% included skills-based tests (e.g., observations of handling skills) (Figure 5). Most programs (80%) included some type of hands-on bicycle training either as a main or optional component.

A large proportion of programs (59.4%) were not age-specific, meaning they did not have content divided by appropriate age/developmental cut-points. Most of the programs had target ages, but many of these age groups were quite large (e.g., a program for all elementary school age children) often with material too advanced or complex for the youngest children. Overall, the most common age range

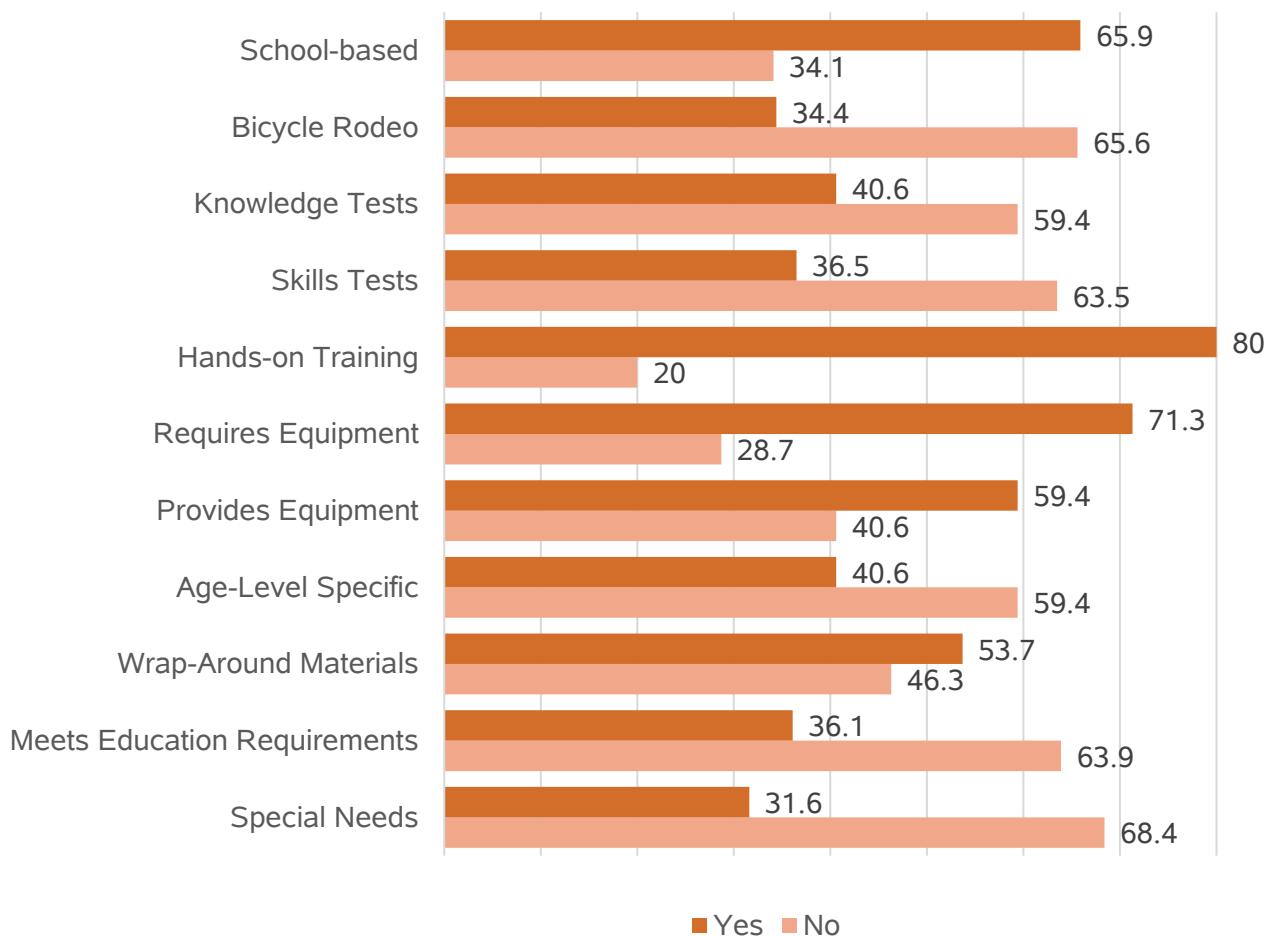


Figure 5. Percent of programs with specific components

included across programs was nine to twelve years old, which corresponds to fourth through sixth grade in the United States.

Just over half of the programs (53.7%) include some type of wrap-around materials. These often consist of handouts or materials for children to take home to their parents to encourage at-home practice or to be used as a reference (e.g., handout on hand signals). Over half of the included programs clearly indicate that they meet some type of educational standards, either for their particular school district or often state or national-level core curricula requirements around traffic safety. Several of the programs specifically outline which education requirements their program meets (e.g., Bike Utah's Youth B.E.S.T¹⁸, Let's Go NC¹⁹, BikeSafe Florida²⁰).

Many of the programs (62.5%) provide needed equipment to participants and/or schools, including anything from cones to set up a practice course to bicycles. There are several programs who have fleets of bicycles for students to use, often transported in a trailer from location to location (e.g., Bike Smart Vermont²¹, After School Education Program²², Cycles of Change Safe Routes to Schools Safety Program²³, and Bike Utah's BEST¹⁸). A third of the programs reported that they could accommodate special needs so that all children could participate and learn. This included things like spending extra time with children who needed it, one-on-one instruction, and an extra optional day of practice for special needs students. Several programs also indicated they had adaptive bicycles that they could provide for special needs children (e.g., Bike Smart Vermont²¹, Positive Spin²⁴, Safe Routes to School Oregon²⁵, Safety on Wheels²⁶, and Bike Utah's BEST¹⁸).

The majority of programs had total durations less than 10 hours, though there were several that took between 10 and 20 hours and one outlier above 30 hours (Figure 6). The number of sessions was also primarily less than 10. The few programs with large numbers of sessions and duration were primarily programs designed to follow children throughout several years of school or had extensive on-bicycle practice sessions. Most programs are provided at no cost to participants. Seven programs are fee-based with costs to the participants ranging from \$5 to \$300 USD.

Specific program components by age group

Full program curricula were available for review for 27 of the programs in the inventory. Using the detailed curricula, we created a summary of common components by age group

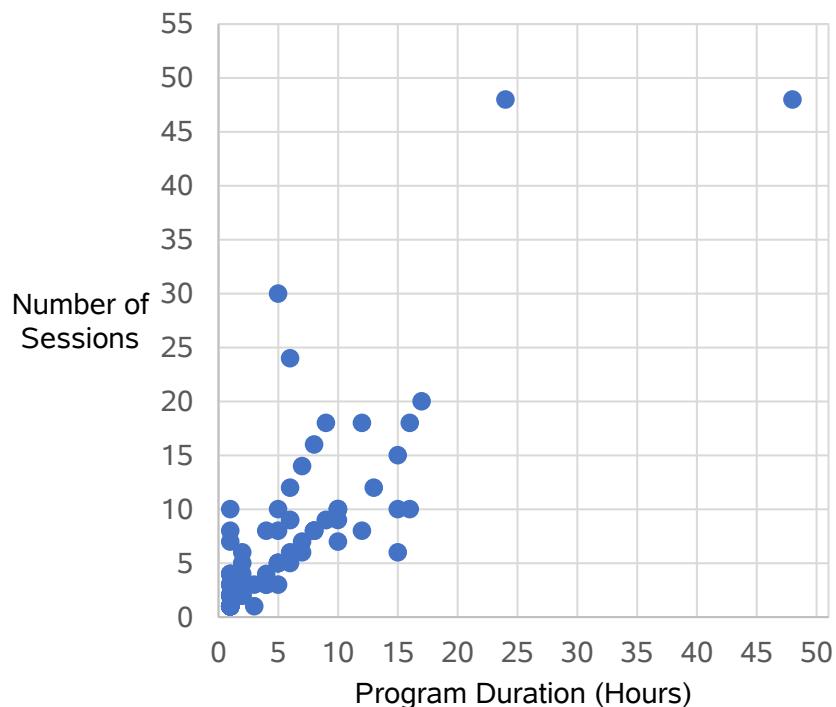


Figure 6. Number of sessions by total duration (hours) to complete the program

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(Table 1). This is by no means an exhaustive list; instead highlighting the most common components, by age and development appropriateness. The table can be used as a guideline, but individual skill levels should be taken into account, regardless of age.

Table 1. Common age-appropriate bicycle education program components

GENERAL COMPONENTS	Ages 5-7	Ages 7-9	Ages 9-12	Ages 12-18
Benefits of bicycling and walking (transportation, environment, exercise/fitness, fun, etc.)	X	X	X	X
Observational skills check (e.g., hand signals, ride in straight line)		X	X	X
Pre/post knowledge tests			X	X
Video component (e.g., helmet fit, ABC quick check, how to fix a flat)			X	X
PERSONAL SAFETY (BRAIN, HELMET, VISIBILITY)				
Importance of wearing a helmet	X	X	X	X
Helmet fit (2-finger test)	X	X	X	X
Helmet Safety and Brain injuries (Causes, effects, and prevention)			X	X
Visibility--bright and reflective clothing	X	X	X	X
Visibility-- head and tail lights			X	X
TRAFFIC SAFETY, LAWS, RULES, AND HOW TO RIDE				
Never enter street unsupervised, cross with adult or older child	X			
Crossing the street safely (look left, right, left; stop at edge; scan for traffic; cross at marked crosswalks or corners, dangers of darting out midblock)	X			
How to follow basic pedestrian rules, signs, and signals	X	X		
Pedal power position / Starting technique	X	X	X	X
How to ride on sidewalks (yield to pedestrians, give audible signal before passing with bell or 'on your left', look for cars at driveways and intersections, etc.)	X	X		
How to ride on multi-use paths (yield to pedestrians, give audible signal before passing--bell or 'on your left', look for cars at driveways and intersections, etc.)	X	X	X	X
Scan for traffic (look and listen, look over left shoulder, etc.)		X	X	X
Traffic laws and rules of the road, how they relate to bicycling, and why it is important to follow laws and rules (consequences)		X	X	X
Identify and obey traffic signs and signals		X	X	X
Ride in a straight line (no wobbling or swerving)		X	X	X
Signal your intentions (hand signal types and when to signal)		X	X	X
Ride in same direction as traffic ('go with the flow')			X	X
Navigating intersections and turns			X	X
Be predictable (avoid risky behaviors, signal, etc.)			X	X
Roadway hazard anticipation, identification, and avoidance (potholes, sharps, railroad tracks, slick surfaces, door zone, driveways, other road users, common crash types, etc.)			X	X
Basic bicycle etiquette (courtesy, cooperation, and communication with other bicyclists and roadway users)				X

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	Where to Ride	Ages 5-7	Ages 7-9	Ages 9-12	Ages 12-18
Ride on sidewalk or multi-use path (okay up to age 9)	X	X			
Only ride in street when with an adult or capable older child	X	X			
Ride in the street (riding on sidewalk not recommended and/or warned that sidewalk can be more dangerous than riding in road)			X	X	
Ride on the right side of road/ Road positioning			X	X	
Skills and Handling Practice (Hands-on)					
Bicycle skills practice through on bike games	X	X	X	X	
Practice street crossing (on foot) in protected area (gym or playground)	X				
Basic bicycle control practice using strider/balance bicycles or bicycles with pedals removed (balance, striding, gliding/coasting, bike control, slalom navigation, starting/stopping) in protected area (playground, gym)	X				
Basic on-bicycle handling and control skills practice (balance, riding in straight line, starting/stopping) with pedal bikes on an activity course in a protected area (playground, gym)	X	X	X		
Intermediate on bicycle handling, control, and traffic skills practice (starting/stopping, controlled braking, riding in straight line, scanning, proper positioning in the road, hand signals/riding with one hand, riding safely in a group, maneuvering around hazards, etc.) on an activity course in a protected area like a playground			X	X	
Neighborhood/community ride, on-road (planned route, low speed roads) to practice and demonstrate safety and navigation skills			X	X	
Navigation: Bicycle ride route planning & safety			X	X	
Advanced bicycle handling skills (gearing, obstacle avoidance, cadence, changing directions, balance-based on-bike challenge activities) in protected area				X	
Emergency bicycle handling skills (quick stop and turns, maneuver around a hazard, ready position for riding over things) in protected area				X	
Bicycle Maintenance and Fit					
Bicycle safety check (ABC Quick Check--air, brakes, chain, and cranks; quick check bolts and quick-release levers, take short spin to make sure everything is working)		X	X	X	
Importance of bicycle safety checks; How equipment and gear relate to bicycle safety		X	X	X	
Proper bicycle fit		X	X	X	
How to fix a flat tire			X	X	
Parts of a bicycle and how they work (bicycle orientation)			X	X	
Bicycle parking and locking			X	X	
Other bicycle maintenance (fallen chain repair, adjusting brakes, etc.)				X	

As can be seen in Table 1, many of the elements of bicycle safety education are common across all ages (e.g., helmet fit, ABC Quick Check, on-bicycle handling practice in a protected area). Mock activity and traffic condition courses were very common across all programs with hand-on components,

regardless of age. Figure 7 is an example activity course set-up diagram from the sixth to eighth grade curriculum of the Florida Safe Routes to School program.

The commonality of program components is not surprising, as there are elements of bicycling that need to be understood and mastered at all ages. We know that repetition, reinforcement, and practice are key to improving the necessary skills for biking, so repetition of certain components as a child ages is appropriate and likely an effective approach to improving youth bicycle safety.

However, Table 1 also reveals important and developmentally appropriate differences in program content for different ages. For example, it is common for bicycling programs to teach children to ride on

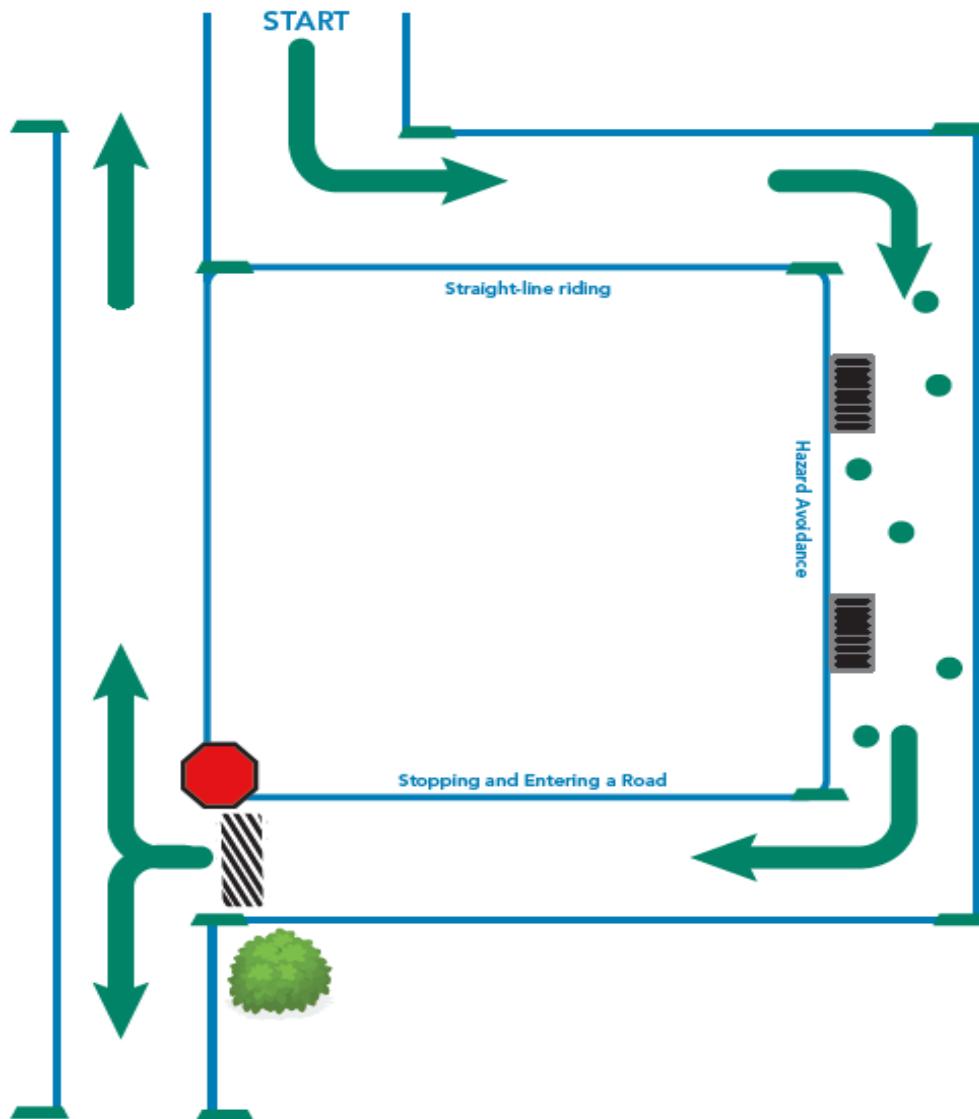


Figure 7 . Example on-bicycle practice course set-up from Florida Safe Routes to School

the sidewalk until about age nine and then on the road thereafter or when they are ready (able to successfully handle the bicycle and execute proper traffic safety skills at the same time), which is generally developmentally appropriate. However, children age nine and under should still be encouraged to bike to school as long as there are considerations for safe routes and supervision by adults or capable older children. There may be children who are able to handle more complex tasks at a younger age, due to more time practicing and developing the necessary motor and cognitive skills. The opposite is also true. Therefore, it is important to use these as general guidelines, not hard and fast rules.

By far the most common components are helmet fitting and the importance of wearing a helmet. Every program we reviewed, regardless of age level, includes these components. We also found that many programs include how to select a helmet that meets the Consumer Product Safety Commission (CPSC), American Society for Testing Materials (ASTM), or Snell standards for bicycle helmets and make sure the helmet is still in good condition (i.e., not damaged or out of date). These are important aspects of helmet safety because not all helmets are appropriate for bicycling (i.e., helmets designed for other activities) and helmets have a life span. The CPSC has useful information on how to choose the appropriate helmet for bicycling and other activities on their web site.²⁷

In general, the programs for five to seven year olds (kindergarten and first grade) focus more on pedestrian safety and very basic bicycle components, such as helmet safety and basic bicycle handling and control skill practice (often starting with balance bicycles). For seven to nine year olds (second and third grade), there is less focus on pedestrian safety and more bicycle-specific content and practice, such as introductory traffic safety and rules of the road (e.g., hand signals). Children in this age group are still commonly recommended to ride on the sidewalk or in the street, only with supervision from an adult or competent older child.

Once a child reaches the nine to twelve year old age group (fourth to sixth grade) they continue to learn and practice more advanced traffic safety skills both in the classroom and on the bicycle. By age nine and beyond, children are commonly encouraged to ride in the street and discouraged to ride on the sidewalk (required by law in some jurisdictions). The specific components for the nine to 12 age group and 12 to 18 age group do not vary greatly. Programs targeted to the 12 to 18 age group (grades seven to twelve) generally spend more time on the bicycles practicing handling and traffic safety skills and less time in the classroom. It is also common for the twelve and older age group to have more advanced handling and mock traffic navigation practice (e.g., emergency maneuvers, advanced balance and handling drills, defensive riding, and ‘taking the lane’).

One rare, but important component among programs is how to navigate on-road bicycle facilities and other less frequently seen facilities, like bicycle lanes and roundabouts. Although not present in all communities, both on-road bicycle facilities and roundabouts are becoming more prevalent throughout the United States. This is most relevant to children ages 10 and older, given they will primarily be riding in the street (as opposed to sidewalks). The Wisconsin Bike Fed Bike Driver’s Ed Curriculum²⁸ is one of the programs that includes lessons on bicycle facilities and the Florida Safe Routes to School²⁹ program includes instruction on how to navigate roundabouts.

Some of the programs for older children also provided specific lesson plans or recommendations for educators/trainers on how to accommodate older children who may be considered ‘beginner’ riders. These riders may need additional instruction and practice to gain confidence and skill on the bicycle. It is not uncommon for some older children to either have never ridden a bicycle or to have undeveloped handling skills due to little practice. The Kansas City BLAST³⁰ program, which is targeted for fourth to sixth graders, contains supplemental curriculum for beginning riders that includes having students practice coasting without the pedals to improve balance, the power pedal position, and stopping

technique. These are useful supplements for any program, given the importance to recognize that students within the same age group will likely have some variation in skill and/or development, which will impact their compatibility with what is being taught.

Mastery/capstone type activities like a neighborhood or community ride at the culmination of the program were common, but less so than on-bike practice in a protected area. They were more common in the older age groups, which makes sense, given the older age groups have more focus on mastering both handling and traffic safety skills together, skills that are needed to complete a neighborhood or community ride, particularly ones with routes that include all or some on-street riding.

Several programs also included cross-curricular activities (e.g., Bikeology³¹, Let's Go NC!¹⁹). The Bikeology program provides a suggested list of activities for language arts, science, history, social studies, and math³². These include things like demonstrating how to measure a bicycle frame (math) and demonstrating helmet construction and effectiveness (science). The Let's Go NC! program describes these cross-curricular activities as ways to have a balanced curriculum and they are optional components which extend the bicycle program into other learning areas.¹⁹ Examples include having children research a segment of bicycle tourism (English/language arts) and calculating how long it would take someone to ride a bike across the state (math).

Program evaluation and effectiveness

Many of the included programs in the inventory conduct regular informal (unpublished) evaluations, such as pre/post knowledge tests and observational skills checks (e.g., handling, hand signals, helmet fit, etc.). We also found examples of programs assessing increases in the number of children biking or walking to and from school. For example, the Wisconsin Bike Fed Bicycle Driver's Ed²⁸ program includes a commuter survey at the beginning of each lesson to measure how their program impacts the amount of active commuting by students. This helps them evaluate the success of their program in encouraging more students to bike and walk. They also administer pre/post knowledge tests to assess knowledge change. The Kansas City BLAST³⁰ program also includes a component to track the number of students biking and walking to school and pre/post knowledge tests. To track walking and biking to school, they do one observation of biking and walking counts during school arrival and dismissal before the BLAST program and one observation of biking and walking counts after the program.

Published program evaluations (peer-reviewed manuscripts or publicly accessible detailed reports) were found for only a small portion (N=10, 10.4%) of the programs included in the inventory (Table 2). For a program to qualify as evaluated in our inventory, it needed to have a detailed published report describing the methods and findings of the evaluation.

The majority of the evaluations we reviewed were outcome evaluations, although there were also several formative or combination of outcome and formative evaluations. We did not find any process evaluations. The formative evaluations focused on assessing usability, acceptability, and the fidelity of implementing the program, while the outcome evaluations focused on knowledge or behavioral changes that occurred as a result of the program. The scientific rigor of these evaluations varied widely. Table 2 provides a summary of the evaluations, including outcomes measured and main results. The overwhelming majority of evaluations were in the form of a knowledge assessment.

Only two of the included evaluations assessed on-bicycle skills, which were the Kids CAN-bike program from Canada³³ and the Safe Cycle program from Australia. The Kids CAN-Bike program from Canada was evaluated through a randomized controlled trial of fourth and sixth graders, assessing knowledge, attitudes, and on-bicycle handling skills. No significant differences were found in any of the assessed

measures.³³ Six elementary schools in Canada participated in the study. Three of the schools participated in the Kids-CAN-Bike program. The study measured if children at all 6 schools showed improved safe cycling behavior, using pre and post-intervention observations and pre and post-intervention questionnaires. No significant change was seen between the schools given the intervention, and schools that did not participate in the program. The study concluded that the brief training program was not effective in improving behavior, knowledge, or attitudes. This program lasts two hours and mostly consists of a bicycle rodeo. The program is also not age-specific, so similar content is taught to all ages that participate in the program. This could lead to the assumption that programs similar to this might not be long enough, or comprehensive enough to effectively teach children bicycle safety. Looking at programs that have been evaluated can be valuable in creating new programs, or deciding which programs to implement in an area.

The evaluation of Safe Cycle in Australia had particularly innovative methods.³⁴ They used bicycles instrumented with forward and rear-facing video cameras to observe child bicycling safety behaviors among during real-world rides before and after program delivery. They also had a comparison group who did not receive the intervention (Safe Cycle program). They did not find any significant difference between groups in bicycling safety relevant behaviors (use of hand signals, yielding right-of-way, sudden braking, bicycle handling, scanning for traffic, general high risk behaviors). However, their sample size was quite small (N=12, 3 in each study arm) and, therefore, limited their conclusions. This study serves more as a demonstration and feasibility trial of a methodology that can objectively evaluate behavioral change. The Safe Cycle is a school-based program for with one session per week for eight weeks, including both lecture and hand-on bicycling skills components (e.g., ABC quick check, hazard awareness, and bike control, etc).

Most of the evaluations that assessed knowledge showed increases in bicycle safety knowledge. For example, a knowledge-based evaluation of the BikeSafe program from Florida found that students demonstrated increased bike safety knowledge (helmet fit, bicycle parts, rules of the road, and signs and signals) from pre to post-testing.³⁵ The Alaska Injury Prevention Center conducted an evaluation of the Bikeology program through pre/post program knowledge assessments of 130 middle school students.³⁶ They found an increase in bicycle safety knowledge (e.g., helmet fit, hand signals, bicycle is a vehicle), with test scores increasing from 53% to 73% and sustained for two weeks after the program at 70%.³⁶ The Certificat Cycliste Averti (Certified Aware Cyclist) program from Canada also used pre- and post-program surveys to assess knowledge change among 153 fifth and sixth grade students and their parents.³⁷ They found that bicycle safety knowledge increased, especially related to street signs and hand signals.³⁷ The participants also reported that they were more confident riding a bike and parents reported improvements in their children's cycling abilities.³⁷

Despite the increases in knowledge found in several of the evaluations, we know that increases in safety knowledge does not always translate to increases in safety behaviors.³⁸⁻⁴⁰ There is a lack of evidence for program effectiveness, overall. This is partially due to the paucity of evaluations, but also because existing evaluations have either not shown significant behavior change, have had weak methods, or have been limited to showing only knowledge change.

Table 2. Evaluations of Bicycle Education Programs and Rodeos Included in Inventory

Program Name	Type of evaluation	Intervention	Study design	Study participants	Outcomes measured	Results
Bikeology ^a	Outcome	Students taught with the Bikeology curriculum, which contains 7 units. Each unit has introductory material, skill-based activities, and closure activities. Contains both lectures and on-bicycle practice.	Before and after	130 middle school students	Knowledge change measured using pre- and post-program tests.	Increases in knowledge of correct helmet fit (39% to 67%), hand signals (15% to 62%, and that a bicycle is a vehicle (55% to 91%). Average score on knowledge test increased from 53% to 73%. Two weeks after the program, the test score averaged 70%.
Certificat Cycliste Averti (Certified Aware Cyclist) ^b	Outcome	The program includes off-bicycle theoretical lessons, practical on-bicycle lessons in a gym or playground, neighborhood bicycle rides, and an on-road exam	Before and after	153 5 th and 6 th grade students from 5 schools	Used pre- and post-surveys to measure children's safety knowledge.	Safety knowledge increased (e.g., right hand signal increased from 41% to 94%, and knowledge of street signs increased at least 11%).
Walk! Bike! Fun! ^c	Formative	Teachers and educators participate in training to prepare them to teach the curriculum to students. They trained both in the classroom and hands-on with the activities included in the program.	Before and after	255 Teachers and 193 Educators	Participants reported on usefulness of program components, their confidence in teaching the program, and how successful they think the program could be.	85% of participants thought the training was useful. 83% agreed that the resources provided were useful. Participants felt more confident teaching the curriculum after training.
Kids Can Bike! ^d	Outcome and Formative	Weekly bicycling events were held that taught bicycling safety, and on-bicycle safety skills.	Before and after	13 children in 3 rd , 4 th , and 5 th grade	Participants took a survey and knowledge test before and after the program measuring their feelings about the program and bicycling knowledge.	100% of participants felt the program was fun and 84.6% felt it was helpful in learning bicycle safety. No difference in individual questions from pre- to post- test, but overall bicycling knowledge increased (pre: 3.31 ± 0.63 correct responses vs. post: 3.77 ± 0.44 correct responses; $p=0.008$).
BikeSafe ^e	Outcome	4 day off-bike program that follows a train-the-trainer model, with a 5 th on-bike day optional (not used in the intervention)	Before and after	193 students from 18 classes at 6 middle schools	A knowledge assessment of the curriculum was administered to students before and after the program.	Improved bike safety knowledge. Specifically, almost all helmet fit knowledge increased significantly (P -value <0.001)

Program Name	Type of evaluation	Intervention	Study design	Study participants	Outcomes measured	Results
Bike Utah's Youth B.E.S.T. ^f	Outcome and Formative	5 hour course administered to schools over 5 days that teaches bicycle safety	Before and after	3,053 4th to 7th grade students from 44 schools in Utah	Pre- and post-program knowledge assessments administered to all participating students	77% increase in bicycle safety concepts assessment scores after completing the program.
Safe Kids Erie ^g	Outcome	Bicycle rodeo that includes an educational video, and lessons about bicycle safety	Before and after	K-5 grade students	Pre- and post-program knowledge surveys were administered to students. Post-program surveys were given a month after the program.	Knowledge of bicycle safety between the pre- and post-knowledge surveys overall increased.
Kids CAN-Bike ^h	Outcome and Formative	Playground-based instruction on bicycle handling skills	Before and after with a control group	141 children in 4 th grade from 6 elementary schools	Before and after program self-report questionnaire collected data on knowledge and attitudes. Safe bicycle handling skills were also observed before and after the program	No significant differences between the intervention and control groups in safe cycling knowledge, behaviors, or attitudes.
Safe Cycle ⁱ	Outcome	Theoretical and practice sessions that teach cycling safety to students in school one day a week for 8 weeks	Before and after with a control group	12 children aged 11-13 from 4 schools in Australia (2 males for 1 female)	Naturalistic before and after riding data were collected via video cameras to observe real-world bicycling behavior.	No significant difference between treatment groups and control groups in riding behavior
New Jersey Bike School ^j	Outcome	Program was taught in physical education class for up to 5 weeks	Before and after	588 children aged 7-15 from 3 New Jersey schools	Pre- and post- program survey was given to participants that asked about bicycling behavior and bicycle knowledge	Children on average gained between 0-4 points on the post-test compared to the pre-test. Significant difference of 1.4 points between the pre- and post-test scores (p<0.01). 55% of children improved significantly.

Full citations to the evaluations:

^a Alaska Injury Prevention Center. Evaluating Bikeology at Wendler, An Evaluation of Bicycle Education in Schools. Available at: <http://alaskainjurypreventioncenter.org/wp-content/uploads/2017/10/Wendler-Bike-Eval.pdf>

^b van Lierop D, Bebronne M, El-Geneidy A. (2017) Bicycle education for children: Evaluation of a program in Montreal, Quebec, Canada. *Transportation Research Record*, 2587, 23-33.

^c BikeMN (2017). Minnesota Walk! Bike! Fun! Evaluation Summary. Available at: http://www.bikemn.org/storage/documents/Documents/Education/WBF_Evaluation_Infographic_2017.pdf

^d Chandler, JL. (2012). Kids Can BIKE! A Parks and Recreation Program to Promote Youth Cycling. Master's Thesis, University of Tennessee, Available at: http://trace.tennessee.edu/utk_gradthes/1295

^e Hooshmand J, Hotz G, Neilson V, Chandler L (2014). BikeSafe: Evaluating a bicycle safety program for middle school aged children. *Accident Analysis & Prevention*, 66, 182-186.

^f Bike Utah (2017). Youth Bicycle Education and Safety Training Program 2016-2017 Impact Report. Available at: <https://bikeutah.org/wp-content/uploads/2015/08/2016-2017-Youth-BEST-Program-Impact-Report.pdf>

^g Puline, Patty. (2007). Pre- and Post-Knowledge Survey Comparisons at Tracy Elementary School. May 2007.

^h Macarthur C, Parkin PC, Sidky M, et. al. (1998) Evaluation of a bicycle skills training program for young children: a randomized controlled trial. *Injury Prevention*, 4, 116-121.

ⁱ J. Hatfield, M. Dozza, D.A. Patton, P. Maharaj, S. Boufous, et al. (2017). On the use of naturalistic methods to examine safety-relevant behaviours amongst children and evaluate a cycling education program. *Accident Analysis & Prevention*, 108, 91-99.

^j Lachapelle U, Noland RB, Von Hagen LA, (2013). Teaching children about bicycle safety: An evaluation of the New Jersey Bike School program, *Accident Analysis & Prevention*, 52, 237-249.

Discussion

This inventory reveals the large quantity and breadth of youth bicycle education programs throughout the United States and beyond. Program durations vary widely, ranging from one to 48 in both number of hours and sessions. There are many common themes in program content, across the categories of personal safety, traffic safety, how to ride, where to ride, hands-on practice, and bicycle maintenance. It is also very common for programs to be adapted from other programs or have entire lessons or components borrowed from other programs, which contributes to the common themes seen throughout. Online bicycle safety materials from national sources (National Highway Transportation Administration⁴¹, Federal Highway Administration - PedBikeInfo⁴²) were used by many programs. These included downloadable handouts and videos.

Program components

By far the most common program components, across all ages, are the importance of wearing a helmet and helmet fit (Figure 8). Some programs elaborate on this by doing demonstrations (e.g., egg/melon drop) to show how helmets protect the brain from injury. Helmet use and bicycle maintenance are importance pieces to bicycle safety and are generally the first steps that a child should take before getting on their bicycle to ride. Therefore, the abundant presence of these elements is good and relevant for all ages. Most programs also taught the “ABC Quick Check” (Figure 9) and “Power Pedal” position or starting technique (Figure 10). The ABC quick check teaches children to check their Air pressure in the tires, Brakes, and Chain, Cranks, and Cogs, every time before riding their bike. The power pedal position is a starting technique that has children get their pedals and feet in ready position to start efficiently. Many programs use supplemental handouts with

Easy Steps to Properly Fit a Bicycle Helmet

It's not enough to simply buy a bicycle helmet – it should be properly fitted, adjusted, and worn each time you ride.

Step 1 Size:
Measure your head for appropriate size. Try the helmet on to ensure it fits snugly. While wearing flat on top of your head, make sure the helmet doesn't rock side to side. Sizing pads come with new helmets; use the pads to securely fit your head. Mix or match the sizing pads for the greatest comfort. In your child's helmet, remove the padding when your child's head grows. If the helmet has a universal fit ring instead of sizing pads, adjust the ring size to fit the head.

Step 2 Position:
The helmet should sit level on your head and low on your forehead—one or two finger-widths above your eyebrows.

Step 3 Buckles:
Center the left buckle under the chin. On most helmets, the straps can be pulled from the back of the helmet to lengthen or shorten the chin straps. This task is easier if you take the helmet off to make these adjustments.

Step 4 Side Straps:
Adjust the sliders on both straps to form a "V" shape under and slightly in front of the ears. Lock the sliders if possible.

Step 5 Chin Strap:
Buckle your chin strap. Tighten the strap until it is snug, so that no more than one or two fingers fit under the strap.

Step 6 Final Fitting:
A. Does your helmet fit right? Open your mouth wide...big yawn! The helmet should pull down on the head. If not, refer back to step 5 and tighten the chin strap.
B. Does your helmet rock back more than two fingers above the eyebrows? If so, unbuckle, shorten the front strap by moving the slider forward. Buckle, retighten the chin strap, and test again.
C. Does your helmet rock forward into your eyes? If so, unbuckle, tighten the back strap by moving the slider back toward the ear. Buckle, retighten the chin strap, and test again.
D. Roll the rubber band down to the buckle. All four straps must go through the rubber band and be close to the buckle to prevent the buckle from slipping.

www.safercar.gov
NHTSA

"ABC QUICK CHECK"

- A → IS FOR AIR**
Check the air pressure, spin the wheels, and make sure the tires are not worn out.
- B → IS FOR BRAKES**
Check to make sure the coaster brakes will stop the bike by spinning the back wheel and applying the brake. If the bike has hand brakes, check to see that the levers don't hit the handlebars when squeezed. Lift one tire up at a time and spin it; squeeze the levers to see if the tire stops. The brake pads should be clean, straight, and contact the rims properly.
- C → IS FOR CRANKS, CHAIN, AND COGS**
Grab the crank arms and try to wiggle side to side. There should be no movement. Spin the pedals and cranks to see if the chain drives the rear wheel. The chain should look like metal, not rust or black gunk. If the bike has gears, check to make sure the gear levers and derailleurs (gear-changing mechanism) work to shift the chain between the gears.
- QUICK → REFERS TO THE QUICK RELEASE**
Some bikes have quick releases on the wheels or seat post. Check to make sure they are tight and closed properly.
- CHECK → STANDS FOR CHECK**
After making sure the seat and handlebars are tight and the proper height, have the child ride the bicycle around the parking lot and check that everything works well.

Figure 8. NHTSA helmet fit handout, used in the Colorado DOT Bicycle Safety Lesson Plans

Figure 9. Example of an ABC Quick Check handout from the Walk! Bike! Fun! curriculum



Power Pedal Instructions

The “power pedal” position allows the cyclist to have the most powerful first pedal stroke, resulting in a smoother and faster start

- Identify dominant foot (same as dominant hand).
- Align pedal of dominant foot with bike frame down tube.
- Place dominant foot on the pedal.
- Transfer weight and drive the pedal down.

Figure 10. Example Power Pedal position diagram & instructions from Safe Cycle, Australia

diagrams or videos to supplement their lectures and/or hands-on practice. Beyond these items, there was large variation in the extensiveness and content of programs.

Child bicycling education in the Netherlands, Denmark, and Germany is extensive and is part of their school curriculum, typically completed by age nine (fourth grade).⁴³ Youth cycling training in these countries typically include classroom and on-road sessions starting on a training track (protected area) and then on local streets and using common cycling facilities.⁴³ The United Kingdom has a nationally standardized, voluntary bicycle education program called Bikeability, which has three levels of on-bike training: 1) basic skills in a protected area for children up to age nine, 2) intermediate skills on low-volume streets for children ages nine to 11, and 3) advanced skills on all road types for children over age 11.⁴⁴ In the Netherlands, where bicycling to school is prominent, children must complete up to a nine mile bike ride through normal traffic before they are allowed to ride their bicycles to school.⁴⁵

In the United States, youth bicycle education is not standardized, but often includes some type of hands-on component. Frequent hands-on practice and reinforcement is key to encouraging behavior change in children and this is particularly important for bicycle riding because it is a dual-task, requiring both motor and cognitive skills to be engaged at the same time.⁴⁶⁻⁴⁸ Introductory hands-on practice could include children practicing riding bicycles in an environment that is closed to traffic, such as a playground or barricaded road, until they have mastered their handling and safety skills enough to practice in a real traffic environment (e.g., low-volume street or on a neighborhood ride). Duration and

frequency of the hands-on component is also important. Having the children practice on bicycles several times helps reinforce the concepts being taught and develop the necessary motor and cognitive skills needed for bicycling.⁴⁹ Ideally, this hands-on component would also take place in small groups that each have an instructor available to help correct errors the children might be making.

On-road training via neighborhood or community bike rides is common among programs targeting the nine and older age groups, when on-road, in traffic, riding becomes more prevalent. Adults who are knowledgeable about bicycle safety and are able to help correct errors typically teach these types of rides. Ideally, this would take place at the end of the program, as a capstone or mastery component, to help reinforce and assess what the children have learned. However, this on-road component was by no means universal across programs, regardless of age group. There are many programs included in this inventory that stop with on-bicycle practice in a protected area (e.g., activity course on a playground) and never incorporate on-road practice in the real traffic environment or they label the on-road portion or community ride as optional. This seems to be a large shortcoming, as children will eventually be riding in non-protected areas.

Supervised on-road practice can show children the correct ways to navigate intersections, turns, lane positioning, and other relevant safety skills for their area and prepare them for independent riding. It is important for children to practice their skills in environments that are similar to where they will be riding. In learning theory, this is referred to as encoding specificity; information is better remembered in a context that matches where it will be executed (e.g., better to practice on a barricaded road than in a gym).¹¹

In general, only a small number of programs in the inventory are extensive programs in terms of time commitment, components, and/or additional on-bicycle practice time. These programs often have higher costs, require more equipment, include at least 15 sessions, and have many more hands-on activities (potentially requiring more volunteers or supervisors). One example is a program created by the Boulder Valley School District in Colorado. The program, Bicycle Lessons and Safety Training (BLAST)⁵⁰, includes in-class presentations as well as on-bicycle drills (Figure 11). It is also age-specific, with a program specifically for fourth and fifth grade students and another for sixth and seventh grade students. Several programs have been adapted from this program.

An example community-based program is Positive Spin from Pennsylvania.²⁴ This program teaches youth how to operate bikes safely and navigate through city streets, trails, and parks. Most of this program involves hands-on practice, which is appropriate for the target age (10 to 14 year olds). Another example of an after-school program is the Pedal Power program in Minnesota.⁵¹ This program teaches bicycle safety skills and participants go on a group bike ride each week. The program is also unique in that it targets children who speak languages other than English at home.⁵² The program starts with fourth graders and continues to the end of fifth grade (ages nine to eleven). By the end of the program, participants go on a 21-mile bike ride along the Mississippi River. The program is also able to provide bicycles to children who do not have one of their own. One of the most unique bicycle education programs in the inventory is the Red Shed Bike Camp.⁵³ This is a camp where participants spend a week at camp learning bicycle safety. Participants go on a group bike-ride every day of camp, allowing them to practice the skills they have learned. This is a much more time-intensive program. It is also more expensive for participants (\$200 USD), however, most are eligible for a scholarship to lower the cost.

Many of the included programs have limited time commitments and are feasible on a small budget. The majority of these types of programs are a bicycle rodeo with another component (e.g., one time in-class session, school assembly or presentation, take-home readings for parents to do with their children). These typically introduce some basic concepts of bicycle safety (helmet fit, hand signals, bicycle handling) and accommodate on-bicycle practice. Bicycle rodeos are beneficial for encouraging riding, introducing basic bicycle safety skills, and basic bicycle handling skills. However, evidence of bicycle rodeo effectiveness is very limited. Bicycle rodeos may have a low impact on behavior change, due to the small amount of time reinforcing concepts being taught. Bicycle rodeos are useful to encourage bicycling and as a component of additional programming that includes more time for reinforcement and practice of skills.

Module 7.1 - Controlling, Scanning and Signaling

Purpose: To practice basic bike handling skills required for maneuvering on the road

Time: 35 minutes

Materials: Bikes (one per student), Helmets (one per student), Safety Cones (15 Large, 15 Small), Half Tennis Balls (80), Stop Signs (2), Chalk, Tape Measure (1)

BTA Reference: Pages 47 - 49

Key Messages

- A bicycle is a vehicle
- Maintain control when looking over your shoulder to scan for traffic before turning
- Always signal your intentions
- Use proper stopping technique
- These skills will save your life

Setup

- See diagram in appendix B

Procedure

- Introduce lesson and importance
 - To safely operate your bicycle, you need to have good control in a variety of situations
- Give instructions for lesson
 - Review starting technique - **Power Pedal Position**
 - Instruct students to select an appropriate gearing for the course
 - Review stopping technique - use both brakes and keep weight back to avoid skidding
 - Review hand signals - left and right.
- Run activity
 - Following the sequence below, demonstrate each activity. Have students do each exercise until comfortable and done properly. Then allow them to move to next skill.
 - **1. Warm-up Ride**
 - Explain pattern including the Cone Zone. Students ride the entire course without stopping and circle back through the slalom cones to start line.
 - **2. Smart Stop**
 - A Smart Stop means that the student is standing out of the saddle with both feet on the pedals and comes to a controlled stop with both brakes and their weight shifted back. The students should not skid, or step off the pedals until they are at a complete stop.
 - Ride to the stop sign (row of cones at end of Cone Zone)
 - Come to a full stop with both feet on the ground and both hands on the bars. Straddle the bike.
 - Look left-right-left before proceeding (Stop-Look-Listen)
 - Continue on with proper starting technique (Power Pedal Position)

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Figure 11. Example Lesson Plan from BVSD BLAST Curriculum

There are also several intermediate level programs in terms of time commitment, typically including four to eight sessions. These programs can be molded based on time and budget and can be completed in a month, instead of over years or in one day. They typically require bicycles for all students or one demonstration bicycle. An example of an intermediate program is BikeSafe from Florida (Figure 12). This program has five sessions that can be completed in five days. The first four sessions are in-class, learning basic bike maintenance, rules of the road, hand signals, and how to safely ride a bike. The fifth session is an optional on-bike day that reinforces the lessons from the previous four sessions. Many other programs have been created by adapting this program.

Many of the programs in the inventory have their curricula available for free download via a web site (e.g., BikeSafe²⁰, BVSD BLAST⁵⁰, and Iowa Kids on the Move⁵⁴). These are valuable resources for areas that do not have an existing program or have limited time and resources to create their own. Instructors can adapt these programs based on their needs.

These are also valuable resources for parents that are homeschooling and want to teach their children bicycle safety.

Overall, introducing children to a variety of bicycle education is key. Children are not likely to master bicycle safety from exposure to a single program. Repetition, reinforcement, and supervision of bicycle handling and traffic safety skills are needed to maximize the impact on child safety. Having bicycle rodeos throughout the school year is a great way to continue to encourage practice of handling skills, as well as encourage enthusiasm for bicycling. Longer programs are able to provide more detail about traffic safety and allow for the concepts to be reinforced through hands-on practice to encourage behavior change. Parental/caregiver involvement and reinforcement is needed as well.

Age and developmental considerations

Age appropriateness is one of the key aspects to be considered when choosing or designing bicycle education for children.



BikeSafe
Physical Education
Curriculum for
Grades 6th-8th
www.ibikesafe.org

Day 4: Safe Bike Riding
Instructional Component – Where it is Safe to Ride

Day 4 Overview

- Safe Ride Introduction • Signs and Signals • Safe Riding Skills Simulations • Hand Signals Activity

Learning Targets:

1. Students will be able to explain and perform appropriate maneuvers in response to the most common traffic signs.
2. Students will be able properly signal with their hands to help drivers and other bicyclists know what they intend to do and where they intend to turn.
3. Students will be able to explain why riding on the right side of the road helps to contribute to their predictability and safety.

Materials:

- Sign/Signal flashcards
- Cones (minimum of 8 for two teams)
- Basketballs (enough to divide students into at least 2 teams of no more than 10 students, 1 ball per team)
- Props to mark where to stop, scan, and signal

Optional Supplemental Materials:

- Sidewalk chalk
- Prop traffic signs
- "Intersections Worksheet" (pgs. 57-61)

1) Safe Riding Introduction

- Briefly review safety concepts from Days 1-3.
- Discuss the following procedures for riding a bike safely:

Safe Cycling Procedures

- Exiting a driveway – Stop, look, listen – look L-R-L before you turn onto the road in the same direction as traffic. If on sidewalk, do the same to make sure you don't have a collision with a pedestrian
- Crossing a street – Same process as exiting a driveway.
- Approaching a crosswalk – Slow down and stop. Look L-R-L for pedestrians crossing the street. Cross when coast is clear.
- Passing people on the sidewalk - Yield to pedestrians (people who are walking) and always try to pass them on the left. Warn them by yelling "On the Left!" before passing them. (*Yield: A yield is a traffic sign that lets us know we need to slow down and look for oncoming traffic.*)
- Remind students of the following points and explain how they help them stay predictable and safe

Important points to emphasize:

- ✓ Obey all traffic signs and signals.
- ✓ Bikes on the street and cars are both VEHICLES.
- ✓ Like a car, ride your bike on the right side of the road.
- ✓ ALWAYS ride in a straight line (never weave in between cars!).
- ✓ When on a bike, ride where cars expect you to be

Q: Can we ride on the sidewalk?

A: In Florida, yes we can but even when we ride on the sidewalk we have to be careful.

Q: What are some of the traffic signs we see riding our bikes? Should we do what the signs tell us?

A: Stop signs, yields, and railroad crossings, just to name a few. Yes, always follow the traffic signs! Bikes are vehicles and need to follow rules too.

Q: Who has the "right-of-way" – bikes or pedestrians?

A: Pedestrians

Q: If a person rides in the street, which side of the street should they ride on?

A: Always ride WITH (not against) the flow of traffic, on the right side of the street. When walking/jogging, we do the opposite.

Q: What if the street is a one-way street?

A: Always ride WITH traffic. Do not ride the wrong way down a one way street.

Q: Should we ride our bikes in a zigzag pattern, back and forth from side to side?

A: No! Always ride in a straight line to be predictable.

Figure 12. Example Lesson Plan from the Bikesafe Curriculum

There are many important developmental milestones that occur throughout the years a child is in school, which are relevant to bicycling safety. An alarming proportion (over half) of the programs included in this inventory are not explicitly age-specific. In an age-specific program, different elements are taught based on age and corresponding developmental differences in abilities and comprehension levels.

General motor development (behavioral milestones of walking, running, jumping, bending, etc.) occurs through age seven.¹¹ Bicycle riding also requires development of additional motor skills, beyond general motor development. The main motor skills needed for bicycling are handling (balancing/riding in a straight line, pedaling, steering, braking) and safety-behaviors (scanning for traffic, quickly moving through a chosen gap in traffic, braking to stop at lights and signs, and using hand signals when turning).¹¹

Bicycling also requires cognitive skills, so both brain and cognitive development are important to consider as well. The primary cognitive skills for bicycling include hazard identification and avoidance, choosing safe gaps, and recalling and executing the rules of the road.¹¹ However, it is important for children to become efficient in the motor skills required to ride a bicycle before adding in the cognitively demanding tasks of traffic safety skills (scanning, navigating intersections, using hand signals, etc.). The more refined the motor skills, the less likely performance will decrease when cognitive tasks are added.⁵⁵ The development of proficiency in bicycling occurs through repeated practice of the handling and safety-skills, together. It is also important for educators to know that young children tend to prioritize the motor task (e.g., balance) over cognitive tasks (e.g., negotiating traffic).¹¹ Dual-tasking, engaging both motor and cognitive tasks at the same time, will improve with age and can also improve with training and practice.¹¹

Until early adolescence (around 12-14 years), children have difficulty performing dual-tasks.¹¹ Information processing, response times, and problem solving abilities are slower in children, compared to adults.¹¹ Reaction times increase with age and become similar to adults around age 14.¹¹ Given that bicycling requires both cognitive and motor skills, this means educators should expect children younger than age twelve to be slower during road-based practice (e.g., turning, crossing) than older children and adults.

During puberty the socio-emotional center of the brain becomes more dominant. During this time in adolescence, positive emotional experiences are particularly rewarding and this tends to lead to more risk-taking because it produces an exhilarating, positive emotional effect.¹⁶ Bicycling is not immune to this overall increase of risk-taking behavior. Among adults, the pre-frontal cortex helps to regulate the socio-emotional center to decrease risk-taking, but the pre-frontal cortex is not fully developed until early adulthood, so it cannot regulate the socio-emotional center fully in children¹¹.

The decreases in emotional control and increases in risk-taking behaviors may be most prominently seen in ages twelve and older. We did not find a lot of explicit program content related to the increased risk-taking and emotional state of adolescents, in general. Programs were generally good at teaching handling and traffic-safety skills, but many of the programs targeting adolescents did not have specific risk-taking components. Instead, programs tended to focus on the importance of traffic rules and regulations and consequences of not following them. Programs would benefit from supplementing their curricula with guidance for instructors on how to address the increased emotions and risk-taking among teens.

Based on these developmental factors relevant to bicycling, there are some natural age cut-points for bicycle safety education: five to seven, seven to nine, nine to 12, and 12 to 18. Table 3 contains a summary of some of the important developmental factors to consider for the design and implementation of youth bicycle education programs by these age groups and for all school-aged children. These are some of the most prominent considerations and are simplified for ease of understanding and use.

INVENTORY OF YOUTH BICYCLE EDUCATION PROGRAMS

Table 3. Developmental considerations important for youth bicycle safety education by age group^{11, 16, 19}

<p style="text-align: center;">Ages 5-7 <i>Kindergarten and First Grade</i></p> <p>General motor development (running, jumping, climbing, hand-eye coordination, etc.) is still occurring</p> <p><i>Implications:</i> Children may have varied levels of coordination, balance, and endurance and may have reaction times as much as two times slower than adults</p>	<p style="text-align: center;">Ages 7-9 <i>Second and Third Grade</i></p> <p>Decreased use of peripheral vision cues motor skills, like balance, giving preference to central vision</p> <p><i>Implications:</i> Children may miss important peripheral information relevant to their safety or may have balancing problems when shifting their focus to peripheral traffic safety information. Slower reaction times, overall, compared to older children and adults.</p>
<p style="text-align: center;">Ages 9-12 <i>Fourth to Sixth Grade</i></p> <p>Cognitive development and ability to combine motor skills and cognitive skills for bicycle riding still underway</p> <p><i>Implications:</i> Although they may be better than younger children at riding and process information about traffic and safety at the same time, they will still require more supervision than older children</p>	<p style="text-align: center;">Ages 12-18 <i>Seventh Grade through High School</i></p> <p>Socio-emotional center of brain more dominant and pre-frontal cortex not fully developed to help regulate</p> <p><i>Implications:</i> Decreased emotional control, increased risk-taking behaviors. Programs should stress risk-avoidance and risk-taking consequences.</p>
<p>All school-aged children</p> <p>Pre-frontal cortex still developing into early adulthood</p> <p>Slower ability to process information and slower response times, compared to adults</p> <p><i>Implications:</i> Compared to adults, children will have slower reaction times, slower problem solving abilities, and slower response to emergency situations. These things will improve as age increases. Risk-taking behaviors will increase with age.</p>	

Unfortunately, many programs fail to recognize these age and development aspects and use the same curriculum for a wide range of ages (e.g., all elementary school aged children—ages five to 12). This is especially problematic among bicycle rodeos with an additional component. A program with age-considerations may primarily teach the youngest school-aged children (ages five to seven) pedestrian-related traffic safety skills. This gives them a good background on basic rules of the road that pedestrians would know to stay safe. Bicycle safety lessons for the youngest age groups (up to age nine) may primarily focus on the basics of riding a bicycle through practice of bicycle handling and control. Starting around age nine, there would be more focus more on traffic safety, rules of the road, and more complex bicycling maneuvers. Following this, more complex bicycling and traffic safety skills can continue to be reinforced as the child moves through middle and high school. Generally, complex information should be minimized among the youngest age groups and necessary bicycle motor skills (balance, handling) should be developed among older children before teaching more complex traffic safety skills (e.g., bicycle handling mastered before teaching hand signals).

One example of a program designed with age and development considerations is Let's Go NC¹⁹. This program is targeted to kindergarten (age 5) through fifth graders (age 11) with lessons for the younger children focusing on basic concepts and less on-bike time, while the older children spend more time on the bike practicing increasingly complex skills. They also include explanations of developmental aspects that should be considered in their lesson plans for instructions and in Parent/Caregiver Tip Sheets, which are part of the wrap-around materials included as part of the program. Figure 13 shows an example tip sheet from one of their fourth and fifth grader (ages 9 to 11) lessons, which includes a 'Did you know?' section indicating that children at this age level "have generally developed enough cognitive capacity to understand more complex road rules".

The Bikeology curriculum is another example of a program designed with age and developmental aspects in mind and has a target age range of 11 to 18 (6th to 12th graders).³¹ One thing that sets this program apart is that they have developed their objectives in relation to which type of skills are being focused upon: cognitive, psychomotor, or affective. They have also explicitly designed their program with lesson modifications based on skill level (beginner, intermediate, advanced), which they refer to as differentiated instruction. Although it is likely that many educators provide accommodations for varying skill levels, we found it rare for programs to explicitly provide lesson plans containing level-based content (beyond being age-specific).

Limitations

Although we were not able to find every youth bicycle education program taught in the United States, this inventory includes the most prominent and accessible programs. Programs that do not have an online presence are likely underrepresented in this inventory, with the exception of the programs captured via our online survey. However, the mixture of programs with online presence and those captured from the survey likely provide insights on the general characteristics and breadth of programming throughout the nation.

An overall limitation to this inventory is that only a small subset of the included programs have been evaluated for effectiveness. This inventory identifies the most common components taught in youth bicycle education programs, but it does not reveal which are the most important and effective in increasing child bicycle safety. For example, we know that all programs teach about helmet safety and fit, but we cannot determine if that is more effective than other components, like extent and amount of bicycle handling or traffic safety skills practice, or a mastery component like a neighborhood ride. Many of the programs use knowledge-based tests

Let's Go Biking!

Parent/Caregiver Tip Sheet

Basic Traffic Skills

Today your child completed the fifth and final lesson of *Let's Go Biking!*, the bicycle component to *Let's Go NC! A Pedestrian and Bicycle Safety Skills Program for Healthy Active Children*.

The course was designed to help your child learn to bike safely on the street around pedestrians, other bicyclists and motor vehicles in a safe and simulated environment. Review the *Final Skills Checklist* to see how your child performed and ask your child to tell you what he or she learned during the course.

PRACTICE AT HOME!

Encourage your child to continue working on these skills, especially those on the checklist where the child needs more work. If possible, bicycle with your child to observe how well he or she handles the bicycle and demonstrates knowledge of rules of the road. It is better for children not to bicycle on the street without adult supervision until they have demonstrated mastery of these skills.

Consider your child's level of maturity, traffic skills, and the amount of traffic on the streets adjacent to your home when deciding whether to permit your child to ride on the street. Establishing boundaries is a good way to keep your child within a specified distance from home. Note that some jurisdictions limit or prohibit bicycling on the sidewalk.

Did you know?

On-bike practice is a critical part of safety training for fourth and fifth graders. By addressing bicycle safety issues and working with your child on basic traffic rules now, you can help reduce your child's chance of having an injury later on.

Children in fourth and fifth grade:

- Are capable of bicycling as far as 10 miles with sufficient snacks and rest periods,
- Need outdoor time and physical challenges,
- Have generally developed enough cognitive capacity to understand more complex road rules, and
- Have improved coordination and reaction time.

M4-5 B5

Figure 13. Parent/Caregiver Tip Sheet from Let's Go NC!

to assess knowledge change, but knowledge change often does not translate to behavior change or increased safety.³⁸⁻⁴⁰ It is also likely that some programs have conducted informal evaluations that are not published, therefore, not available for our review. This inventory highlights the need for more program evaluation, overall, as well as the need to determine which program elements can increase safe bicycling behaviors.

Another area in need of further evaluation is parental involvement. We could not fully determine level of parental components and/or involvement in all programs. Many of the programs with wrap-around materials included parent handouts and parents are present at many of the bicycle rodeos. However, the extent and effectiveness of parental involvement in combination with school-based or community-based youth bicycle safety programming is largely unknown.

We were not able to assess the extent to which programs make causal connections between risky behaviors and outcomes (consequences of those behaviors). It was clear that the majority of programs were making these connections related to helmet use, but not as clear for other components. Among the full curricula we reviewed, there were examples of importance and consequences of risky behaviors given in some of the programs, however, we are unable to determine if there are programs that are teaching this, even though not explicitly stated in the curricula. For these reasons, our conclusions in this area are limited and warrant more investigation, as we know that explaining the “why” is important for behavior change.⁵⁶

Conclusions

This inventory of child bicycle education contains a wide variety of current programs and examples of components by age appropriateness. In particular, this inventory provides common components of bicycle safety education programs and how these differ by age and development. Consideration of age, development, and skill-level are important for youth bicycle education programming, but were lacking in many of the programs we examined. Results from this project also revealed a lack of program evaluation, highlighting the need for more research to determine the effectiveness of overall programs and specific program components and approaches, particularly in regard to behavior change. This inventory can be used by educators to identify example programs suitable to their needs (age, duration, cost, etc.) or component to improve programs in their area. This inventory also provides a foundation upon which child bicycle education standards can be built, with a goal of increasing overall childhood safety.

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Appendix A – Online Survey

Youth Bike Education Program Survey

Youth Bicycle Education Program Inventory



The purpose of this survey is to gain information about various youth bicycle education programs from local, national, and international sources and input the information into a bicycle education program inventory. We hope that this inventory will be able to be used by educators throughout Iowa and beyond.

All information will be confidential. If you do not wish to share information about your bicycle education program, you may exit this questionnaire.

Only one person should fill out the survey per program.

If you know of anyone else with a youth bicycle education program, please forward this survey on to them. There will be an opportunity at the end of the survey to provide contact information, or you can share this link with them: https://uiowa.qualtrics.com/jfe/form/SV_cOtoAnfoPFOJCYJ

If you have any questions, please email alyssa-conrad@uiowa.edu

Thank you!!

INVENTORY OF YOUTH BICYCLE EDUCATION PROGRAMS

What is the name of your program?

What is the delivery area(s) of your program? (Name of the state, country, city, etc.)

What is the content of your program?

- Bicycle-Only Education
- Bicycle and Pedestrian Education
- Other _____

Is your program only self-taught? (no teachers or instructors for any of the program)

- Yes
- No

Who teaches your program? (check all that apply)

- School Teacher
- Trained Instructor
- Volunteers
- Other _____

INVENTORY OF YOUTH BICYCLE EDUCATION PROGRAMS

Are there any costs to the participants of your program?

Yes

No

What is the cost(s) to the participants of your program?

Are there any costs associated with the administration of your program?

Yes

No

What is the cost(s) associated with the administration of your program? (please estimate the cost)

What is the target age(s) and/or grade level(s) of your program?

How many sessions does it take to complete your program?

How long (in hours) does each session take to complete?

INVENTORY OF YOUTH BICYCLE EDUCATION PROGRAMS

Does your program involve children practicing on their bicycles? (hands-on training)

Yes
 No

What hands-on training takes place?

Does your program require and/or provide equipment? (check all that apply)

	Equipment <u>Required</u>	Equipment <u>Provided</u>
Bicycle	<input type="checkbox"/>	<input type="checkbox"/>
Helmet	<input type="checkbox"/>	<input type="checkbox"/>
Cones	<input type="checkbox"/>	<input type="checkbox"/>
Bicycle Maintenance Equipment	<input type="checkbox"/>	<input type="checkbox"/>
Miscellaneous Equipment for Activities (e.g. jump ropes, basketballs, etc.)	<input type="checkbox"/>	<input type="checkbox"/>
Other	<input type="checkbox"/>	<input type="checkbox"/>

Does your program provide wrap-around materials? (e.g. materials that participants can take home to share with their families)

Yes

No

Do participants take **knowledge-based** tests during the program?

Yes

No

Do participants take **skill-based** tests during the program? (on-bike tests)

Yes

No

Does your program have accommodations for special-needs participants?

Yes

No

Please describe the accommodations your program makes for special-needs participants.

INVENTORY OF YOUTH BICYCLE EDUCATION PROGRAMS

Does your program meet education requirements for schools in your area?

- Yes
- No
- Unsure

Is your program a bicycle rodeo? (A rodeo is defined as a one-time bicycle skills event which provides an opportunity for bicyclists to practice and develop skills that will help them to become better bicyclists and avoid typical crashes.)

- Yes
- No
- Unsure

Does your program have components other than the rodeo?

- Yes
- No

Has your program been evaluated for effectiveness in terms of knowledge, behavior, and/or attitude change?

- Yes
- No

INVENTORY OF YOUTH BICYCLE EDUCATION PROGRAMS

If available, could you provide a link or upload a document (pdf, word, etc.) of the evaluation?

- Yes, I have a link to the evaluation
- Yes, I can upload a file of the evaluation
- Yes, I have a link and a file
- No, the evaluation is not available

Please summarize the evaluation:

Please provide a link to the evaluation below.

Please upload the file of the evaluation below.

Please provide a link to the evaluation below.

Is your program adapted from another program?

- Yes
- No

What program(s) did you adapt your program from?

Is your program theory driven?

- Yes
- No
- Unsure

Which theory is your program guided by?

Do you have a website with more information about your program?

- Yes
- No

Please provide a link to the website.

Do you have a file (word document, pdf, etc.) of your program's curriculum? (This is confidential and will not be shared.)

- Yes
- No

Please upload the file of your program's curriculum.

INVENTORY OF YOUTH BICYCLE EDUCATION PROGRAMS

Please provide a brief summary of your program:

Do you know of anyone else with a youth bicycle education program that we can contact?

Yes

No

Please list the names and contact information for anyone else with a youth education program.

Is there anything else you would like to tell us about your program?

Can we use the information you have provided about your program in a bicycle education inventory that may be published? (Personal contact information will not be included)

Yes

No

Would you like to be notified when results from the survey are available?

Yes

No

INVENTORY OF YOUTH BICYCLE EDUCATION PROGRAMS

Please provide an email address (or other contact information) we can send the survey results to.

Can we contact you if we have more questions?

Yes

No

Please provide the following contact information:

Program Contact Name _____

Program Contact Email _____

Appendix B – Youth Bicycle Education Inventory Summary Matrix

Headings Descriptions

- Program Name – What is the name of the program? (*Programs that are underlined are hyperlinked to their webpages*)
- Location – Where is the program primarily taught?
- Subject – Does the program include components that teach about both bicycle and pedestrian safety, or only about bicycle safety?
- Instructor – Who teaches the program?
- Delivery Method – Is the program taught in school, or out of school (in person)?
- Target Age – What are the target ages of the program?
- Sessions – How many individual sessions does it take to complete the program?
- Time – How long does it take to complete all of the sessions of the program?
- Age-Level Specific – Is the program age-level specific (is it designed with different components for different age groups/developmental cut-points)?
- Hands-on – Is there a component of the program that involves children practicing bicycle handling skills?
- Requires Equipment – Does the program require equipment to complete all or part of it?
- Provides Equipment – Does the program provide needed equipment to the participant-s and/or the instructors?
- Wrap-Around Materials – Does the program include materials that the child can take home to reinforce components taught during the program?
- Knowledge Tests – Does the program include tests that measure knowledge change about bicycle safety/handling?
- Skills Tests – Does the program include tests that measure behavior change while on a bicycle?
- Special Needs – Does the program have accommodations for special needs participants?
- Meets Education Standards – Does the program meet education standards set for the area it is taught in?
- Evaluated – Has the program been formally evaluated for effectiveness and reported via a peer-reviewed journal article or detailed report?
- Curriculum Available – Is the curriculum available to the public for download via a contact person or website?

Youth Bicycle Education Programs (Longest time to complete → Shortest time to complete)

Program Name	Location	Subject (B =Bike-Only, BP = Bike and Pedestrian)	Instructor (ST= School Teacher, TI=Trained Instructor, V=Volunteers, O=Other)	Delivery Method (S = School-based C = Community-based)	Target Ages	Sessions	Time (Hours)	Age-Level Specific	Hands-on	Requires Equipment	Provides Equipment	Wrap-Around Materials	Knowledge Tests	Skills Tests	Special Needs	Meets Education Standards	Published Evaluation	Curriculum Available
<u>Pedal Power</u>	Minnesota	B	ST, TI	C	9-11	48	48	X	X	X	X		X	X	X			
<u>Florida Safe Routes to School</u>	Florida	BP	ST	S	9-14	24	48	X	X	X			X	X		X	X	
<u>Red Shed Bike Camp</u>	Rhode Island	B	TI	C	8-13	5	30		X		X			X				
<u>Wheel Kids Bicycle Club</u>	California	B	TI	C	10-18	6	24		X	X								
<u>Brevet du Cycliste</u>	Belgium	B	ST	S	10-12	4	24	X	X	X			X	X				
<u>Iowa Kids on the Move</u>	Iowa	BP	ST	S	5-10	17	20	X	X	X		X	X		X	X	X	
<u>New Jersey Bike School</u>	New Jersey	BP	ST	S	5-14	16	18	X		X			X	X	X	X	X	
<u>Pedal Power</u>	California	B	TI	C	10-16	12	18		X	X	X	X	X	X	X	X	X	
<u>Safe Cycle</u>	Australia	B	ST	S	10-12	9	18	X	X	X							X	X
<u>Positive Spin</u>	Pennsylvania	B	ST, TI, V	C	10-14	8	16		X		X	X		X	X			
<u>SafeCyclist</u>	Texas	BP	ST	S	9-11	15	15	X	X	X			X					
<u>Bikeology</u>	United States	B	ST	C	11-18	7	14	X	X	X			X	X	X	X	X	
<u>Pedal Ready</u>	New Zealand	B	TI	C	4-8	3	13		X	X	X	X	X	X	X	X	X	
<u>Certificat Cycliste Averti (Certified Aware Cyclist)</u>	Canada	B	ST, TI	S	10-12	13	12	X	X	X	X		X	X			X	
<u>BikePro</u>	Missouri	B	TI	C	11-14	6	12	X	X	X		X		X	X			
<u>Colorado DOT Bicycle Safety Lesson Plans</u>	Colorado	B	ST	S	8-12	16	10	X	X	X		X				X	X	
<u>Let's Go NC!</u>	North Carolina	B	ST	S	5-11	15	10	X	X	X		X	X	X	X	X	X	
<u>Bike Driver's Ed</u>	Wisconsin	B	ST	S	10-12	10	10	X	X	X	X	X	X	X			X	
<u>CycleRight</u>	Canada	B	TI	C	> 10	10	10		X	X								
<u>Kids on Bikes</u>	Florida	B	ST, TI	S	5-12	10	10		X	X	X						X	

Program Name	Location	Subject (B =Bike-Only, BP = Bike and Pedestrian)	Instructor (ST= School Teacher, TI=Trained Instructor, V=Volunteers, O=Other)	Delivery Method (S = School-based C = Community-based)	Target Ages	Sessions	Time (Hours)	Age-Level Specific	Hands-on	Requires Equipment	Provides Equipment	Wrap-Around Materials	Knowledge Tests	Skills Tests	Special Needs	Meets Education Standards	Published Evaluation	Curriculum Available
Safe Routes for Kids	Oregon	B	ST	S	9-13	10	10	X	X	X			X			X	X	
Millennium Development Cycling	New York	B	TI	C	8-13	5	10		X	X	X	X				X		
Safe Routes to School	Oregon	BP	TI	S	10-12	10	9	X	X	X	X	X	X	X	X	X		
Let's Go	Washington	BP	ST, TI	S	8-11	9	9	X	X	X	X		X		X			
Bicycle Colorado's Safe Routes to School	Colorado	BP	ST	S	5-11	6	9	X	X	X							X	
Cycle Safe	New Zealand	B	TI	S	9-11	6	9	X	X	X	X	X	X	X	X			
Walk! Bike! Fun!	Minnesota	BP	ST	S	5-14	12	8	X	X	X			X			X	X	
Comprehensive Bicycle Safety Education	Nebraska	BP	TI	C	5-12	8	8		X	X	X	X		X				
Kansas City BLAST	Kansas/Missouri	BP	ST, TI, V	S	9-12	8	8	X	X		X	X	X	X	X	X	X	
Pedal Up	Virginia	B	TI, V	S	7-12	8	8		X	X	X			X	X			
Safe Routes to School	Washington	BP	ST	S	10-14	8	8		X	X	X	X	X			X		
Safe Routes to School Marin County	California	BP	ST	S	5-14	5	8	X	X	X			X			X	X	
Bike Right - Kids	New Jersey	BP	TI	C	5-13	4	8		X	X								
Cycle Right	Ireland	B	TI	C	4-6	4	8	X	X	X	X			X	X			
Bike Pro	Missouri	B	TI	C	11-13	1	8	X	X	X			X	X				
Safe Kids Platte Valley - CHI Health Good Samaritan Hospital	Nebraska	B	O	S	8-9	10	7	X			X	X						
Kids Can Bike!	Tennessee	B	TI, V	C	8-11	7	7	X	X	X	X		X	X			X	
Sprockids	Canada	B	V	C	5-18	7	7	X	X	X	X							
Classroom Cruisin'	Vermont	B	O	S	5-18	1	7		X	X	X	X						
Safe Routes Nebraska	Nebraska	BP	ST	S	6-14	15	6	X								X	X	

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Bike Smart	Vermont	B	ST, TI	C	5-14	7	6		X	X	X				X		X	
Bike Smarts	Canada	B	ST, TI	S	7-13	6	6			X	X					X		X
Cycles of Change Safe Routes to Schools Safety Program	California	B	ST, TI	S	5-18	6	5		X	X	X		X					
BikeEd Hawaii	Hawaii	B	TI	S	5-14	5	5		X	X	X	X				X		
BikeSafe	Florida	B	ST	S	11-14	5	5	X								X	X	X
Bike Utah's Youth B.E.S.T.	Utah	BP	TI, V	S	9-13	5	5	X	X			X	X	X	X	X	X	X
Northeast Iowa Safe Routes to School	Iowa	BP	TI, V	S	5-11	5	5		X	X	X	X	X	X	X			
Safe Routes Philly (Bike Section)	Pennsylvania	BP	ST	S	10-11	4	4	X								X		X
Bike Sense	Kentucky	B	ST, V	S	8-11	5	3	X		X		X	X	X	X	X	X	X
Boulder Valley School District B.L.A.S.T.	Colorado	B	ST, TI	S	9-11	4	3	X	X	X	X				X			X
Friends of God Camp Bikes	California	B	TI, V	C	4-9	4	3		X	X	X	X				X		
PATH Youth Bike Ed	Hawaii	B	TI	C	9-10	3	3	X	X	X	X							
Safekids Albion	Illinois	BP	V	S	7-14	2	3					X	X	X	X			
Optimist Safety on Wheels	North Dakota	B	ST, TI, V	S	8-9	1	3	X	X	X	X	X			X	X		
After School Education Program	New York	B	TI	C	> 10	1	2		X	X	X							
The Bike Campaign & Bike Garage	California	B	TI, V	C	10-15	1	2		X	X	X	X	X	X	X	X	X	
Bicycle Safer Journey	United States	B	ST	S, C	5-18	3	1	X				X	X					

Rodeos with an Extra Component (Longest time to complete → Shortest time to complete)

Program Name	Location	Subject (B =Bike-Only, BP =Bike and Pedestrian)	Instructor (ST= School Teacher, TI=Trained Instructor, V=Volunteers, O=Other)	Delivery Method (S =School-based C =Community-based)	Target Ages	Sessions	Time (Hours)	Age-Level Specific	Hands-on	Requires Equipment	Provides Equipment	Wrap-Around Materials	Knowledge Tests	Skills Tests	Special Needs	Meets Education Standards	Published Evaluation	Curriculum Available
Safe Kids Erie	Pennsylvania	BP	ST, TI, O	S	4-12	2	6		X	X	X	X	X	X	X	X	X	X
<u>Safe Routes to Schools</u>	North Dakota	BP	V, O	S	5-14	5	5	X		X		X	X					
<u>Youth/Teen Bike Safety</u>	Georgia	BP	ST, TI, V	C	10-16	2	5		X	X	X	X	X	X	X	X	X	
University of Iowa Stead Family Children's Hospital Cool Riders are Safe Riders	Iowa	B	TI, V	S	5-9	4	4		X	X	X	X	X	X	X	X	X	
Live Well Omaha Bicycle Safety Education	Nebraska	BP	TI	C	5-18	2	4			X	X	X	X	X				
Nevada Department of Transportation Bicycle and Pedestrian Program	Nevada	BP	ST, TI, V	S	5-14	1	4		X	X	X	X	X	X	X		X	
Safe Kids Salt Lake County Bike/Ped	Utah	BP	TI, V	S	5-12	1	4		X	X	X	X						X
Bike and Ped Safety	Tennessee	BP	V	S	6-11	2	3		X	X	X	X					X	
Bike it! Walk it!	California	BP	TI, V	S	8-14	1	3		X	X		X	X	X	X	X		
Organizer's Guide to Bicycle Rodeos	New York	B	ST, TI	S, C	5-14	1	3		X	X								X
Bicycle-Driver Training Course	Washington	B	ST	S	5-14	1	3		X								X	X
Bike East Bay	California	B	TI	C	5-12	1	3			X	X							
Bicycle/Pedestrian Safety Education Program	Florida	BP	TI	S	5-14	2	2		X		X					X	X	
Safety on Wheels	North Dakota/Minnesota	BP	TI, V	S	4-18*	2	2		X	X	X					X		
Safe Routes to School	Maryland	BP	ST, TI, V	S	8-11	2	2	X	X	X	X	X	X	X				

*emphasis on ages 8-11

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Bike & Walk Montclair	New Jersey	BP	ST	S	5-14	1	2	X	X	X	X	X	X	X	X			
Bike and Pedestrian Safety	Nebraska	BP	TI, V, O	S	5-8	1	2	X	X	X	X	X	X	X	X			
California Pedestrian and Bicyclist Enforcement and Education Project	California	BP	O	C	5-18	1	2	X	X	X	X	X	X	X	X			
Kids CAN-Bike	Canada	B	TI	S	8-13	1	2	X	X	X	X	X	X	X	X	X	X	
Safe Kids Spartanburg: Roll This Way	South Carolina	BP	V	S	5-18	1	2	X	X	X	X	X	X	X	X	X		
Bicycle/Pedestrian Safety Program	New York	BP	TI, V	S	5-16	1	1	X	X	X	X	X	X	X				
Connecticut's Safe Routes to School Program	Connecticut	BP	TI, O	C	5-18	1	1	X	X	X	X	X	X	X	X	X		
Ready to Roll	New Mexico	B	TI	S	6-11	1	1	X										
Sacramento Police Bike Programs	California	BP	O	C	5-18	1	1	X	X	X	X	X	X	X	X	X		
Safe Kids Harrison County	Indiana	BP	TI, V	S	7-12	1	1	X	X	X	X	X	X	X				
Safe Kids Huron Valley	Michigan	BP	TI, V	C	4-18	1	1	X	X	X	X	X	X	X	X	X		
Safe Kids Local Coalition	Nebraska	B	V	C	10-14	1	1			X	X	X	X	X				
Safe Kids Toombs Bike Safety	Georgia	B	V	S	8-13	1	1	X	X	X	X	X	X	X	X			
Safe Routes to School: Students Taking Active Routes Safely (S.T.A.R.S.)	Mississippi	BP	TI, O	S	5-11	1	1	X	X	X	X	X	X	X	X			
School Bike Rodeo	Iowa	BP	O	S	5-12	1	1	X	X	X	X	X	X	X	X	X		
Walk 'n Rollers	California	BP	TI, V	S	5-18	1	1	X	X	X	X	X	X	X	X	X		
Washoe County Safe Routes to School	Nevada	BP	ST, TI, V	C	5-14	1	1	X	X	X	X	X	X	X	X	X		

Appendix C – URLs for Programs with Web Sites

Program Name	Creator/Used By	URL
After School Education Program	Bike New York	https://www.bike.nyc/education/programs/after-school/
Bicycle Colorado's Safe Routes to School	Bicycle Colorado	https://www.bicyclecolorado.org/initiatives/safe-routes-to-school/
Bicycle Safer Journey	Federal Highway Administration	http://www.pedbikeinfo.org/bicyclesaferjourney/
Bike Driver's Ed	Wisconsin Bike Fed	http://wisconsinbikefed.org/wp-content/uploads/2015/02/BFW-Bike-Drivers-Ed-Walking-Wisconsin-Curiculum-2nd-Edition.pdf
Bike East Bay	Bike East Bay	https://bikieastbay.org/
Bike Right - Kids	TransOptions	http://www.transoptions.org/bike-right-kids
Bike Sense	Bike Louisville	https://louisvilleky.gov/government/bike-louisville/youth-bicycle-education-bike-sense
Bike Smart	Local Motion	http://www.localmotion.org/bike_smart
Bike Smarts	Insurance Corporation of British Columbia	http://www.icbc.com/road-safety/teaching/Documents/bike-smarts.pdf
Bike Utah's Youth B.E.S.T.	Bike Utah	https://bikeutah.org/youth-bicycle-education-program/
BikeEd Hawaii	Hawaii Bicycling League	https://www.hbl.org/bikeed/
Bikeology	SHAPE America	http://www.actionforhealthykids.org/game-on/find-challenges/safe-route-challenges/1460-bikeology-curriculum
BikeSafe	The University of Miami Kidz Neuroscience Center	http://kidzneurosciencecenter.com/bikesafe/
Boulder Valley School District B.L.A.S.T.	Boulder Valley School District	http://www.bvsd.org/transportation/toschool/blast/Pages/BLASTCurriculum.aspx
Brevet du Cycliste	Pro Velo	https://www.provelo.org/fr/page/brevet_du_cycliste
Colorado DOT Bicycle Safety Lesson Plans	Colorado Department of Transportation	https://www.codot.gov/programs/bikeped/safe-routes/lesson-plans/CDOTCoreSubjectLessonPlans.pdf
Cycle Right	Department of Transport, Tourism, and Sport, the Road Safety Authority, and Cycling Ireland	http://www.cycleright.ie/
Cycle Safe	Christchurch City Council	https://ccc.govt.nz/transport/getting-to-school/resources-for-schools/cyclesafe/
Cycles of Change Safe Routes to Schools Safety Program	Cycles of Change	http://www.cyclesofchange.org/safe_routes_to_schools_safety_program

Program Name	Creator/Used By	URL
Florida Safe Routes to School	University of Florida	http://floridasrts.com/
Friends of God Camp Bikes	St. Gregory of Nyssa Episcopal Church	https://sqnsource.weebly.com/foq-camp.html
Iowa Kids on the Move	Iowa Bicycle Coalition	http://www.pedbikeinfo.org/cms/downloads/iowa%20kids%20on%20the%20move.8.22.08.pdf
Kids on Bikes	Capital City Cyclists	http://cccyclists.org/kids/elementary-education/
Let's Go	Cascade Bicycle Club	https://www.cascade.org/node/6921
Let's Go NC!	North Carolina Department of Transportation	https://www.ncdot.gov/bikeped/safetyeducation/letsgonc/7.html
New Jersey Bike School	New Jersey Safe Routes to School	http://www.saferoutesnj.org/resources/education/
Northeast Iowa Safe Routes to School	Upper Explorerland	http://uerpc.org/safe-routes.html
Organizer's Guide to Bicycle Rodeos	Cornell Bike	http://www.bike.cornell.edu/pdfs/Bike_Rodeo_404.2.pdf
PATH Youth Bike Ed	PATH	https://pathhawaii.org/get-involved/education-programs/
Pedal Power	SB Bike	http://www.sbbike.org/pedal_power
Pedal Ready	Greater Wellington Regional Council	https://www.pedalready.org.nz/schools
Positive Spin	Bike PGH!	http://www.bikepgh.org/our-work/education/positivespin/
Red Shed Bike Camp	Woonasquatucket River Watershed Council	http://www.wrwc.org/gwybikercamp.php
Safe Kids Grand Forks (Safety on Wheels)	Safe Kids Grand Forks	http://www.safekidsgf.com/BikeSafety.html#CommunityEd
Safe Routes for Kids	The Street Trust	https://www.thestreettrust.org/saferoutestoschool/
Safe Routes Nebraska	Nebraska Department of Roads	http://archive.saferoutesinfo.org/program-tools/safe-routes-nebraska-safe-routes-classroom
Safe Routes Philly (Bike Section)	Bicycle Coalition of Greater Philadelphia	http://saferoutesphilly.org/
Safe Routes to School	Montgomery County Department of Transportation	www.montgomerycountymd.gov/srts
Safe Routes to School Marin County	Transportation Authority of Marin and Marin County Bicycle Coalition	http://www.saferoutestoschools.org/
Safe Routes to Schools	North Dakota Department of Transportation	https://www.dot.nd.gov/divisions/localgov/docs/srts-bro.pdf

Program Name	Creator/Used By	URL
SafeCyclist	Bike Texas	http://www.biketexas.org/education/safecyclist-curriculum-and-certification?lang=en_US.utf8%2C+en_US.UTF-8%2C+en_US%2C+eng_US%2C+en%2C+english%2C+english-us%2C+us%2C+usa%2C+america%2C+united+states%2C+united+states
Sprockids	Sprockids	http://sprockids.com/the-sprockids-program/
The Bike Campaign & Bike Garage	The Bike Campaign	https://thebikecampaign.com/bike-help/
Walk 'n Rollers	Walk 'n Rollers	www.walknrollers.org
Walk! Bike! Fun!	Bicycle Alliance of Minnesota	http://www.bikemn.org/education/walk-bike-fun
Wheel Kids Bicycle Club	Wheel Kids Bicycle Club	http://wheelkids.com/about-us/programs/
Youth/Teen Bike Safety	Cycles and Change	http://cyclesandchange.org/programs/course-catalog/