BIKE WORKS
Bicycling • Youth • Community • Education • Access • Environment • Social Justice

FRAMEWORKS
A Modular Guide to Youth Development and Bicycle Repair
# WHAT YOU WILL FIND IN THIS BOOK

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INTRODUCTION: Lessons from Bike Works

Bikes are becoming more and more popular as a form of transportation, but also as a means of empowering young people and adults to move themselves forward. Youth Earn-A-Bike (EAB) programs are popping up all over the country in response to the demand for quality out of school programming: sustainable, affordable transportation; the refocusing on Science, Technology, Engineering and Math (STEM) education; and the dearth of workforce development training in traditional educational settings. The thing is, we all seem to be designing programming independently—“recreating the wheel,” if you will.

As part of the 2015 Youth Bike Summit, Bike Works decided to share our experience in the form of a modular youth development and bike mechanics curriculum. In the past 19 years Bike Works has taught over 250 individual programs and camps and served over 4,500 youth. We’ve increased the number of our youth from 60 the first year in 1998 to 778 in 2014. In addition, we have increased the depth of our program offerings over the years to provide more leadership opportunities that make real impact in our organization and our community. We have youth serving on our board of directors, on a Youth Advisory Council, and as bicycle leaders on our rides and in our classrooms. Our mission is not just to build bikes, but to build sustainable communities by educating youth and promoting bicycling. Our vision is to create a just world where young people are empowered and engaged in communities that foster understanding and participation and encourage the health of people and our planet. We provide opportunities for youth to learn, lead, explore and challenge themselves and each other.

THE 7 VALUES

BICYCLING: We believe that bicycling is an accessible form of transportation that promotes public health, builds confidence, encourages environmental stewardship and strengthens community.

YOUTH: We are committed to youth empowerment. We provide youth opportunities to grow as leaders, give back to the community, work together and see themselves as owners and creators of our collective future.

COMMUNITY: We work to build a strong, supportive, inclusive community. We welcome and respect diversity of experience, identity and opinion and believe that collaboration is a powerful tool for social change.

EDUCATION: We believe that we are all teachers and learners, and we strive to be a place where we can work, learn, and grow together. Through our work we foster creativity, critical thinking, curiosity and cooperation.

ACCESS: We are committed to making cycling accessible, affordable and welcoming to people of all backgrounds, abilities and incomes.

ENVIRONMENT: We believe that respecting and connecting to the world around us leads to more livable communities. To that end, we practice and encourage waste reduction and reuse, prolong the life of bicycles, promote cycling and teach environmental stewardship.

SOCIAL JUSTICE: Inequalities of wealth and opportunity in our community privilege some and marginalize others. We see bicycles as vehicles of empowerment, and our work as contributing to creating a more just and equitable world.
All of our work is guided by 7 values. These values help challenge us to have a greater impact, deeper connections and increased responsibility. Because there is no “right” way to work with youth, and because we are constantly in conversation with, learning from, and building off of others, this work draws on the incredible work of our partners in the bike world: Bikes Not Bombs (Boston, MA), Community Cycling Center (Portland, OR), Neighborhood Bike Works (Philadelphia, PA), Recycle-A-Bicycle (New York, NY), WE Bike NYC (New York, NY); as well as leaders in the youth development field: The David P. Weikart Center for Youth Program Quality, Schools Out Washington, Passages Northwest/ Girls Outdoor Leadership Development (GOLD), Safe Routes to School, and The Caring Classroom.

Many of the activities in this book draw on the long oral history of youth programs. Activities have been passed down from camps, schools, retreats, etc. over many years. Thankfully, some books and resources have taken the time to write down these activities. Whenever we use materials from these written sources, we have attempted to cite them in the lesson. Thank you to all of the organizations that have allowed us to reprint their work here.

For us bikes are a literal and figurative vehicle—an opportunity for developing strong youth leaders, independent thinkers and motivated young adults. For that reason, this curriculum includes equally as many resources for running an effective youth development program as it does for how to fix bikes. We believe that these two parts are indivisible- there is no way to work with youth without being aware of youth development, team building, and leadership skills.

The point of this curriculum is to give groups a starting point. We encourage educators to share resources and ask questions. Contact us at Bike Works at programs@bikeworks.org.

PROVEN IMPACT & EVALUATION

As mentioned above, our programs are about creating spaces where youth can grow, learn and take risks. We invest time in youth and develop caring, long-lasting relationships they can depend on as they grow into adulthood. Our challenge is to prove that what we are doing is producing the desired outcomes beyond bicycle competency. In order to do this we have turned to outside organizations, such as the David P. Weikart Center for Youth Program Quality (YPQ) with their active–participatory approach to programming, and the Schools Out Washington Quality Standards for Afterschool and Youth Development Programs, to guide our approach.

The Youth Program Quality Assessment (YPQA) developed by David P. Weikart Center for Youth Program Quality has been a valuable tool in evaluating and improving our programs. We know we do amazing work, but no matter how hard we work on developing evaluations of our youth, much of the work we do gets lost in the numbers game. The YPQ Initiative (YPQ) offers an assessment of the quality of our program, not just our youth. It is shown that youth who participate in programs that score high on the YPQ assessment, also show improvements in self-perception, school bonding and positive social behavior, reduction in behavior problems and drug use, and increases in test scores, grades, and school attendance. Using the YPQ Assessment over the last three years has helped us measure our impact and shape our curriculum and the physical space in which we offer our programs.

Another tool we have used is the Washington State Quality Standards for Afterschool and Youth Development Programs. These quality standards are a collection of guidelines to help staff understand “what quality looks like in a program setting.” These standards are grounded in the principles that 1) program quality matters, 2) program quality is measurable, and 3) program quality can be improved. This helps us continually expand and evaluate our programs to better serve our youth. This resource has been particularly helpful in our evaluation of the cultural competency of our staff and programs. We feel this is one of the most important and most difficult to measure indicators of program quality.

We encourage organizations to think about the content of their programs by using curriculum guides like this one, but also to look at how that content is being delivered and evaluated. How are we shaping our physical spaces? How are we pushing youth to connect their classroom work with their everyday lives? How are we measuring these efforts and their efficacy or success? At Bike Works we have made two major changes since working with the YPQ Assessment: how we structure our classrooms physically, and how we use group activities to intentionally build community and depth in our programs.
Physical Spaces

One of the values in a YPQ approach is to allow for choice in the environment. This is particularly difficult when you have a set curriculum and need to teach about a specific topic—overhauling a hub, for example. For us, providing choice meant creating a work space that youth could re-arrange every day. In this way youth were able to make choices about their environment when there was not much choice in the curriculum. We did this by replacing traditional work benches and peg-board tool walls with movable stands, benches and tools. Everyday youth set up their work space in the area they choose, and pick tools from tool drawers that they then organize on their benches as they see fit. It also encourages youth to think about what they will need and how to create an environment that works for them. The only classroom that does not have this system is the Job Skills Training classroom where youth are encouraged to work in a traditional setting like they might see in a commercial bike shop.

Asking Questions

In addition to creating their own space, it is our goal to prioritize the collective knowledge of our youth over the right answers of our staff. One of the ways we prioritize this during drop-in hours is by providing youth with different colored aprons depending on which classes they have taken. Beginning youth wear blue aprons, intermediate students wear brown and advanced students wear black. Youth are instructed to ask questions to each other, especially someone with more experience, before asking staff for help. This helps set the expectation that adults are there to facilitate, not to dictate.

Digging Deeper

Asking youth to connect bike mechanics and riding to everyday life is one of the most difficult tasks we take on. This is one of the main reasons we’ve incorporated “group forming” and “reflection” activities into every class. These activities ground our physical work in social/emotional work and provide opportunities for youth to connect with the materials and with each other.

All these things help us build our programs from the youth up, not from the adults down.

THE PYRAMID OF YOUTH PROGRAM QUALITY

The pyramid below visualizes the values of the YPQ approach that we have adopted at Bike Works. The pyramid expresses the idea that “Young people can thrive when they feel safe and supported to learn and lead.” Each level of the pyramid builds on the level below it. For example, without a physically safe environment, it is hard to create an emotionally supportive environment. As a supportive environment grows, youth interact more, and as interaction increases, so does engagement and higher level participation. In addition to these ideas, Bike Works values Schools Out Washington’s measure of Cultural Competency as an important element in working with people of all ages. The activities collected in this book are tools we have used at Bike Works to increase youth engagement and other positive youth outcomes through intentional community building and hands-on bike mechanic work. We hope they will be useful to other organizations, as well.
BUILDING YOUNG LEADERS

The materials included in this book have been collected and refined over the years as Bike Works has developed and grown. These are the ones that have worked for us and the youth we work with. However, this is only a guide. We encourage you to attend workshops, ask questions and adapt your activities to your participants and your space, as well as add new activities about things like: social justice, body image, and mental health, to name a few. Look at this curriculum as a place to start and let your passions and participants guide you as you go.

Working with youth is much more than presenting a lesson plan and following it through. Young people notice everything. They notice what color shoes you have on, how you wear your hair, which hand you write with, how many times you look at them, whether you say hello, whether you check your cell phone, everything you say to them and how you say it. Youth will reflect your leadership example back to you, as well as out to other youth in the community.

With that in mind, Bike Works teaches within these guidelines:

- **Ask twice as many questions as you answer.**

  In many cases, the most important thing you will be teaching is not how to fix a flat tire, but how to solve a problem. Give students the opportunity to try to figure out what to do next. Instead of answering the question “Am I done? Did I do it right?” You might respond, “Does it work?” In this way, it’s not about gaining your approval; it’s about solving the problem at hand.

- **Emphasize a hands-on approach to learning.**

  Two-thirds of every class should be hands-on time for youth. As an instructor, resist the urge to just to do the work yourself (i.e. “show” the student how to do it) as this creates a passive learning environment. Instead, talk the student through the process (even though it may feel slower and more trying), as it will keep them actively involved and helps prevent the dreaded “Brain Shut-off.” One way to think of this is to put on your “Mentor Mittens.” These can be literal or figurative mittens. Think about being ‘hands off’ so the youth can be ‘hands on.’

- **Focus on “problem solving” and “trouble shooting.”**

  Classes should focus on what can go wrong with a bike and why and how to fix it. These classes are about making things work, not about mechanics for mechanics sake. A good way to do this is by asking students what kinds of problems have they had with, say, their brakes? Explain the concept of trouble-shooting: look at the bike, listen to it, try out different things in order to find and fix issues. If the first thing doesn’t work, encourage youth to try something else. That is how professional bike mechanics work.

- **Safety is part of every lesson.**

  Each week, try to discuss some aspects of bicycle safety within your lesson. For example, what types of problems could riding with loose handlebars cause? Or ineffective brakes?

These four guidelines permeate our staff and our programs. We currently have 7 program staff, 3 on-site classrooms, 16 off-site partners and a variety of classes ranging from advanced certificate classes to one-time fix-a-flats. No matter who, where or what we are teaching, these four points ensure that all our programs have a consistent feel and energy.
One of the goals of this curriculum is to create something that can be adapted to a variety of settings. Instead of listing full lessons from start to finish, we have broken down each part of a lesson into its' own module. In this guide a group of modules are combined to form a lesson, several lessons taught over a variety of days make up a class, and all of our different class offerings combine to make up our programs. We have included a “Lesson Plan Scaffold” (p. 211) to help you combine modules into lessons. In addition, we have included a list of what lessons our current Bike Works classes include (p. 17–20).

To help staff and organizations figure out what modules make sense for them we have included a variety of ratings in terms of ability level of staff, age of youth, youth skill level and required materials. These are guidelines and most activities can be adapted to any age group or ability level. With any group you’ll need to mold and change your style and programming based on the youth you are interested in recruiting and serving.

**Time**
The time guidelines are meant as that—guidelines. It is a joke here that our fix–a–flat class can take anywhere from 15 minutes to 2 hours depending on how we teach it and who we are teaching. For that reason, use these as rough estimates and feel free to stretch or compress lessons to meet your needs.

**Participant Age**
Bike repair isn’t an easy thing to learn. It takes a lot of time and a ton of patience. The age rankings on these classes take into account the tools being used, the number of steps involved in the repair, and most importantly, the amount of frustration tolerance needed to master the skill.

**Youth Skill Level**
These levels are based on what we teach in each of our classes—Beginner, Intermediate, and Advanced. For almost any mechanic skill it is possible to teach a basic, intermediate or advanced version of the skill. See our “Classes at Bike Works” section (p. 17–20) to see how we structure our classes.

**Staff Mechanics Skill Level**
The Staff Mechanics Skill Level is based on a 1-3 scale. 1 means this activity can absolutely be learned through some quick online research. 2 means this one is a little harder to grasp, but many will be able to teach confidently after some online research and a bit of practice. 3 means this is a very challenging activity to teach and staff should search out some professional instruction before trying to teach this one.

**Good for Groups**
We understand that qualified and motivated staff are a precious resource. For that reason, we’ve marked activities that work well with large groups where the staff to student ratio is more than 1:9. Many repairs require a lot of guidance, however, some lessons work just as well with larger groups.

**Tool Kit**
The tool kits for each level (Bare Minimum, A, B, and C) are listed in the appendix (p. 235–238) along with the approximate cost for each kit. Although a lot of bike mechanics can happen with a hammer and an allen key, using the right tool for the job teaches youth proper technique as well as improves the quality of their repairs.

Use the chart on the next two pages to help you identify, choose and implement modules that make sense for your organization!
The matrix below contains all the lesson modules in this book. Each module is between 5 and 45 minutes long and is intended to be combined with other modules to create an entire Lesson Plan using the Lesson Plan Scaffold (p. 211). By breaking our lessons into small parts, we hope that other organizations will be able to tailor classes to their youth as well as the staff, tools and time they have available. Individual lesson rankings reflect what we do at Bike Works, however, most activities can be adapted to any age range or skill level.

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# Curriculum Matrix

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## Reflection & Review

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The Lesson Plan Scaffold to the left is included to help combine modules into full lessons. Using the same scaffold for each lesson in a class also helps provide youth with structure. Uncertainty can make a young person anxious, which can lead to acting out. Consistent structure can help alleviate anxiety and decrease this behavior. To the left is an example of a completed Lesson Plan Scaffold for a two hour class.

In the sample scaffold to the left, we have plugged in the modules (and included page numbers) for one way to teach a two hour lesson on ball bearings and hub overhauls. We have written the module in the top of the box, and included a few important notes below each module. The goal is after reading each module this scaffold can be used as a tool to help teach the lesson without flipping back and forth between modules in the curriculum binder.

There is a Blank Lesson Plan Scaffold included in the appendix (p. 211).

**IMPORTANT:** “Practice” units should never be taught without an “Explanation” unit first!
Beginning, Intermediate and Advanced curriculum can look different depending on the youth you are teaching, the time you have and the mechanics skill level of your instructor. Here’s how we do it at Bike Works!

We currently teach classes in 3 quarters of the year (fall, winter and spring) and run a variety of day camps and overnight bike touring camps in the summer. The first quarter we split classes by gender (Boys Beginning class, Girls Beginning class, etc.). The second quarter we split up classes by age (9–12 or 13–17). The third quarter we offer only one of each class, so all ages and all genders are together.

At Bike Works we offer different kinds of mechanics classes—some are community classes, some are school–based, some are organization-based, and some are Earn–a–Bike classes where youth earn hours that they can “spend” on a bicycle to take home after the class.

During our Earn–a–Bike classes, Bike Works’ students work on BMX bikes or mountain bikes (depending on the level) to be donated to other youth in the community who do not have access to our programs or sold in the shop. For every hour youth work in the class, they earn one community service hour. At the end of the class they are 2 hours short of the total hours needed to pick out an Earn–a–Bike bike: students earn 16 hours over the 8 week class, and a bicycle “costs” 18–24 hours at Bike Works. This means participants must come to open–shop drop–in hours (offered twice a week for two hours) to earn those last hours. After they have earned enough hours, they can “spend” them on a bike. They can work on this bike during drop in for up to a month to fix it up before they take it home. Youth also earn a helmet and lock with their bike.

Below are the bicycle mechanics modules included in each of our Earn–a–Bike classes—Beginning, Intermediate and Advanced. Each class also includes a “Group Forming” activity and a “Review/Teach Back” activity not listed as these are left up to the individual instructors.
BEGINNING MECHANICS CLASS

8 weeks, one 2-hour lesson each week

Week 1: Rules, Tools and Bikes
  Introductions ......................................................... 63
  Shop Rules .......................................................... 172
  Bike Works Contract ............................................... 27
  Community Values Talk ........................................... 33
  Name Games ......................................................... 34
  Bike Break Down ................................................... 115

Week 2: Wheels Part I—Tires and Tubes
  Fix a Flat Explanation ............................................... 67
  Fix a Flat Practice .................................................. 118

Week 3: Wheels Part II—Front Hubs
  Ball Bearings Explanation ........................................ 71
  Front Hub Explanation ............................................. 73
  Front Hub Practice ................................................ 120

Week 4: Threaded Headset Overhaul
  Threaded Headset Explanation .................................... 78
  Threaded Headset Practice ........................................ 122

Week 5: 1-Piece Bottom Bracket
  1-Piece Bottom Bracket Explanation ........................... 82
  1-Piece Bottom Bracket Practice ............................... 124

Week 6: BMX Brakes
  BMX Brakes Explanation ........................................... 85
  BMX Brakes Practice ............................................... 128

Week 7: Bike Rodeo and Safety Class/ Review
  ABC Quick Check .................................................... 167
  Head to Toe .......................................................... 168
  Helmet Fitting ....................................................... 169
  Bike Rodeo ............................................................ 176

Week 8: Test and Graduation
  Beginning Test ....................................................... 220
  Graduation Celebration ............................................. 205

Graduation Certificate .............................................. 233
INTERMEDIATE MECHANICS CLASS

8 weeks, one 2-hour lesson each week

Week 1: Re-introduction: Rules, Tools, Bikes, Tubes and Steps of the Overhaul Review
  Introductions ................................................................. 63
  Name Games ................................................................. 34
  Bike Works Contract ...................................................... 27
  Community Values Talk ................................................... 32
  Parts of the Bicycle .......................................................... 239
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Week 2: Front Hubs with Dust caps
  Ball Bearings ................................................................. 71
  Front Hubs Explanation .................................................... 73
  Front Hubs Practice .......................................................... 120

Week 3: Threadless Headset
  Threadless Headset Explanation ........................................... 96
  Threadless Headset Practice ................................................. 132

Week 4: 3-Piece Bottom Bracket
  3-Piece Bottom Bracket Explanation ..................................... 98
  3-Piece Bottom Bracket Practice .......................................... 134

Week 5: MTB Brakes
  MTB Brakes Explanation .................................................... 85
  MTB Brakes Practice .......................................................... 126

Week 6: Derailleurs and Drivetrain
  Front Derailleur Explanation ............................................... 94
  Rear Derailleur Explanation ............................................... 89
  Front Derailleur Practice ..................................................... 130
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Week 7: Review, Finish Bikes, Check-In
  Review for Test
  Finish work on bikes
  Plenty of time for working and asking questions!

Week 8: Test and Graduation
  Intermediate Test ............................................................ 224
  Graduation Celebration ...................................................... 205

Graduation Certificate .......................................................... 233
# ADVANCED MECHANIC CLASS—PARK TOOL CERTIFICATE CLASS

The Advanced Mechanic class at Bike Works is meant to prepare youth to work in a shop. Students use the Park Tool Book, have weekly assigned readings, and quizzes every class. Not all of these materials are provided here; however, if you’d like more information, feel free to write us an email!

**8 weeks, one 2-hour lesson each week**

## Week 1: Introduction: Wheels, Tires and Tubes
- Introductions ........................................ 63
- Name Games ......................................... 34
- Bike Works Contract ................................. 27
- Community Values Talk .............................. 32
- Have students diagnose and fix as many problems as they see using Earn–a–Bike “Bike Check Tag” ............................. 234

## Week 2: Rear Hub Overhaul
- Rear Hub Overhaul Explanation .................. 105
- Rear Hub Overhaul Practice ........................ 140

## Week 3: Headset Overhaul: All Types
- Threadless Headset Explanation ................. 96
- Threaded Headset Explanation .................... 78
- Threadless Headset Practice ........................ 132
- Threaded Headset Practice ........................ 122

## Week 4: Bottom Brackets: All Types
- 3-Piece Bottom Bracket Explanation ........... 98
- 1-Piece Bottom Bracket Explanation ............ 82
- 3-Piece Bottom Bracket Practice ................. 134
- 1-Piece Bottom Bracket Practice ................. 124

## Week 5: Derailleurs and Drive Train
- Advanced Drive Train Explanation ............... 101
- Advanced Drive Train Practice ..................... 138

## Week 6: Brakes: All Types
- Advanced Brakes Explanation .................... 85
- Advanced Brakes Practice ........................... 134

## Week 7: Wheel Truing
- Wheel Truing Explanation .......................... 108
- Wheel Truing Practice ................................. 142

## Week 8: Test and Graduation
- Advanced Test ....................................... 228
- Graduation Celebration .............................. 205
- Graduation Certificate .............................. 233
GROUP FORMING
QUICK NOTES

We have labeled this “Group Forming” in order to stress the importance of intentionally building community in our classes. We invite youth to participate in our programs because they are fun, but also because we feel we have skills to offer that will help our youth become successful adults. The term “group forming” comes from the idea that communities grow and develop over time and that youth will interact with each other, the class and the teacher, differently at different points in this timeline. The five stages in this model, developed by Bruce Tuckman, are forming, storming, norming, performing, and adjourning. Some groups may go through all of these stages; some groups may stick at one spot or another. The use of intentional activities from this section as well as the Reflection section can help a group work to its fullest potential.

Forming

Forming is the first stage of group development, when youth (and staff) get to know each other as well as build routines and processes. Youth may use this time to figure out where they fit in, or to test the boundaries of others. This is a good time to do name games and get-to-know-you activities that provide an opportunity for youth to learn about each other and try out different ways of interacting.

Storming

Storming is a necessary, but often uncomfortable, part of group development. This is when conflicts that may have been avoided during the forming stage begin to surface. In addition, this is the time where norms put in place during the “forming” stage may be openly challenged by individuals or the group. Experiences from the “forming” stage may help youth engage the patience and acceptance necessary to work through this stage. Productive activities might include problem solving models like V.O.M.P. (p. 174) and activities that allow students to learn more in-depth things about each other such as Concentric Circles (p. 201).

Norming

During the norming process, the group creates a rhythm and identifies a common goal. They are focused on reaching an end as a team and understand that this involves compromise. While a common goal often means things get done, sometimes the group becomes so focused on the goal that individual needs are not met, or controversial ideas are ignored. Compromise means giving up some things for the good of the group, but you may find that some youth are bending more than others, or that they are forfeiting something that is important for their happiness.

Performing

Performing is a rare state. The group has figured out how to respect difference without excessive conflict and how to work together to get the job done. This is part of a process as opposed to an end-state. Groups may reach a “performing” state for an hour before entering another “storming” or “norming state” continuing the cycle.

Adjourning

The “adjourning” state refers to the end of a team due to a set time limit or the creation of a final product that is now done. It’s a chance for team members to take what they have learned working in this environment and transfer it to other areas of their lives. It is a great time for reflection activities that allow students to name things that worked well, roles they played and ways they deal with conflict. Every group will have an “adjourning” state, even if they don’t go through all the other phases of group development. The Graduation Celebration (p. 205) is a prime opportunity to help youth identify things they have learned (besides bikes) and understand how to take that forward in their lives. A great format for this is for instructors to publically acknowledge each youth through a “Thank you for…I encourage you to…” format. For example, “Thank you for your silly sense of humor. I encourage you to see yourself as a leader and step into that more serious role in the future.”
Another issue when working with new groups is resistance. This section is called “Group Forming” but you may recognize many of these activities as dreaded “icebreakers!” Many youth and adults show resistance to these kinds of activities and nothing can bring a facilitator down like a group of youth refusing to do an activity. These resistant groups, although challenging, are exactly the groups that need these kinds of activities. Youth may be showing resistance because they don’t yet feel comfortable or safe in the space. They may be shy around new people or unwilling to put themselves on the line for people they don’t trust. In these cases, start small. Ask youth to participate in low–stress, small group activities like “Unique in Common” (p. 45) or “Going on a Bike Ride” (p. 36). Don’t jump in with “Human Knot” (p. 51) right off the bat. As the group increases their trust of you, each other and the space, you can ask them to participate in louder, sillier or larger group activities and ask the group to push themselves out of the comfort zones. The process of forming, storming, norming, performing and adjourning helps us look at group development as a process, however, these activities are ones you can continue to do throughout the course. Ask youth to try increasingly challenging “group forming” activities each time they meet to continue building the team and pushing towards your goals.
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BIKE WORKS CONTRACT

Create a set of guidelines for the class that can be revisited in order to create a safe and fun environment for everyone.

LESSON

1. Use the Bike Works Contract (p. 213) as a starting point for conversation. Have students read off a rule and discuss its importance for a minute or two. “Respect” and “waste nothing” usually take up the most time.
2. Let the students come up with ideas, then add whatever you think is necessary.
3. Students should sign the contracts, agreeing to abide by them, and pass them in.

MATERIALS

Printed contract for each student
Pens/pencils
Bigger butcher paper version of contract if desired

RESOURCES

Bike Works Contract (p. 213)

NOTE

Be sure to include a short discussion on the “value of a signature” and what it means to sign your name to something. Ask each student to make a “personal, executive decision” to sign-on to the project and ideas laid out in the contract.
WHEEL CONTRACT

Make a space for participants to showcase their strengths (bike related or not) and voice their apprehensions in order to build community for future classes. Learn the parts of the wheel.

LESSON

1. Start by drawing a large picture of a wheel labeling the different parts “rim”, “hub”, and “spokes”.

2. Explain that the wheel only works when all the spokes are the same tension. This is like us—we are all working together to make this program work, just like all the spokes work together to make the wheel roll. We all bring strengths and skills to the table.

3. In addition, this class is all about learning new things. With new things come new challenges. We are here to support each other in these challenges, so it’s important that we feel comfortable sharing them.

4. Ask each participant to write a strength they have on the spokes.

5. Ask each participant to write a challenge they anticipate in the space around the wheel.

6. Then finally, ask each person to sign their name in the rim.

7. After everyone signs the paper, read off some of the challenges we will all face together.

8. Then read off all the strengths that we have in this group.

MATERIALS

Large paper
Markers
Parts of the Wheel image

RESOURCES

Parts of the Wheel (p. 245)
Completed Wheel Contract (p. 245)

SOURCE

WE Bike NYC

NOTE

Be conscious of different levels of literacy and be sure to let people know that you can write for other people or that they can work in teams.
WHAT DO I NEED?
WHAT CAN I GIVE?

Identify the needs and skills of participants.
Create a set of values and rules for the classroom.

LESSON

1. Hand two sticky notes to each student—two different colors would be great, but isn’t necessary!
2. Ask students to think about what they need in order to feel safe and respected in this class. Write this on one note.
3. Ask them to think about what they can give to make others feel safe and respected in this class. Write this on the other note.
4. Give them time to think and write.
5. Divide class into groups of 4-6.
6. Ask students to share what they wrote on their sticky notes.
7. Have them combine their ideas. For example, if two or more people wrote something like, “I need people to take me seriously” or “I need people not to laugh at me,” these things can be combined.
8. Give each group a turn to share one of their ideas. No repeats! As each idea is stated, write it on the flipchart or butcher paper.
9. After all the combined ideas are written publically, ask students to read them out loud. Ask them to think about three things:
   - Do they need clarification about any of the ideas?
   - Can they agree to work towards doing what is written?
   - Is there anything missing?
10. Hold a discussion to clarify.

MATERIALS

Sticky notes (2 colors)
Pens/pencils
Large paper

RESOURCES

None

SOURCE

The Caring Classroom
FIVE FINGER CONTRACT

Create a set of class rules and guidelines that can be easily referenced throughout the course.

LESSON
Each finger acts a reminder about points that will make this class a safe and respectful place for everybody:

THUMB Safety—it’s the smallest and most vulnerable finger.

POINTER Commitment—willingness to let things go (and not hold grudges).

MIDDLE Awareness of put-downs.

RING Taking responsibility—instead of pointing blame.

PINKY Agreement to work towards group goals—thumbs up!

Activity Options:
• Describe and discuss each finger with the group.
• Create your own ideas about what each finger stands for and why.
• Revisit periodically to explain, refresh or dive deeper into any of these.
• Make a poster with the above information and have everyone sign with a thumb print.

MATERIALS
None

RESOURCES
None

SOURCE
The Caring Classroom

NOTE
Youth who have been involved in the justice system or foster care system may be triggered by being asked to give a finger print. Be aware and sensitive to your participants
PEEP

This activity helps create classroom expectations and introduces a culture of peer to peer responsibility.

LESSON

“PEEP” is a nice way to create a group contract that is easy to enforce throughout the class. Students can “PEEP” in class to draw attention to put-downs, unsafe bikes or racks, or not wearing helmets. Once someone makes a “PEEP” class can stop to discuss what is going on and figure out how to fix it.

NOTE

Some students may bring up the concept of “snitching” during this exercise. Be ready to talk about personal responsibility, group responsibility and accountability in this context.

PERSONAL

Take off jewelry, dangling earrings; wear appropriate clothing for the task (closed toe shoes, for example); nothing in mouth, etc.

EMOTIONAL

Respect each individual’s decision to challenge themselves as well as assign personal boundaries; only volunteer yourself, no put-downs.

ENVIRONMENTAL

Move in a controlled manner; follow safety protocols/directions; be aware of your surroundings. Take care of the environment. When inside be aware of furniture. Also respect the tools and the space!

PHYSICAL

Be aware of physical limitations; take care of yourself. Be careful of yourself and others when handling tools. When outside, use sunscreen, drink water, wear appropriate clothing.

MATERIALS

Large paper
Markers

RESOURCES

None

SOURCE

The Caring Classroom
COMMUNITY VALUES TALK

Set community expectations.

LESSON
1. Introduce the lesson as a way of looking at our group as an “intentional community.” You can use any intentional community, a family, sports team, or what have you, as a metaphor for this new group.

2. Ask participants what it takes for them to work well with others, even if they don’t get along. Some answers to look for: honesty, trust, hard work, cooperation, pulling your load, dependability, friendship, caring, safety, fun, watching out for each other. You can also ask them what doesn’t work in a group.

3. Take these ideas and have the group develop them into a value system that they can implement. What are specific rules that this particular group needs in order for each member to feel safe taking personal and physical risks? Have someone write these in the group journal or on a shared large piece of paper.

4. Look back on them throughout the class; change them as the group evolves.

5. During this talk you may also want to set up a system that allows students to make mistakes and help each other grow. As an instructor you may want to ask the students to help you fulfill the group values, making it okay for students to do the same. This is something that should be revisited throughout the class.

MATERIALS
Group journal or large paper

RESOURCES
None
LESSON

1. Ask students if they have ever participated in a team that has performed extremely well (i.e. soccer, year book staff, musical production). Ask them what qualities they remember about these teams.

2. Write these qualities down.

3. Then tell the students to look around—the people in their circle will soon be functioning as a high performance team: helping each other survive in the wilderness, biking mountains together, cooking nourishing meals, and making it through tough times.

4. What qualities do they think will be necessary for them (or include yourself and say “us”), as a high performance team, to aspire toward?

5. Brainstorm and write ideas down.

6. As a group, select the most important qualities and, if applicable, record them in the group journal.

7. Can they agree to live by these for the duration of the class or course?
   Now you have a set of values that the group has generated themselves and has agreed to live by.
NAME AND MOTION 1 OF 2

Learn names!

LESSON

1. Circle up.
2. Each group member steps forward and says their name and makes a motion and a sound.
3. The next person in line says the name of the person before them and repeats their sound and motion before adding their own.
4. The third person repeats the name, sound and motion of each person before them before adding their own to the group.
5. Continue until the last person says the name, sound and motion of everyone in the group.

VARIATION 1: "CHECK-IN"

Use later in course, having participants make sound and motion in accordance with how they feel at that moment.

VARIATION 2: "AMPLIFY"

1. Have the first person start by saying their name very quietly and making a tiny motion.
2. Have the person next to them say the first person’s name a little louder and make their motion a little bigger.
3. The next person in line should do the sound and motion a little bigger and a little louder.
4. Once the name goes around the circle back to the person whose name it is, they should scream their name and make a huge motion. Make time so that you can go around the circle and do each name.

CONTINUED ON P. 35
VARIATION 3: "QUIET"

Just like “Amplify,” but getting quieter. This is useful for groups that are reluctant to be silly such as older youth or particularly shy groups.
LESSON

1. Tell the group we’ll all be going on a pretend bike ride today, and everyone is going to bring something.

2. You can do any of a million versions of this.
   - If you want to review safety gear, or actual things to bring on a ride, have everyone “bring” something they’ll need.
   - If you want to do a silly name game, have everyone “bring” something that starts with the first letter of their first name.

3. Have one person start by saying their name and the desired object. “I’m Liz, and I’m bringing a multi-tool.” Or “I’m Liz, and I’m bringing lemonade.”

4. The next person should say the person’s info before them and their own like this: “That’s Liz and she’s bringing lemonade. I’m Ricky, and I’m bringing rutabaga.”

5. The third person repeats the name and object of each person before them before adding their own to the group.

MATERIALS

None

RESOURCES

None
NAME TOSS

Learn names!

LESSON

1. Stand in a circle and have all participants introduce themselves (suggest that they pay close attention to at least a few names). The instructor is holding a toy, shoe or a ball.

2. Explain that group members must toss this object to someone they do not know, stating their own name first and then the name of the person to whom they are tossing the object.

3. Continue this until everyone has received the object. Then add extra challenges:
   - Have them set a time goal and then increase speed of tossing to reach the goal (they can drop saying their name and just say the name of the person to whom they are tossing);
   - Add more balls or shoes so that people are continually tossing and receiving until chaos and laughter take over.

MATERIALS

Ball(s) or toy(s) to toss

RESOURCES

None
**Lesson**

1. Have the group form a circle and then put yourself at the circle center.
2. The players should be about 4 to 5 steps away from you.
3. Point decisively at 1 of the circled folks and say that person's first name with conviction, following their stated name immediately with the exclamation, “bumpity bump bump!”
4. The person that you pointed to and named must respond by saying the first name of the person to the left, before you finish exclaiming, “bumpity bump bump.”
5. If they flub the name or completely forget who’s who, that person takes your place in the center, and subsequently attempts to trap someone else.
6. It obviously pays to know who is on your left, unless the person in the center exclaims, “RIGHT!” before pointing and saying, “bumpity bump bump!,” then you must name the person to your right.

**Materials**

None

**Resources**

None
LESSON
1. Everyone stands in a circle.
2. Person A calls Person B’s name and Person B says, “Go.”
3. Person A starts to walk towards Person B.
4. Person B avoids the collision by calling someone else’s name.
5. Person B starts to walk towards Person C.
6. Continue until everyone’s name has been called.

MATERIALS
None

RESOURCES
None

SOURCE
David P. Weikart Center for Youth Program Quality
NAME TAG SWAP

Learn names!

LESSON

1. Ask participants to write their name on a name tag.

2. Have them walk around and introduce themselves to others in the room. With each introduction, each member of the pair should share three facts about themselves.

3. The pair then switches name tags. Each assumes the other person’s identity and must introduce themselves and the three facts associated with the new identity to the next person.

4. Play continues for several rounds.

5. At the end, each person goes around and introduces themselves according to the name tag they are currently wearing. The real person identifies him/herself and confirms (or corrects) the three facts.

NOTE

This is best done with groups who already know each other’s names, but might not know much else about each other. Great for half way through an 8 or 10 week earn a bike class!

MATERIALS

Name tags

RESOURCES

None

SOURCE

David P. Weikart Center for Youth Program Quality
LESSON

1. After a brief name introduction, have someone (or yourself) stand in the center of the circle with a bandana. The object is to avoid getting swiped with the bandana.

2. When the center person says someone’s name, that person has to say another person’s name quickly before the center person swipes him/her with the bandana.

3. When the center person successfully swipes someone, the person swiped moves into the center. This is a fast and effective way to learn people’s names.

NOTE

Make sure to remind students to swipe below the neck and aim for arms or legs to avoid injuries.

MATERIALS

Bandana

RESOURCES

None
NAME BY NAME

Learn names!

MATERIALS
None

RESOURCES
None

LESSON

1. Inform the group that you have a challenge for them to get to know each other. Do not play this game after introductions or doing other name games. If the group knows each other you can do middle or last names instead.

2. Have everyone get into a circle, and one at a time go around so everyone has a chance to say their name once (first, middle, OR last, just one.) It should be said loudly and proudly; if anyone can’t hear the name clearly, that person calls out “REPEAT!” in a loud voice.

3. After all of the names have been said, announce the challenge. All players must now rearrange themselves so that the circle is alphabetical by name. No talking, no signing, no gesturing, no visually indicating letters, no showing ID cards, etc. Helpful pointing or repositioning is allowed, but the challenge is for individuals to place themselves in the circle in the appropriate place.

4. Once the group has moved and the circle is re-formed, that ends Round One.

5. Take a test. Listen as all the names are said again. If people are out of sequence and corrections need to be made, allow people to move a second time (again with no speaking, etc.).

6. Take another test. So ends Round Two.

7. The challenge is to form an alphabetical circle in the fewest number of rounds.
WHAT'S IN A NAME?

Learn names!

LESSON

1. Have participants take turns introducing themselves.
2. For each introduction, ask participants to state:
   - Their name
   - A nickname that they have or have had in the past
   - The meaning of their name (if known)
   - Whether they would choose the same name for themselves if they could
3. Follow up with a group discussion about origins, families, identity or related ideas.

MATERIALS

None

RESOURCES

None

SOURCE

David P. Weikart Center for Youth Program Quality

LESSON TIME: 15 min
STUDENT AGE: 13–17
STUDENT LEVEL: beg
STAFF LEVEL: 1
GOOD FOR GROUP: no
TOOL KIT: none
**Lesson**

1. Ask participants to introduce themselves to others in the room and share a “first,” such as a first job, first movie remembered, first day of school experience, etc.
2. Go around the circle again and ask them to reveal another first.
3. The exercise can continue for several rounds.

**Note**

This is especially good for groups that are a mix of old and new members. It helps remind everyone how hard it can be to do something for the first time and think about ways to support each other.

**Materials**

None

**Resources**

None

**Source**

David P. Weikart Center for Youth Program Quality
UNIQUE IN COMMON

Find common ground in a large group. Share information about each other in gradually larger group settings.

LESSON
1. Group participants in pairs.
2. Ask pairs to introduce themselves and find the most unique thing that they share in common. Be sure to stipulate that the thing they have in common should not be something visible (i.e. “We both are wearing red shirts.”).
3. After several minutes, have pairs group with another pair, share their unique fact and find a new fact (no repeats) with their group of 4.
4. Continue until the whole group finds one thing they have in common.

MATERIALS
None

RESOURCES
None

SOURCE
David P. Weikart Center for Youth Program Quality
**SILENT INTERVIEWS**

Get to know people in your group.

**LESSON**

1. Have the group pair up.

2. The object is for each person to communicate to their partner as much as they can about themselves without using any words. Each person has three minutes to interview their partner. The “interviewer” can speak and ask questions, but the responses must be silent.

3. At the end of the time, partners should introduce each other to the group (verbally) with as much information as possible.

**MATERIALS**

None

**RESOURCES**

None

**SOURCE**

David P. Weikart Center for Youth Program Quality
**STRONG WIND BLOWS**

Find common ground in a large group.

**MATERIALS**
Something to mark spots

**RESOURCES**
None

**LESSON**

1. Start the game by making sure everyone has their own space in the circle, with everyone standing shoulder-to-shoulder so there are no extra spaces.

2. Have everyone mark their space with a piece of tape, water bottle, or shoe. There should be one less space than there are people.

3. Explain that even though we don’t know each other yet, we all have a lot in common. The object of this game is to find out what you have in common with other people in the circle. Encourage people to avoid things we have on the surface like our clothes, and to dig a little deeper; things we like, or feel, or care about.

4. One person starts off by coming into the middle of the circle and saying, “A Strong Wind Blows for anyone who... (is a little nervous, has never been camping, is an only child, etc.)”

5. Everyone who relates to the statement must leave their place and find another, including the participant in the middle.

6. Once all places have been taken one person should be left in the middle to start the next round.
2 TRUTHS AND A LIE

Learn a little more about each other.

**LESSON**

1. Demonstrate how the activity works by telling the group three statements about yourself; two of which are true and one which is not.
2. Repeat each statement. Then ask participants to guess which one is the lie.
3. After demonstrating, ask each participant to come up with their own two truths and a lie. You might have them write them on an index card or piece of paper.
4. Participants now share their statements in small groups or with the full group and listeners guess which statement is a lie.

**VARIATION:**

This can also be used to test students’ bike knowledge midway through the course. Say two facts that you have learned to be true, and one that is not. It can also be used to introduce a new concept—two things that we will learn to be true, one that we will learn is not.

**MATERIALS**

None

**RESOURCES**

None

**SOURCE**

David P. Weikart Center for Youth Program Quality
MOOSE

Lesson

1. The object is to become the “head moose” or the only one left in the game.

2. Stand in a circle and start by making moose horns with your hands (thumbs in your ears, fingers up). Students on either side of you each make one horn according to the side they are on—student on right puts right thumb in ear; student on left puts left thumb in ear.

3. Then you (as full moose) take away one hand. If you have only your right hand up, the person on your left becomes the full moose; this new full moose must put his/her right hand in ear, and the person to his/her left must put his/her left thumb in ear.

4. The new full moose now takes down one hand.

5. The game continues like this, increasing speed as you go. Anyone who messes up and puts up the wrong hand has to step out.

6. You will end up with three moose battling it out.

Materials

None

Resources

None
**BALANCE PUSH**

Have some fun!

**LESSON**

1. Have students break into pairs any way you like.
2. Ask pairs to stand facing each other about 2 feet apart. They should be able to touch palms without straightening their elbows when their hands are in front of them.
3. Players should touch hands in front of them. Without moving their feet, each person is trying to push the other person off balance by only touching hands.
4. The winner is the player who moves his or her feet last.

**NOTE**

Remind students that the goal is to gently push each other off balance, not force each other to fall to the ground.

**MATERIALS**

None

**RESOURCES**

None

**LESSON TIME**

5 min

**STUDENT AGE**

all

**STUDENT LEVEL**

beg

**STAFF LEVEL**

1

**GOOD FOR GROUP**

yes

**TOOL KIT**

none
**Lesson**

1. Form a tight circle with shoulders touching.
2. Have each person reach across the circle and take someone’s hand.
3. Then, with second hand, reach for another hand. Each person should be holding the hands of two separate people.
4. Do the “squeeze test” to make sure you are forming one large circle and not two smaller ones. The instructor starts by squeezing one hand he or she is holding. That person then squeezes the other hand they are holding and so on until it gets back to the instructor.
5. Have the group untangle and re-arrange themselves into a large circle without letting go of hands.

**Variation:**

Untangle in silence or do this exercise before students know each other’s names.

---

**Materials**

None

**Resources**

None
COPY CAT

Explore ideas of leadership, who youth chose as leaders and why.

LESSON

1. Ask the group to form a circle.

2. Ask each person to choose someone in the circle to be their leader but not to tell anyone who their leader is. Explain that once the activity starts, if the person you chose as a leader moves or changes position in any way, you must do exactly as she does. Whenever she moves, you mirror her. Ask that people try to watch their leaders without staring directly at them so that leaders won’t know who (if anyone) is following them.

3. After explaining and asking for questions, check to be certain that everyone has a leader chosen.

4. Before beginning, have people close their eyes and get in a comfortable pose.

5. As soon as everyone opens their eyes on your command, they should change their pose to duplicate that of their leader.

6. Debrief the significance of conformity versus independence, the challenge of selecting a qualified leader and the consequence of one or more people deciding to act on their own and what impact that has on the rest of the group.

MATERIALS

None

RESOURCES

None

LESSON TIME

15 min

STUDENT AGE

9–13

STUDENT LEVEL

beg

STAFF LEVEL

1

GOOD FOR GROUP

yes

TOOL KIT

none

FRAMEWORKS

Group Forming
COUNT TO TEN

Help youth learn how to listen to each other.
Provide time for individuals to speak and share.

LESSON

1. Have the group make a circle.
2. Instruct the group that they must count to ten, out loud, with one person saying each number and no more than one person talking at a time.
3. You may not make any other sounds, and the person on either side of someone who just called out a number may not call out the next number. If two people speak at the same time, the group must start at number one again.
4. The group keeps trying until they get it. Challenge them to count as high as they can!

MATERIALS

None

RESOURCES

None
LESSON

1. Give each person a large sheet of paper and markers, colored pencils, or crayons.
2. Ask participants to draw a large shield, or crest, that is divided into sections.
3. Within each of the sections, instruct participants to draw a symbol that expresses any one of the following:
   - A belief
   - A fear
   - A personal goal
   - A personal accomplishment
   - A role model
   - A favorite food
   - A talent
   - A hobby
4. Encourage youth to draw pictures, not words—even if they are art-phobic.
5. Once everyone has finished, have participants share what they have drawn, proving short explanations to the others. You can have volunteers share with the full group or share within pairs.

HEAD BADGE VARIATION:

Have students do this activity on Shrinky Dink plastic. Then shrink the crests down in the oven to make head badges. Attach badges to earned bikes with double-sided tape.

MATERIALS

Paper
Markers
Head Badge Variation:
Shrinky Dink plastic
Colored pencils/markers
Access to an oven
Double-sided tape

RESOURCES

Personal Crests Template
(p. 214)
LESSON
1. Have young people select a topic on which they are interested in doing research or a hands-on project. In our case the topic is probably “Bike Repair” or “Bicycle Riding.”
2. Have youth brainstorm 20 questions they have about the topic.
3. Ask youth to narrow the questions down to a handful that are most important.
4. Address these questions with youth throughout the project.

BIKE VARIATION:
This can be a great way to let youth structure the class!
1. Have the youth brainstorm bike questions.
2. Then narrow down the questions to the number of sessions in the class. If the class is 8 sessions long, have them pick 7 key questions (because the first class is already happening.)
3. Then have youth arrange the questions in order of what they would like to learn first, second, third, etc. The instructor may have to add in a few key ideas to get from one question to another, but in general, this can create the curriculum for the class each day.

MATERIALS
Big Paper
Markers

RESOURCES
None

SOURCE
David P. Weikart Center for Youth Program Quality
THIS IS A WHAT?

Learn and review tool and part names.

LESSON

1. Circle up with tools or parts in the middle.
2. One person picks up an object that they know the name of.
3. While passing it to the person on their right, the two recite the script below:
   - Person 1: “This is a ___[con wrench]____.”
   - Person 2: “A what?”
   - Person 1: “A___[con wrench]____.”
   - Person 2: “A what?”
   - Person 1: “A ____[con wrench] __.”
   - Person 2: “Ooooh! A ___[con wrench]___.” and takes the object from P1
4. P2 then begins the conversation again with the person on his or her right, P3.
5. Keep going adding more and more objects until everyone in the circle is both presenting and object to the person on the right and asking about an object from the person on the left.

MATERIALS

Collection of tools or parts

RESOURCES

None

SOURCE

Community Cycling Center
**LESSON**

1. Students stand in a circle with their shoulders touching. Everyone should be holding onto a circular rope that is knotted. A deflated bicycle tube will also work. The value is the “knot.”

2. When the facilitator says ‘go’ the group begins to move the rope between their hands so that it spins around the circle, then the facilitator says ‘stop.’

3. Whoever is closest to the knot in the rope goes first.

4. Facilitator chooses a random question from those listed below for the person to answer.
   - Tell us about a time when you stood up for yourself or someone you know.
   - Tell us about a particular challenge you are dealing with in your life right now.
   - Sing us a part of your favorite song and explain why it’s your favorite.
   - Tell us about something courageous you have done.
   - Talk about something or someone you love.
   - What is your dream bicycle?
   - What have you done to make the world a better place?

5. The person who answers then becomes the facilitator saying go and stop, then picking the question.

6. The facilitator changes with every person until all participants have had a turn.

**BIKE VARIATION:**

Have a list of bike questions ready. Instruct youth to ask bike–related questions from your list, or that they come up with in, order to test youth knowledge and review key concepts.

**MATERIALS**

Knotted rope or deflated tube

**RESOURCES**

None
**LESSON**

1. Players stand in a close circle, shoulder to shoulder.
2. Players look at the floor ("Earth") while someone counts "1, 2, 3, People!"
3. On the word "People!" everyone raises their eyes to look directly at one other person in the circle. If two participants are looking at each other (they will be making eye contact), they are both eliminated, and they leave the circle.
4. The game continues until there are only 1 or 2 winners left (depending on odd/even number of players).

**VARIATION #1**

Players who make eye contact are not out. They simply let out a scream upon making eye contact, and the game continues.

**VARIATION #2: TOOL NAMES**

Instead of having players eliminated when they look at each other, have a tool placed in the center of the circle. Everyone looks down at the tool and then up at the group. If two players are making eye contact, they must yell the name of the tool. You can leave everyone in, have the last person to name the tool go out, or have both players go out. Make sure to have a stash of tools handy so you can keep changing it up.

**MATERIALS**

Tools for center of circle

**RESOURCES**

None

**SOURCE**

Community Cycling Center
MECHANIC SKILLS: Explanation
Skills explanations and demonstrations are a great teaching tool. They require fewer tools and less time than hands-on “practice” classes; however, they are less engaging. As noted in the introduction, we follow four main guidelines when teaching all our classes:

- Ask twice as many questions as you answer.
- Emphasize a hands-on approach to learning.
- Focus on “problem solving” and “troubleshooting.”
- Safety is part of every lesson.

Asking questions and allowing youth to talk about their experiences helps keep youth engaged and promotes problem solving, instead of just mechanics for the sake of mechanics. Emphasizing a “hands-on” approach is particularly difficult during “Explanation” lessons. At Bike Works we combine these lessons with hands-on “Practice” lessons in every class. “Problem Solving” and “Troubleshooting” during these lessons involves asking youth what they think might happen if their brakes fail, or encouraging them to look at an entire system instead of just one part of the bike. Safety in every lesson often revolves around the youth experience. Why do we care if a chain is worn? What is an example of a time your brakes didn’t work as well as you’d hoped? Each teacher will add his or her own energy and ideas to each lesson, however, these four guidelines help us provide uniform quality of programs across instructors.
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**INTRODUCTIONS 1 OF 2**

Introduce yourself, the project, the space, the organization and expectations.

---

**LESSON**

Take time to welcome students into the space by introducing all the elements of your organization.

1. **Staff and students**
   - Give the students the opportunity to introduce themselves and give a brief explanation of why they’re taking the class, if they have any repair experience, what kind of bikes they like. Students are often shy at first, but may get into telling stories; this is good as an ice-breaker of sorts, but can quickly start taking up time.

2. **Your organization**
   - Ask youth what they know about the organization, and then fill in the gaps. Cover non-profit status, community bike shop, how donations work, recycling ethos, Earn-a-Bike, rides, weekend/ additional events, as well as why we do this.

3. **Mandated reporters**
   - Talk about who is a mandated reporter (all staff who work with youth) and what this means. Disclose the fact that we are each Mandated Reporters here at Bike Works in a clear, specific, and tangible way that is age appropriate.

4. **Contract and shop rules**
   - Use standard organization rules or do one of the activities in the “Group Forming” section of this book in order to create a class-specific set of guidelines. Have students read off a rule and discuss its importance for a minute or two. If using standard organization rules, let the students come up with ideas, then add whatever you think is necessary. (See pages 27–33 for more ideas about how to create a contract that works for you.)

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**MATERIALS**

Print out signage with shop expectations/rules—this can be created in some of the earlier activities in the “Forming” section

**RESOURCES**

None

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**CONTINUED ON P. 64**
LESSON (CONTINUED FROM P. 63)

5. Tour of the Space

At this point the youth can be getting antsy, if so have them move around for the tour. Be sure to show them where to wash hands, the bathroom, where to hang their jackets and backpacks, etc.

NOTE
For classes with many returning students, have youth lead the review of these things for new students and each other.
**PARTS OF THE BIKE**

Introduce students to the parts of a bike.

---

**LESSON**

1. Pass out a handout with an image of a bicycle (labeled for younger youth or for a shorter time frame; or un-labeled for older youth or a longer class).

2. Using the bicycle in the stand, talk about the different parts of the bicycle pointing at the parts on the bicycle in the stand and comparing that to the handout. If you have an older group, you can use an un-labeled handout and have students fill in the parts as you learn about them.

3. Give participants a chance to share what they know as well as different names for different parts depending on region and country of origin.

---

**MATERIALS**

- Pens/ pencils
- Bicycle in a stand
- Parts of the Bike handout

**RESOURCES**

- Parts of the Bike—English/Spanish (p. 239)
- Parts of the Bike—Student Worksheet (p. 240)
- Parts of the Bike—Student Worksheet Answers (p. 242)
- Partes de la Bicicleta—Student Worksheet Spanish (p. 241)
- Partes de la Bicicleta—Student Worksheet Spanish Answers (p. 243)
IN-ROOM SCAVENGER HUNT

Familiarize youth with the space, allow them to explore.

LESSON

1. Split kids into groups of 2 or 3.
2. Give each group a “goodie bag” of bike parts or tools. Try to choose materials that youth are likely to need during the class. This is an opportunity for youth to learn where things are located and explore the space.
3. Have them look around the shop to find where that part is kept and what it is called. You may want to leave out catalogues and books so they can look up parts.
4. Once they find where that part (or tool) goes, have them make a sign (English plus any other languages they may know) for that drawer and draw a pic if possible. You can also prepare the signs ahead of time.

MATERIALS

Brown paper bags for “goodie bags”
Variety of parts and/or tools
Paper
Markers
Books and catalogs for identifying part names

RESOURCES

None

SOURCE

Recycle-A-Bicycle
LESSON

Demonstration:

1. What is the most common type of bicycle repair? Flat tire.
2. Why? Based on the students’ experience, discuss the different ways a tire can go flat. For each cause, briefly go over how to prevent that type of flat, i.e. proper tire pressure (what’s PSI? why do different bikes take different PSI’s?), check tire for wear, etc... Prevention is key.

   - Punctures
   - Pinch flats
   - Too little air
   - Too much air
   - Bike sitting in the garage for 6 months
   - Cut valve stem
   - Leaky/loose valve
   - Broken rim strip
   - Bald tire
   - Worn-thru sidewall
   - Burred rim
   - Whatever else they can think of...

MATERIALS

- Repair stands
- 13, 14, 15mm wrenches
- Pens
- Sandpaper
- Vulcanizing fluid
- Bulk patches
- Rags
- Floor pumps
- Holey tubes
- BMX bikes with flats & worn out tires and/or wheels

RESOURCES

None

CONTINUED ON P. 68
LESSON (CONTINUED FROM P. 67)

3. Introduce important shop concepts and ideas:

**Proper tool selection**

One great way to explain this with the three sizes of 15mm wrenches—the cone, pedal and combination. Why in this case is the last wrench the best to use?

- The cone wrench is thin so it can fit in-between the hub and the cone. We use this one for hub adjustments.
- The pedal wrench is really long to give us lots of leverage when taking off pedals, but thin enough to fit between the pedal bearings and the pedal arm.
- The combination wrench is long enough that we can get leverage, but not so long we are far away from our bike, and it is strong enough to grip those stuck axle nuts.

**Leverage**

Show how starting the wrench at 9 o’clock provides the best leverage to loosen axle nuts.

**Clockwise and counter-clockwise**

Try to get students away from “lefty loosey, righty tighty.” This is because sometimes we are reaching through the bike or the bike is upside down and “righty tighty, lefty loosey” gets confusing.

**Dropouts**

Introduce these by catching the wheel when it drops out of the fork once the axle nuts are loose enough. Students should understand that it’s always important to hold on to whatever it is they are loosening.

**NOTE**

When it comes to “nuts,” be sure to distinguish what kind of nut it is, whether axle nut, lock nut, adjustable nut, anchor nut, brazil nut, etc. This helps keep the giggles to a minimum, especially when instructing 10-13 year olds.

CONTINUED ON P. 69
LESSON (CONTINUED FROM P. 68)

Demonstration:

1. **Remove the wheel**
   Explain the difference between quick release and bolt-on wheels.

2. **Remove the tire**
   Be sure to deflate the tube completely first, then use tire levers to remove the tire from the rim.
   - Explain what the bead of the tire is and pass a tire around so they can feel it.
   - It is easiest to remove a tire starting opposite the valve.

3. **Find and mark the hole**
   Remove the tube, pump it up nice and plump. Using a ballpoint pen, mark the hole with a big “X”. This makes it easy to find later.
   - Look, listen and feel for the hole (using your cheek); still difficult?
   - Use the water bucket. Ask them why the water bucket works? What is happening here? What could you use if you didn’t carry a bucket of water on every ride? In the woods? In rainy Seattle?

4. **Apply the patch**
   Deflate the tube.
   Scuff the area to be patched with sandpaper.
   - Why? This is like scoring a clay pot or buffing nails before a manicure.
   - The rough surface helps the two parts bond together.

   Apply to vulcanizing fluid.
   - Lay a thin layer of vulcanizing fluid in a circle around the hole. Stress that the glue must be spread thinly, evenly, and over an area larger than the patch.
   - Students can draw a circle around the hole when they make their “X’s” to make this easier.

   Let the glue dry.
   - Why? Actually, vulcanizing fluid isn’t glue. It’s science! The fluid, patch and rubber in the tube create a chemical reaction when they meet. This reaction happens best when the fluid is dry.

CONTINUED ON P. 70
LESSON (CONTINUED FROM P. 69)

Apply the patch.

- Peel the patch off the foil, lay it down over the glue, rub over the cellophane with a tire lever or wrench on a hard surface.
- What could you use as a hard surface if you were out on a ride?

Wait.

- Have everyone guess how long the patch should be held on the tube before the next step (approx. 5 minutes).
- While you wait, skip to step 6 and inspect all the parts of the tire and rim.

Remove cellophane.

- This step is purely aesthetic, so kids can skip it if they like; peeling the cellophane will often pull a poorly-glued patch off.

5. **Test for leaks**
   Inflate the tube gently and look, listen and feel for other holes.

6. **Inspect the tire and rim**
   Before reinstalling, inspect the inside and outside of tire, rim strip, condition of valve stem, etc. Use a cloth or corner of your t-shirt to check the inside of the tire and rim.

7. **Reinstall tire and tube**
   Install one side of the tire. Then insert the slightly inflated tube with the valve in the valve hole of the rim. Tube should look like a “floppy donut.”
   Replace the bead on the rim using only your hands—NO TOOLS! Why?
   Show how to use thumbs, heels of hands, and other people’s help to ease the process.

8. **Reinstall the wheel and inflate tire to proper pressure**
   Emphasize that the wheel should be all the way up in the dropouts and centered. For tight axle nuts, place the wrench at 3 o’clock for best leverage.

**Coaster hubs, freewheels, derailleurs, brakes:**
Briefly discuss challenges encountered when removing wheels with coaster hubs, with freewheels/derailleurs and with brakes in the way.
BIKE WORKS 2015

BALL BEARINGS EXPLANATION

Understand how and why ball bearings work.
Locate bearing systems on the bike.
Understand proper bearing system maintenance.

LESSON

Overview:

1. What are bearings?
   Start by discussing bearings: what are they? What do they do? Why are they in bicycles? Where on bicycles are they? What would bikes be like without them? Most of the systems in the bike that move have ball bearings to help make the movement smooth and lasting.

   The three key elements:
   • Bearings reduce friction.
   • Bearings support weight.
   • Their ability to do a) and b) increase with the number of bearings.

2. Friction
   Why is friction unwanted in your bicycle?
   Have everyone rub their hands together really fast; what does friction generate? Heat!
   Translate this to energy lost when riding a bike. What else is used in a bike to reduce friction?
   Grease.

3. What can go wrong?
   What can happen to bearings and grease over time? Let students brainstorm all the possible things that could go wrong with bearings, specifically in the hub. Dirt, water, mud, rust, dried-out grease, loose bearings...
   How can we prevent any of these things from happening? (i.e. not riding through huge puddles). What can we do if things get so bad that the hub has a ton of friction? Is an overhaul necessary or just an adjustment?

CONTINUED ON P. 72

MATERIALS

Loose ball bearings, large gauge (big ones) if possible
Heavy tool box, cinder block or other box

IMAGES

Front Hub—Exploded (p. 246)
LESSON (CONTINUED FROM P. 71)

4. Different kinds of bearings: loose, caged, cartridge
   Caged bearings always go bearing side into the cup.

5. Cup and cone systems
   Use the “ice cream” analogy at right.
   Ice cream comes in a cup or a cone, right?
   Bearing systems have both a cup and a cone. The cone goes into the cup, with the bearings in-between the two. The “locknut” is on top like the “ice cream.”

Demonstration:
Activity #1:
1. Get a heavy toolbox and place it on the table.
2. Have the kids try to push the box across the table with one finger. Then two fingers, then their whole hand. Is it difficult or easy?
3. Next take out a few loose ball bearings and place them under the toolbox.
   Now have youth push the box with one finger, two fingers, whole hand. Is it easy or hard? Is it different than before?
4. Finally, put a whole handful of ball bearings under the box. How does that change the motion? More bearings = easier motion.

Activity #2
1. If you don’t have the above materials, ask youth to imagine stepping onto 1 bearing vs. 10 bearings vs. 100 bearings. Are different things going to happen?
Pay attention to dustcaps! We usually save hubs with dustcaps for our more advanced classes. To remove the dustcaps, use a flathead screwdriver to gently pry them out. Damaged dustcaps can ruin a wheel, and dustcaps put in upside-down will make a wheel impossible to adjust.

NOTE
For everyone’s sake, refer to them as “ball bearings” or “bearings,” but never, ever “balls.”

Overview:
1. Overhauls!
   What does that word mean to everyone?
   For us, it means taking everything apart and putting it back together.
2. Ball bearings review
   What are they?
   What do they do?
   Why are they in bicycles?
   Where on bicycles are they?
   What would bikes be like without them?

NOTE
For everyone’s sake, refer to them as “ball bearings” or “bearings,” but never, ever “balls.”

Materials
- Repair stands
- Cone wrenches
- Combination wrenches
- 12” adjustable wrench
- Simple green
- Rags
- Grease
- Bearings
- Drop gauge tool
- BMX bikes and/or wheels

Images
Front Hub—Exploded (p. 246)

Source
Image: cycler.tumblr.com

CONTINUED ON P. 74
LESSON (CONTINUED FROM P. 73)

Demonstration:

Explain the 5⅛ steps of an Overhaul for the first time!

½. Put out a rag

Make sure you have a place to set your parts as you take something apart and that these parts are oriented to how they go back on the bike.

1. Disassemble

Pull the front wheel off the bike and demonstrate how to use the cone wrench and another wrench in opposition to one another. Put wrenches at 5 and 6 o’clock making a “tiny pizza slice” and squeeze together.

Be careful not to have your fingers between the two wrenches. The nuts may loosen quickly and smoosh your fingers!

Thread off the locknut, any spacers, and the cone. Discuss what the locknuts do, using the terms “lock” and “unlock”.

The bearings will drop onto the rag and the axle (with accompanying locknut, cone and bearings) can be pulled out the other side.

Stress that only one side needs to be pulled apart. Why? This is because the cones should be measured out perfectly on the axle for even axle length one each side in order to attach the wheel to the fork. Working on only one side helps maintain this spacing.

Youth tools should remain on one side of the hub throughout this work. This is very important.
LESSON (CONTINUED FROM P. 74)

2. **Clean**
   Old grease looks like dirty ear wax. Gross. We don’t want that in there.
   Cleaning can mean wiping with Simple Green, using a toothbrush or even using steel wool. Start with three squirts of simple green on a rag and use that. Don’t squirt directly onto bike parts. This is because Simple Green is a de-greaser and if excess is left in the hub it will break down new grease. More elbow grease, less simple green!
   If the sample hub is fairly dirty, pretend to clean it during your demonstration instead of actually doing it, as students will quickly become bored watching the instructor clean parts.

3. **Inspect**
   **Bearings**
   Have students think about the divots in a golf ball. That’s what pitting on a bearing looks like. If students see pits, or if a bearing doesn’t “shine up” it is damaged and should be replaced.
   What size bearings? Have students show you (with their fingers) the equivalent of: an inch, a $\frac{1}{4}$ inch, a $\frac{1}{8}$ inch, etc. all the way down to $\frac{1}{32}$ of an inch. How can we see size differences in such small increments? For drama, you can pitch a bearing into a random crate of parts and ask how we will find that same size. Bust out the Drop Gauge here if you have one.
   **Cups**
   Check the cups for pitting, just like the bearings.
   **Cones**
   Check for pitting, scratching or cracks. In addition, if the cone has built-in dustcaps, make sure they aren’t bent or chipped.
   **Axle**
   Look to make sure the axle is not bent and the threads are in good shape.
LESSON (CONTINUED FROM P. 75)

4. **Grease and Reassemble**
   Scrape some grease into the cup; how much is enough? How much is too much? There should be just enough for the bearings to stick in it upside down. Another way of showing this is to just fill the edges of the cup.

   A good grease analogy for youth is to think about putting “frosting on a cake,” not “butter on toast.” When you put butter on toast, you can still see the toast but if you add frosting to the cake, you can’t see the cake anymore. Think more like frosting and less like butter!

   After laying the bearings in, add a second, thin layer of grease on top. Students can think about “tucking in” the bearings.

   Reinstall the axle; does it matter which side it goes in? No, on a front hub, the wheel is centered on the axle. Thread the cone, any washers and the locknut on. Is it OK to have grease on the threads? Yes. It’s a good idea!

5. **Adjust**
   Have a student help out by holding the fixed side of the axle so it doesn’t spin.

   Finger-tighten the cone until it touches the bearings, then back it off a ¼ turn (15 min. in the clock analogy).

   Holding the cone in that spot with a cone wrench (it may be helpful to lightly hold a spoke in that area so you are sure not to move), tighten (“lock”) the locknut with another wrench. This is “tool tight” as opposed to the cones which are “finger tight.”

   **Too Tight:** What would the problem be if the cone were too tight, i.e. touching the bearings? The wheel won’t spin smoothly, it will feel “crunchy” and hard to turn.

   **Too Loose:** What would the problem be if the cone were too loose? The wheel will spin smoothly, but there will be “knocking” in the hub.

   Test the adjustment in two ways:
   - First, spin the axle in the hub—does it spin freely without slowing down?
   - Second wiggle the axle up and down—can you feel any movement? This knocking movement is called play and we want none of it.

   Have the students feel these adjustments if time permits.

CONTINUED ON P. 77
LESSON (CONTINUED FROM P. 76)

If either is the case, hold the cone still with a cone wrench, unlock the locknut, and make a small adjustment of the cone: if the axle had play, tighten the cone about 2–5 min, hold it there, and lock the locknut. If the wheel didn’t spin smoothly, loosen the cone about 2-5 min, hold it there, and lock the locknut.

Emphasize to students that small adjustments go a long way!

6. Review key points
   - Make sure everything is tight.
     Make sure the locknut is “tool tight” before checking any adjustments.
   - Don’t lose the point of reference.
     Don’t let the cone move when you unlock the locknut; if it moves, you have to start the adjustment process all over again.
   - Use small rotations of the cone.
     They make a big difference in terms of adjustment.
   - Don’t get frustrated!
     Even seasoned mechanics don’t always get adjustments on the first try.

7. Remount the wheel in the frame
   - Make sure axle nuts are “tool tight.”

NOTE

Many mechanics use a cone wrench on each side of the hub for small adjustments. We teach beginning youth to only work on one side of the hub in order to preserve axle spacing.
Know what that word overhaul means. Review the 5½ steps of an overhaul. Understand maintenance, adjustment, and overhaul of the headset.

LESSON

Overview:

1. Review the 5½ steps of an overhaul
   Ask for input from everyone. Discuss and ask questions about each step. Write the step on a blank chalkboard as you go.

   ½. Put out a rag
   1. Disassemble
   2. Clean
   3. Inspect
   4. Grease and Reassemble
   5. Adjust

2. Discuss stem and handlebars
   We will be overhauling the headset. The stem and handlebars are nearby, but not part of the headset. Cover the different types of stem and handlebars; what the individual parts are; how they connect. Pass out a stem for the class to inspect.

   Make sure to point out:
   • Binder bolts
   • Stem
   • Stem wedge
   • Stem bolt
   • Limit markings

MATERIALS

Repair stands
Allen keys
Combination wrenches
30, 32, 36, 40mm headset wrenches
Channel locks
Large adjustable wrench
Simple green
Rags
Grease
Bearings
Drop gauges
Bikes to work on!

RESOURCES

None

SOURCE

Threaded Stem image: www.montaguebikes.com

CONTINUED ON P. 79
LESSON (CONTINUED FROM P. 78)

3. **Remove the stem**
   Before removing the stem take a “mental picture” of how the housing is routed! Be sure the cables are running the same way, and not twisted when reassembling.

   Face the front of the bike and stabilize the front wheel with your legs to loosen the stem bolt with the allen key. If necessary, tap stem bolt with a mallet. Pull the stem and handlebars out. You may find it useful to remove the wheel from the fork before beginning the overhaul.

4. **Hold the fork!**
   Remind everyone to hold the fork during disassembly. It’s a good reminder to hold on to anything you are loosening on a bike to prevent it from falling.

**Demonstration:**

½. **Put out a rag**
   A rag helps keep parts organized in the order that you disassembled it and prevents loose bearings from rolling away.

1. **Disassemble**
   First remove the locknut. Look for keyway and keyed washers. Why is the washer keyed? How will this help your adjustment?
   Remove the keyed washer.
   Remove the cone next. Unscrew the cone and point out the bearings. If retainer bearings are used, take note of their orientation (which way are the bearings facing?) in the cup. Also a good time to ask where is the cup anyway? A little different than the hub...

**NOTE**
Depending on the age of the class, you can also explain the “crown race” on the fork, and how the bearings “race” around the cone, also known as the “crown race” on the fork.

2. **Clean**
   Get rid of all that old “ear wax” looking grease. Use a minimum of Simple Green and a maximum of elbow grease!

CONTINUED ON P. 80
LESSON (CONTINUED FROM P. 79)

3. **Inspect**
   Inspect the crown race, cups and bearings for pitting, cracks or other damage. Replace if necessary.

4. **Grease and Reassemble**
   If retainer bearings are used, make sure the bearing side faces into the cup. Make sure that everyone knows that this will mean having the bearings facing upward on the bottom of the headset. (Inverted bearings or ‘spaceship’ bearings are different).

   Make sure bearings are seated properly when reassembling.

   Make sure you aren’t cross threading when putting the cone back on. Always start putting on parts by hand to prevent cross-threading.

   Put all parts on and lock down locknut with wrench before checking adjustments.

5. **Adjust**
   It may be helpful to re-install the wheel at this point as it will make it easier to feel the adjustments.

   Be sure to tighten the locknut before testing your adjustment! If your headset is perfectly adjusted before tightening the locknut, thread compression will make the adjustment too tight once you tighten the locknut. For this reason, try to adjust the cone to be a little too loose, tighten the lock nut, and check for play again.

   **Too Tight:** Fork won’t turn with fluid motion. This is sometimes called “indexed steering.” The handlebars click into different positions.

   **Too Loose:** Movement can be felt between fork and frame. This is called play. Have everyone feel while pushing and pulling forwards and backwards.

   Test this adjustment in two ways:
   - Turn the handlebars to one side and let them swing back and forth. They should swing easily.
   - Put one hand on the lower part of the fork and one hand on the frame. Push and pull your hands forward and backwards. You should not be able to move the parts independently.

CONTINUED ON P. 81
Lesson (continued from p. 80)

6. Re-install and align stem and handlebars
   Grease the stem.
   Check height level—you should not be able to see limit marks.
   Make sure all the housing is running the same as when you took it apart.
   Refer to the “mental picture” you took at the beginning of class.
   Tighten the stem bolt.

Materials & Resources

See p. 78
1-PIECE BOTTOM BRACKET EXPLANATION 1 OF 3

Drive home the steps of an overhaul.
Introduce the bottom bracket and the one-piece crankset overhaul.

LEsson

Overview:

1. Review the 5½ steps of the overhaul.
   Ask for input from everyone. Discuss and ask questions about each step.
   
   ½. Put out a rag
   1. Disassemble
   2. Clean
   3. Inspect
   4. Grease and Reassemble
   5. Adjust

2. Remove the chain guard
   With the bike in the stand, show how to remove the chain guard (if necessary) to get to the bottom bracket.

3. Drive–side vs. non–drive–side
   Re–position the bike in the stand so everyone can see the two sides of the bike. Introduce the terms drive–side and non–drive–side.

MATERIALS

Repair stands
Bottom bracket wrenches
Large and small adjustable wrench
Simple green
Rags
Grease
Spanner wrenches
Pedal wrench
Screwdriver
BMX bikes

RESOURCES

None

CONTINUED ON P. 83
LESSON (CONTINUED FROM P. 82)

4. Reverse threading
   Make sure that everyone understands that with a one-piece bottom bracket, on the non-drive side of the bike, that everything associated with the bottom bracket is reverse threaded. Why is this? So that things don’t un-thread and loosen as you pedal the bike!

   One way to help youth remember that the non-drive side is reverse-threaded is to call it “Backward Land!” Anything that is not on the side with the chain is “Backward Land.” If a student is having trouble loosening a bolt, ask them where they are. “Are you in Candyland?” “No.” “Are you in Disneyland?” “No.” “Where are you?” “Backward Land!”

Demonstration:

½. Put out a rag
   Make sure you have a place to set your parts as you take something apart and that these parts are oriented to how they go back on the bike.

1. Disassemble
   Remove non-drive-side pedal. Remember, you’re in “Backward Land,” so all the parts, including the pedal, are reverse threaded.

   Remove the locknut, keyed washer, and cone.

   Remove the one-piece crank and bearings. Where are the cups? Where is the other cone? It’s on the crank next to the chainring. Tighten it onto the crank. Which direction? Clockwise or counter-clockwise?

NOTE

   This is another good time to discourage the use of the phrase “lefty loosey, righty tighty.” Reinforce how important it is to think about the way you are turning the tool, how you are standing in relation to the bike, and which part of the bike you are working on.

2. Clean
   Get rid of any rust, old grease, dirt and grime.
   Make sure there’s no “old earwax” in there!
LESSON (CONTINUED FROM P. 83)

3. Inspect
   Look for pitting in the cups and the cones on both sides. Inspect bearings for golf-ball like pitting.

4. Grease and Reassemble
   If you put bearings into the cups before re-installing the crank, is there enough room? How can you fix this? Which way do bearings go?

5. Adjust
   Remember the adjustment will tighten when you tighten the lockring. Keep the cone just a “smidge” loose.

   Which way do you turn the wrench to tighten the locknut? Stop and think before you do it.

6. Re–install pedal, chain and chainguard
   Re–install the pedal.

   Loosen the rear axle nuts, push the wheel forward (watch for the coaster brake strap).

   Set the chain on, and pull the wheel back into place.

   Make sure the wheel is centered, the chain tension is correct, and tighten down each side little by little.

   While pedaling, feel the chain tension all the way around since the rear and front chainrings are often slightly elliptical.

   Re–install the chain guard!
LESSON

NOTE: Depending on what skill level you are teaching, youth can work on BMX (Beginner) or MTB (Intermediate) bikes.

Overview:

1. **What is “troubleshooting?”**
   In the past classes we have overhauled different components of the bike. This works well for bearing systems where we can’t see what’s going on until we take it apart. But what if we can see all the parts of the system, like in the brake system? Then we don’t need to dis-assemble the whole thing, we only need to find the broken part and fix that. This is called “troubleshooting.”

2. **Cables**
   What is a wire? What is bundle of wires called? A cable.
   Pass around examples of the different cables (bmx/mtn brakes, road brakes).

3. **Housing**
   Where do some people live? In a house. Where does the cable live? In housing.
   *Brake housing:* brakes have spiraled metal housing. Looks a little like a spring (but isn’t one.)
   *Shift housing:* shift housing looks like a bundle of un-cooked spaghetti.
   Show examples of cable through “good” housing, versus cable through kinked or broken housing. Have everyone feel the difference.

CONTINUED ON P. 86
LESSON (CONTINUED FROM P. 85)

4. The braking system
   How does the brake work? Follow the system from the levers to the cable, to
   the housing, to the calipers to the brake shoes and rim. Point out each part
   and what it does. When “troubleshooting,” start at the brake levers and work
   your way to the rim.
   
   Parts of the braking system:
   - Brake levers
   - Cables
   - Housing
   - Brake calipers
   - Brake pads
   - Rims

   What are some of the things that can go wrong in cable systems? Cables
   stretch, dry, break, and fray. Springs collapse. Housing could crack, bend, or
   break in parts.

5. Types of brakes
   Ask youth to brainstorm as many types of brakes as they can.
   - Coaster brakes
   - Cantilever brakes
   - Side pull or caliper brakes
   - V-brakes
   - Center pull brakes
   - Disk brakes (can be cable or hydraulic)
   - Drum brakes

   See Brake Type Flow Chart (p. 249)

6. Springs
   Why do the brake calipers, after releasing the brake lever, move away from
   the rim? Explain the role of springs.
   
   Cable = tension
   Springs = release

CONTINUED ON P. 87
LESSON (CONTINUED FROM P. 86)

Demonstration:

There are 5 main aspects of brake adjustment:

1. **Brake pads**
   - **Height**
     Make sure that all the pads are contacting the rim only. They should not hang off the bottom, or rub on the tire.
   - **Angle-Toe-In**
     Toe-in refers to the angle at which the bike pads hit the rim. What causes squealing brakes? Think about chalk squealing on a chalk board—this happens when the chalk is perpendicular to the board. How can we fix it?
     “Toe-in” the brake pads by angling them so that they are closer to the rim at the front of the pad than the back.

2. **Cables**
   - **Rust**
     Check cables for rust. If they are rusty anywhere, replace them.
   - **Fray**
     If cables are frayed anywhere, replace them.
     Pay close attention to the cable routing so you know how to re-assemble.
     Dis-engage the pinch bolt and pull the cable out of the housing. Cut off cable end if necessary.
     Remove the cable from the brake lever last.

3. **Housing**
   - Cable housing should be cut to the correct length to make a smooth curve—no corners or kinks.
   - Use metal or plastic ferrules on the ends of the housing if they fit.

4. **Tension**
   - After routing a new cable, have one partner hold the brake pads on the rim while the other partner pulls on the cable and tightens the pinch bolt.
   - When properly adjusted the brake lever should be two fingers away from the handlebar when squeezed fully. When there is no pressure on the brake lever, the wheel should spin freely without touching the brake pads at any point.
   - Check the adjustment by spinning the wheel.
   - Use the barrel adjuster to fine tune the cable tension.

CONTINUED ON P. 88
LESSON (CONTINUED FROM P. 87)

5. **Length**
   Cut the cables. Leave four fingers-length at the end. Why? Enough cable is needed for future adjustments and leverage.
   Attach cable ends.

MATERIALS & RESOURCES
See p. 85
Understand how to correctly assess, set up, and adjust the four aspects of derailleurs and shifting.
To encourage youth to work through problems in order to find the part that needs adjusting or replacing.

LESSON

Overview:
1. Parts of the system
   - Front derailleur
   - Front chainrings
   - Rear derailleur
   - Rear cogs/freewheel/cassette
   - Front and rear shifters
   - Shift cables
   - Shift housing

   How many gears does the demo bike have? How do you know? How do they work? How do they help us?

MATERIALS
- Repair stands
- Examples of housing and cables for all systems
- Cable and housing cutters
- Tri-flow or other chain lube
- Screwdrivers
- Cables
- Housing
- Cable ends
- Ferrules
- Y-socket (8, 9, 10)
- Allen wrenches (4, 5, 6)
- Mountain bikes
- Derailleur hanger alignment tool (optional)

RESOURCES
- None

CONTINUED ON P. 90
LESSON (CONTINUED FROM P. 89)

2. “Troubleshooting”
   Revisit the concept of “troubleshooting.” What is unique to the system of gears versus that of brakes? Look at the system from end to end and find the potential “trouble.”

   Show examples of the derailleur cables and housing. Derailleurs use parallel-running housing and thinner cables with a smaller, parallel-facing barrel end. Shift housing looks like a handful of un-cooked spaghetti.

3. Gears, Front chainrings, rear cogs/freewheel/cassette
   What does the word derailleur make you think of? De-rail? Off the track? Show how levers will pull the cable to move derailleurs and move the chain off of the “tracks” in the gears (cogs/chainrings). Also keeps chain tension.

   If you have 3 chainrings in the front, and 7 cogs in the back, how many gears do you have? Why? How does that make a difference?

   When the chain is in the big gear in the front, is it easier or harder to pedal? In the small gear? What about the chain when it is on the rear cogs? Easier on small cog in the rear or harder? Why do you want to have a wider gear range (in Seattle, with hills)?

   Do you always have to be pedaling to change gears? Why?

   Make a point that the fast/slow gears are opposite with the cogs versus the chainrings. Show how the gears work while the bike is in the stand, running through all the gears. When you move the chain towards the bike, the pedaling gets easier, when you move it away from the bike, it gets harder.

   Discuss cross-chaining and how to avoid it.

   When troubleshooting chainrings and rear cogs what are we looking for? Worn or broken teeth. What do those look like?

   Check for loose chainring bolts.

CONTINUED ON P. 91
LESSON (CONTINUED FROM P. 90)

4. **Chains**

   Can you use any kind of chain on any kind of drivetrain? Why not? Discuss matching the chain with the number of cogs in the rear cluster. (For example, a 9 speed chain goes on a bike with 9 cogs in the rear cluster.)

   When troubleshooting: what kinds of wear or problems might you find with a chain? Rust, broken links, “stretch.”

   How can you check chain wear? You can use a chain stretch tool, or measure how many links are in one foot. The 12th pin should line up with the 12th inch mark. If it is \( \frac{1}{8} \) inch past the 12 inch mark, it’s time to replace things.

   Many people refer to chain wear as “chain stretch.” Is the metal actually stretching? No, it’s really the metal wearing away around the pins and rollers.

   Why is it important to avoid over-lubing?

5. **Derailleurs**

   When troubleshooting what are some of the things that can go wrong in these systems? Cables stretch, dry, break, and fray. Springs collapse. Housing could crack, bend, rust, or break in parts. Teeth and pulleys break. Chains stretch.

   Briefly explain the role of limit screws. H & L = High and Low. It is helpful to describe the role of limit screws as being like walls that determine how far the derailleur can move. Tighten the screws and the walls move in, limiting movement; loosen the screws and the walls move out, allowing for increased movement.

CONTINUED ON P. 92
Demonstration:

There are 4 main aspects of adjustment of the Rear derailleur (perform in this order):

1. **Derailleur hanger alignment**
   - True, not actually part of the derailleur, but it can’t work correctly without it.
   - What happens if the derailleur is not parallel to the wheel?
   - Show how a derailleur hanger alignment tool works if you have one.

2. **B-limit screw**
   - The B-limit screw adjusts the distance of the top jockey wheel from the gear cluster. Once set correctly this can generally be forgotten about.
   - This should be set when the chain is on the middle chainring and largest cog.
   - Dial the screw out until the top of the top pulley wheel is 3-8mm (approximately) from the bottom of the largest cog.

3. **Limit screws**
   - Limit screws adjust only the highest and lowest gears. Think of them as the wall on either side of the gear cluster that keeps the chain from falling off.
   - Adjust rear limit screws with chain on the middle chainring. Loosen (unscrew) H limit screw to make chain move out towards dropout; loosen L limit screw to move chain out towards the wheel.
   - The limit screws should be dialed in as far as they can go without the chain making a clicking sound while pedaling in the respective (H or L) gear.
   - Double check that the L screw adjustment is not dialed out too far by pedaling while physically pulling on the rear shift cable, not by using the shifter.
LESSON (CONTINUED FROM P. 92)

4. **Cable tension**
   With the H limit screw properly set and the chain still on the middle chainring, shift onto the smallest (H) cog.
   
   Undo the pinch bolt holding the shift cable, then grab the end of the cable and pull the slack out of it and then tighten the pinch bolt back down.
   
   Pay attention to where the cable is running! There should be a groove in the washer where the cable sits.
   
   Try shifting. Does the chain hesitate moving up to the next largest cog? What does that mean? Too little tension—with increased tension the derailleur pulls a little further with each click of the shifter. Increase tension via the barrel adjuster with quarter turn increments! Does it hesitate moving down to the next smallest? Decrease tension!
   
   An easy way to help youth understand which way to turn the limit screw is to always turn towards the direction where the chain is having trouble moving.
   
   Repeat until you have shifted multiple times between every cog.
FRONT DERAILLEUR EXPLANATION 1 OF 2

Understand the four aspects of front derailleurs and shifting. Encourage youth to work through problems in order to find the part that needs adjusting or replacing.

LESSON

This lesson introduces a new element, but is also a great review of rear derailleur concepts. If you chose to teach front derailleurs first, be sure to look at the “Rear Derailleur Explanation” lesson plan (p. 89-93) for some key concepts and questions.

Overview:
1. Parts of the system
   - Front derailleur
   - Front chainrings
   - Rear derailleur
   - Rear cogs/freewheel/cassette
   - Front and rear shifters
   - Shift cables
   - Shift housing

   How many gears does the demo bike have? How do they work? How do they help us?

2. Revisit the concept of “troubleshooting”
   What is unique to the system of gears versus that of brakes? Look at the system from end to end and find the potential “trouble.”

3. Derailleur cables and housing
   Show examples of shift housing and shift cables. Derailleurs use parallel-running housing and thinner cables.

CONTINUED ON P. 95

MATERIALS

- Repair stands
- Examples of housing and cables for all systems
- Cable and housing cutters
- Tri-flow or other chain lube
- Screwdrivers
- Cables
- Housing
- Cable ends
- Ferrules
- Y-socket (8, 9, 10)
- Allen wrenches (4, 5, 6)
- Mountain bikes

RESOURCES

None
Demonstration:
There are 4 main aspects of adjustment of the front derailleur (in this order):

1. **Height**
   The closest point at the bottom front of the derailleur should be 1-3mm from the top of the highest tooth on the large chainring.

2. **Alignment**
   The flat front part of the derailleur should be perfectly parallel to the large chainring.

3. **Limit screws**
   There is not always an H and L printed! Look inside the derailleur for where the rocker hits the screws.
   Set the L limit screw with the chain on the large cog and small chainring; turn it in until the chain just clears the inside back of the derailleur.
   Set the H screw with the chain on the small cog and large chainring; turn it in until the chain just clears the inside front of the derailleur.
   Adjust as needed for the chain to shift quickly down or up to the respective gear.

4. **Cable tension**
   Shift down to the small chainring.
   Undo the pinch bolt holding the shift cable, then grab the end of the cable and pull the slack out of it and then tighten the pinch bolt back down.
   Pay attention to where the cable is running! There should be a groove in the washer where the cable sits.
   Try shifting up to the middle. Does it hesitate? What should we do? Increase tension! Repeat steps like with the rear derailleur.
Know what that word overhaul means. Review the 5½ steps of an overhaul. Understand maintenance, adjustment, and overhaul of the headset.

### LESSON

Pay close attention to cable routing. Encourage everyone to take a “mental picture” of the bike before beginning. Also if there is a cable stopper/hanger on your bike, make sure that it will get back in the stack as you are re-assembling.

#### Overview:

1. **Different types of headset cups**
   Discuss integrated or “slip fit” systems vs. threadless or “press fit” systems.

2. **Parts of the headset and fork**
   - Head tube
   - Steer tube
   - Crown
   - Crown race
   - Cups
   - Cone
   - Stem
   - Bearings—inverted and “regular”

   Explain the “crown race” on the fork, and how the bearings “race” around the cone, also known as the “crown race” on the fork.

### MATERIALS

- Repair stands
- Allen keys
- Combination wrenches
- Simple green
- Rags
- Grease
- Bearings
- Drop gauges
- Mountain bikes w/ threadless headsets

### RESOURCES

Threadless Headset—Exploded (p. 247)

### CONTINUED ON P. 97
Demonstration:

Perform the 5 ½ steps of an overhaul.

½. Put out a rag
   A rag helps keep parts organized in the order that you disassembled and prevents loose bearings from rolling away.

1. Disassemble
   To disassemble and re-adjust a threadless headset, take off top cap.
   Loosen stem binder bolts and remove stem
   Remove spacers.
   Pull the fork out of the frame and set aside.
   Take off dust caps and remove bearings.

2. Clean
   Get rid of any rust, old grease, dirt and grime.

3. Inspect
   Inspect the crown race, cups and bearings for pitting, cracks or other damage. Replace if necessary.

4. Grease and Reassemble
   Reassembly for a threaded headset is relatively simple. Replace the bearings with new grease, install the fork and re-install the stem. Make sure spacers are in the same place as when you started.

5. Adjust
   Re-install the top cap. Tighten it down enough so that there is no play, but loose enough that the headset turns smoothly. Remind students that this is NOT one of those “as tight as your muscles can get it” adjustments.
   Then tighten the two stem bolts evenly—by alternating back and forth.
   A proper adjustment allows the fork to turn smoothly without any play.
Drive home the steps of the overhaul. Introduce the bottom bracket and the three-piece crankset overhaul.

LESSON

Overview:
Go over the parts of the three piece crank with regards to terminology:

- Crank arms
- Spindle (square taper), octolink, etc.
- Crank Bolts
- Sealed BB Cartridge
- Cup
- Cones
- Bearings
- Discuss Cartridge Style vs. Cup and Cone (Adjustable)

NOTE
This is another good time to discourage the use of the phrase “lefty loosey,” etc. and reinforce how important it is to think about the way you are turning the tool, how you are standing in relation to the bike, and which side of the bike you are on.

Demonstration:

½. Put out a rag
Make sure you have a place to set your parts as you take something apart and that these parts are oriented to how they go back on the bike.

CONTINUED ON P. 99
LESSON (CONTINUED FROM P. 98)

1. **Disassemble**
   Remove both pedals. Non-drive-side will be reverse-threaded.
   Carefully remove both crank bolt caps and crank bolts from the crank arms.
   Be sure to look for a washer before removing the crank arm! Check for the bolt type that has a washer attached to it. Look for a square shape after removing the crank bolt on the crank arm.
   Stress the importance of initially installing the crank arm remover tool by hand. Then fully thread in the tool onto crank arms with a wrench before progressing any further.
   Remove both crank arms.
   Remove lockring—it is most often right hand threaded and will move counterclockwise to loosen.
   Remove the non-drive-side cup—it will most often need to be turned counterclockwise to take it off.
   Adjustable bottom brackets will have a lock ring, adjustable cup (non-drive) and a fixed cup (drive).
   Remove the spindle. Be sure to take note of the orientation or writing on the spindle as it is taken out of the bottom bracket shell.

NOTE
The students need to know that with the three piece bottom bracket system: the non-drive side is most often regular threaded on bottom bracket (pedals still reverse); and the drive side is reverse threaded on bottom bracket (pedals still regular thread). This is just a rule of thumb however. For reference look at the bottom bracket charts in the appendix.

2. **Clean**
   Use a clean, dry rag to remove any old grease or gunk on the cups, bearings, lockring and inside the frame. Careful for sharp parts inside the frame!

3. **Inspect**
   Check for pitting in the cups as well as damaged threads and worn bearings.

CONTINUED ON P. 100
4. **Grease and Reassemble**

*Cartridge bottom bracket*
Discuss this process with the group and show proper tools. Students with these on their bike should remove the system, check its condition, reinstall and tighten.

*Loose Bearing Bottom Bracket*
For the purposes of this class, it is optional to remove the drive side fixed cup. Be sure to check the tightness of the drive side cup if it was not removed. The drive side cup will be reverse-threaded. Move the chain onto the bottom bracket shell before reassembling. Think about why we would do this.

When re-installing the spindle be sure to note the orientation or writing on the spindle. In most cases, if you are straddling the bike, and looking “through” the bottom bracket shell, you would be able to read the markings on the spindle. Do not grease the outside of the spindle because this is a press-fit system and we don’t want the cranks to fall off!

Install drive side crank arm (only) in order to check your adjustment. Grease the bolt threads! Use a torque wrench, if you have one, and have class look up the specifications in their Park Tool books.

5. **Adjust**
Adjustment should be as loose as possible, without play, with the lock ring tightened—if you have one, and if you do then it should be tightened with the correct tool—on the drive side.

6. **Re-install crank arms and pedals**
Install non-drive crank arm—clean the tapers and pedals—make sure to get the right side and left side pedals on the correct crank arms.

Make sure the correct pedals are on each side and remind students that the non-drive side pedal is reverse-threaded. Grease the pedal threads and be careful not to cross thread!
LESSON

Overview:

1. Components of the drivetrain
   - Chain
   - Chainrings
   - Freewheel/cassette
   - Cranks
   - Pedals and shoes (according to the Park Tool Repair Book)

2. Chain

   What is a chain?
   A system of rollers separated by inner plates which are held together at the outer plate by rivets. Because of its design it is allowed to freely rotate around the cogs and chainrings.

   Sizes and compatibility
   Specific chains for different gear options. Single speed vs. 5speed vs. 10speed. What is happening to the chain to accommodate more gears? Does it get thinner, thicker? Can we use any chain on any bike? How to replace a chain depends on the type and size. BMX chain is 1/8 inch and general gear bikes use 3/32 inch.

   Wear
   How is this happening? What happens every time you pedal forward? What is the chain being exposed to? Water, road grime, dirt, oil.

   Define cross-chaining (riding in improper gear combinations such as front high and rear low that stresses a drive chain by putting your chain at an angle where it contacts chainrings/cogs/derailleur) and how this can cause faster wear on a chain. Emphasize that the same gear ratio can be found with different gear combinations. Pay attention to good chain line.

CONTINUED ON P. 102
LESSON (CONTINUED FROM P. 101)

Care
Proper chain care includes keeping it clean and lubing it, as well as checking for chain wear. What are advantages and disadvantages for the different lubrication options? How do you use the chain checker?

Removal and Installation
Show how to properly break a chain with the chain breaker, and how to get out a kink in a chain with the same tool.

Replacing a chain on a bike with gears requires choosing the proper chain, and accommodating for needs with regards to width and length.

Talk about master links, power links, and other modern options.

3. Chainrings
Draw attention to the chain rings, have students note differences in what they see on their bikes… How many rings? How many teeth per chainring?
Define BCD: Chainring Bolt Circle Diameter, common sizes, and tool to measure BCD.

4. Derailleurs, Shifters

What are Derailleurs?
How do they work? Why do we have two on a bike?

Types of Housing
Show compressionless housing and explain why it works with index shifting. There is a defined amount of cable pull in indexed shifting that would be compromised if compression was allowed for, as is the case in coiled brake housing.

Types of Derailleurs
What are the different kinds of derailleurs? Double, triple, long and short cage. When are they used? Why are there differences? Different numbers of front chainrings, sizing of rear cogs and chain slack will designate what types are appropriate. Front bottom/top pull, top/bottom swing, etc.

CONTINUED ON P. 103
**Lesson (continued from p. 102)**

Types of Shifters

Friction
- Thumb shifters
- Down tube shifters

Indexed
- Thumb
- Grip shift
- STI
- Down tube
- Rapid fire

*Trim vs. Index*
Indexed shifters must match the number of gears in the rear cluster. Trim in an indexed system is a half-shift on the front derailleur that alleviates chain rub.

**Demonstration:**

1. **Troubleshooting**
   What sorts of things go wrong in a system? Improper shifting, derail chain into spokes or frame, can’t actuate the lever, persistent clicking, popping of gears, improper cable housing...What sorts of basic steps can we take?

2. **Adjustments**
   1. Derailleur height
   2. B-limit screw (rear derailer)
   3. Derailleur hanger alignment (rear)
   4. Front derailleur alignment
   5. Cable tension
LESSON (CONTINUED FROM P. 103)

Rear Derailleur
Always set the rear first—before the front derailleur.
Start with cable tension at zero, and with the pinch bolt unlocked.

Barrel Adjuster
Use your barrel adjuster to make any fine adjustments to shifting. Rotate the barrel adjuster in the direction the chain is having problems moving into.

Front Derailleur
Start with the adjustment in the high gear first. Have the chain in the big ring up front and small cog in the rear to set the H limit.
The second adjustment should be with the chain in small chain ring and large rear cog to set the L limit.
Front Derailleur Alignment and Height.
Height: Bottom of cage should sit 1 to 2mm above outer chainring.
Alignment: Should be parallel to chainrings.

3. Freewheels and cassettes
Briefly discuss the difference between a freewheel and a cassette.
Show an example of each off a bike.
How can you tell the difference? Cassette has a lockring.
Show examples of freewheel tools and lockring tools.
REAR HUB EXPLANATION 1 OF 3

Introduce freewheels and cassettes.
Learn how to overhaul a rear hub.
Learn new techniques to adjust a hub.

LESSON

Overview:
1. Spacing
   How or why is a rear hub any different from overhauling a front hub? Discuss the importance of spacing.
2. Freewheels vs. cassettes
   Freewheel—a self-contained system which as a unit will thread onto a hub.
   Cassette—a grouping of cogs. These will be either individual cog pieces or a spider of cogs which as a unit will slide onto the free hub body and secure to the hub using a lock ring.
3. Parts of the hub
   • Cone
   • Bearings
   • Locknut
   • Axle Nut
   • Spacer (this one is new to the group)
   • Quick Release
   • Axle
4. Process of disassembly
   Go over the proper removal of the freewheel or cassette. How do we tell which one it is and what tools are involved to take it off? (Bench vice, chain whip, adjustable wrench, freewheel remover tools). Explain the importance of using the proper removal tools.

MATERIALS

- Repair stands
- Bikes
- Two cone wrenches
- Two combination wrenches
- Bench vice
- Axle vice
- Freewheel remover
- Chain whip
- Giant adjustable wrench
- Cassette lockring tools
- Grease
- Rags
- Simple green
- Cleaning brushes
- Torque wrench (if you have one)
- Free wheel example (on a wheel)
- Cassette example (on a wheel)
- Cassette hub w/o cassette
- Freewheel hub w/o cassette

RESOURCES

None

CONTINUED ON P. 106
Lesson (continued from p. 105)

5. **Review the 5½ steps to an overhaul.**
   Be sure to discuss and elaborate on these. For some students this will be a refresher class.
   ½. Get a rag
   1. Disassemble
   2. Clean
   3. Inspect
   4. Grease and Reassemble
   5. Adjust

**Demonstration:**

½. **Get a rag**
   Make sure you have a place to set your parts as you take something apart and that these parts are oriented to how they go back on the bike.

1. **Disassemble**
   *Remove the cassette or freewheel*
   Lock down one side of the hub to ensure you don’t lose adjustment. Then remove the opposite side—for freewheels use the bench vice with the tool locked onto it (turn wheel to the left), for cassettes use the chain whip.

   **Disassemble the Hub**
   Note which side of the axle you are dissembling. Remember, spacing is important for rear hubs!
   Lay out parts on the rag so that it is side specific to avoid mishaps. Think about spacers—they go on different sides for different hubs so the layout on the rag can become key to your success.

   **Dust caps**
   Some students may have dust caps. Leave them in if you have a cassette type rear hub. If they are removed, make sure they are not re-installed upside down—sometimes they may look as if they are going back in backwards, don’t be fooled.

CONTINUED ON P. 107
LESSON (CONTINUED FROM P. 106)

2. **Clean**
   For freewheel—clean the threads grease and install.
   For cassette—clean and grease free hub body, install cogs, and lockring to proper torque rating.

3. **Inspect**
   When checking the cassette or freewheel, look for wear or damaged/pointed teeth, and “overly smoothed” cog edges.

4. **Grease and Reassemble**
   Be sure when re-installing the axle that it goes into the hub the same way it was pulled out.

5. **Adjust**
   Tighten the cone until it is hand tight. Then back off a quarter turn.
   Teach two cone/comination wrench technique to adjust the hub (two cone wrenches to loosen, two combination wrenches to tighten) working on both sides of the hub. This is new—until now we encouraged youth to work only on one side of the hub. Remember adjustments on both sides will have twice the power—a little goes a long way.
   When adjusting quick release hubs we want to start with a little bit of play. To check, re-install the wheel (without installing cassette or freewheel), tighten quick release and check for more play on bike.

MATERIALS & RESOURCES
See p. 105
Discuss different parts of the wheel, types of wheels and the strengths and weaknesses of different components. Understand the concepts of lateral and radial trueness, dish, and correct tension. Practice wheel truing techniques.

**LESSON**

**Overview:**

1. Parts of the wheel
   - Rim
   - Hub
   - Spokes
   - Spoke nipples
   - Rim tape

2. Explain how a truing stand works

3. Explain the four aspects of wheel balance (and demo tools)
   - Lateral True (truing stand)
   - Radial True (truing stand)
   - Wheel Dish (dishing tool)
   - Spoke Tension (tensiometer)

What is the importance of each of these aspects and how does one determine if the wheel is out of true?

On the rear wheel, why do drive-side spokes hold a higher tension than the non-drive-side?

**NOTE**

Enforce the idea of taking it slow. Use ¼ turns on the spoke nipples and constantly spin the wheel to check trueness in order to avoid breaking spokes or rounding out nipples.

**MATERIALS**

- Truing stands
- Spoke wrenches (with correct spoke wrench to match nipple size)
- Dishing tool
- Tensiometer
- Tri-Flow
- Rags
- Demo wheels, rims, hubs, spokes:
  - Double vs. single wall rim
  - Aero rim
  - Bladed and butted spokes
  - Low and high flange hubs
  - Multi-spoke wrench
  - Wheel with rim damage

**RESOURCES**

- Parts of the Wheel (p. 245)

**CONTINUED ON P. 109**
Demonstration:

1. Remove the wheel
   Have students explain how best to remove a geared rear wheel from the bike frame.

2. Put wheel in truing stand
   Demonstrate how to put a wheel in the stand.

3. Demonstrate lateral truing

4. Orient yourself
   Make sure that you point out that students should orient themselves so they are looking at the head of the nipple inside the rim in order to double check that they are turning the spoke wrench in the correct direction.

5. Remove tire

6. Demonstrate radial truing

**NOTE**
When truing, it is especially important to use the correct sized wrench. Spoke nipples are made of a softer metal than the wrench. If the wrench is slightly bigger than the nipple, or if it is seized against the rim, the nipple could be destroyed.
MECHANIC SKILLS:
Practice
MECHANIC SKILLS: PRACTICE

QUICK NOTES

These lessons are not meant to be used alone. Always pair with "mechanic skills explanations."

We broke the lessons into two parts so that teachers could make classes as long or as short as they needed. While we never do this, some schedules may call for doing an Explanation one day and a Practice another day. Other classes may be able to combine two Explanation units and two Practice units into one session. The important thing is that youth are receiving some explanation and safety information before being handed tools and bikes.

As with our Explanation units, when teaching Practice units we follow these guidelines at Bike Works:

- Ask twice as many questions as you answer.
- Emphasize a hands-on approach to learning.
- Focus on "problem solving" and "troubleshooting."
- Safety is part of every lesson.

It is particularly important to stress safety during Practice units. There are countless ways youth can bump, bang, hit, chip, scrape or otherwise dent themselves, each other, and/or the bikes. For this reason it is important to point out general safety guidelines such as, “Use tools for their intended use only.” as well as lesson-specific hints and tricks such as, “Be extremely careful of hitting your knuckles on the chain ring when you are removing crank arms.” We have done our best to include these reminders in “NOTES” boxes throughout the lessons.

Finally, be aware that some students may have never held a tool before. Start from the beginning and help students find a grip that is comfortable for them. Although it may seem like smaller people will have more trouble with loosening bolts or tightenning a cable, most seasoned mechanics will tell you it’s all about leverage. Help students learn how to position themselves in order to put gravity on their side, and how to use the best tools (the longer combination wrench for example) to get the best leverage.
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BIKE BREAK DOWN

Get those hands on those bikes! This is a chance for youth to work with tools and get a feel for the bikes without previous experience.

LESSON

Preparation:
1. Prep your work area with bikes in stands that are ready to be stripped. Make sure the stands are secure. We suggest one bike per two students, if possible.
2. Lay out tools for youth to use. Make sure tools you want youth to use are accessible and those you don’t want them to use are out of sight/reach.

Activity:
1. Break up into pairs at each work station (use strategies on p. 157–161).
2. Discuss the importance of safety and using the right tool for the right job.
3. Go over how to use the repair stand, some of the basic tools you have laid out, the name of the tool, where on the bike it is used, and where it is stored.
4. Have the youth strip bikes in pairs starting with taking off the wheels. This an engaging way to get kids working with tools without really knowing anything yet. A good way to organize strip projects is to list an order on the board.
   1. **Wheels:** Remove wheels from bike. Remove tires and tubes from wheels.
   2. **Pedals:** When most people are done with wheels, have everyone put down their tools and regroup. Spend a minute explaining drive–side and non–drive–side and how non–drive–side pedals are reverse threaded.
   3. **Cables:** Cut all cables
   4. **Brake Levers:** Remove brake levers from bars. Do not take apart further!
   5. **Handlebars and Stem:** Remove bars and stem from bike.

Follow-up:
1. Fill out the “Review Worksheet” (p. 212). This will help you plan the next class, and the next year.
2. Take a “head count” of the tools and make sure they are all in the correct places.

MATERIALS
Whatever tools and bikes you have!

RESOURCES
Review Worksheet (p. 212)
BIKE PART BINGO 1 OF 2

Help students learn the parts of the bike in a fun and easy way!

LESSON

Preparation:
1. Review your notes and “Review Worksheet” from the previous class.
2. Print out blank BINGO cards and BINGO images—one set for each student (p. 216 and 217).
3. Print out labeled image of the bicycle (p. 239).
4. Put a variety of bikes in the stands—one for each pair if possible.
5. Make a space for cutting, gluing and playing BINGO!

Activity:
1. Pass out the labeled image of a bicycle.
2. Go over the parts of the bike using one of the bikes in the stand.
3. Explain the rules of BINGO and hint at some silly prizes.
4. Using the templates provided in the appendix, give everyone time to make their own BINGO card. There are several ways to do this:
   • Allow people to cut and chose the parts they want to put on their card.
   • If you have enough bikes, assign pairs or groups to partially assembled bikes. Tell them they can ONLY include parts on their card that are on their assigned bike.
   • Have participants make a card and then trade with another participant before playing.
   • Don’t forget to leave the “FREE” space open.

MATERIALS

Labeled image of the parts of the bicycle
BINGO cards—you can prepare these ahead of time or have students make them
BINGO markers
Glue
Bikes in stands in various states of completion
Scissors
Silly prizes like bike pins, candy, tattoos, etc.

RESOURCES

Parts of the Bike—English/Spanish (p. 239)
Blank BINGO Cards (p. 216)
BINGO Card Images (p. 217)
Review Worksheet (p. 212)

SOURCE

WE Bike NYC

CONTINUED ON P. 117
5. Play BINGO! You can do four rounds of BINGO depending on time:

   Round 1: Say the name of a part and point to it on the bicycle. Also point to the image that will be on the cards.

   Round 2: Say the name of a part and point to it on the display bicycle.

   Round 3: Say the name of a part and have a volunteer point to the part on the bicycle.

   Round 4: Only point to a part on the bicycle and have the group come up with the name of the part.

6. When someone wins, you can have them come up and identify all 5 parts they covered on the display bicycle before claiming their prize.

Follow-up:

1. Fill out the “Review Worksheet” (p. 212). This will help you plan the next class, and the next year.

2. Take a “head count” of the tools and make sure they are all in the correct places.
LESSON

Preparation:
1. Review your notes and “Review Worksheet” from the previous class.
2. Just before class take a tack and pop at least one tube on each bike.
3. Write the steps to fixing a flat on the board:
   • Remove the Wheel
   • Remove the Tire
   • Patch the Tube
     1. Find and mark the hole with an “X”
     2. Sand area
     3. Apply vulcanizing fluid and let DRY
     4. Apply the patch
   • Test for leaks
   • Reinstall tire and tube—NO TOOLS!
   • Reinstall wheel and inflate to proper pressure

MATERIALS
Repair stands
13, 14, 15mm wrenches
Ballpoint pens
Sandpaper
Vulcanizing fluid
Bulk patches
Rags
Floor pumps
Holey tubes
BMX bikes with flats & worn out tires and/or wheels
Replacement tires and wheels as necessary

RESOURCES
Review Worksheet (p. 212)

CONTINUED ON P. 119
LESSON (CONTINUED FROM P. 118)

Activity:
1. After you have done the demonstration you can divide kids into pairs (use strategies on p. 157–161).
2. Let pairs get to work fixing those flats! Make sure youth do the whole process—from taking the wheel off, to tightening it back onto the bike and inflating the tire to proper pressure!
3. When they are done, have them bring it to an instructor for a final check.
4. After they have completed the entire process as a duo, give them each a popped inner tube for them to repair on their own.
5. Be sure to leave 15 minutes at the end of class for clean-up and “Final Checks” of each bike.

Follow-up:
1. Fill out the “Review Worksheet” (p. 212). This will help you plan the next class, and the next year.
2. Take a “head count” of the tools and make sure they are all in the correct places.
LESSON

Preparation:
1. Review your notes and “Review Worksheet” from the previous class.
2. Make sure you have enough front wheels for one per pair of students.
3. Write the 5½ steps of an overhaul on the board or wall.
   1. Get a rag
   2. Disassemble
   3. Clean
   4. Inspect
   5. Grease and Reassemble
   6. Adjust

Activity:
1. Review the 5½ steps of an overhaul with the students, having them explain each step to each other.
2. Pair up students, two to a bike (use strategies on p. 157–161).
3. Have students work together to overhaul the front hub.

NOTE
Remind students to use particular care with the dust caps (if they have them) and that this is the make or break portion of the repair if they approach it without caution.

CONTINUED ON P. 121
LESSON (CONTINUED FROM P. 120)

4. When students are done, have them bring their wheel to an instructor for a “Final Check.”

5. Be sure to leave 15 minutes at the end of class for clean-up!

**NOTE**

Make sure to monitor that a “stronger” student in the pair isn’t doing all the work.

**Follow-up:**

1. Fill out the “Review Worksheet” (p. 212). This will help you plan the next class, and the next year.

2. Take a “head count” of the tools and make sure they are all in the correct places.

MATERIALS & RESOURCES

See p. 120
THREADED HEADSET

PRACTICE 1 OF 2

Practice overhauling threaded headsets.

LESSON

Preparation:
1. Review your notes and “Review Worksheet” from the previous class.
2. Prepare enough bikes in stands for students to work in groups of two
3. Write the agenda and the 5½ steps of an overhaul on the board or wall.
   ½. Get a rag
   1. Disassemble
   2. Clean
   3. Inspect
   4. Grease and Reassemble
   5. Adjust

Activity:
1. Have students explain the 5½ steps of an overhaul. You can have it already written on the board, or have the students fill in the steps.
2. Pair up students, two to a bike (use strategies on p. 157–161).
3. Work slowly showing everyone how to remove the handlebars from the bike. Make sure everyone has removed their handlebars before continuing with the overhaul.
4. Overhaul that headset! Follow the 5½ steps and be sure to keep the pieces in order on your rag.
5. When students are done, have them bring their headset to an instructor for a “Final Check.”
6. Be sure to leave 15 minutes at the end of class for clean-up!

CONTINUED ON P. 123

MATERIALS

Repair stands
Allen keys
Combination wrenches
30, 32, 36, 40mm headset wrenches
Channel locks
Large adjustable wrench
Simple green
Rags
Grease
Bearings
Drop gauges
BMX bikes
Threadless stem for demo

RESOURCES

Review Worksheet (p. 212)
LESSON (CONTINUED FROM P. 122)

Follow-up:
1. Fill out the “Review Worksheet” (p. 212). This will help you plan the next class, and the next year.
2. Take a “head count” of the tools and make sure they are all in the correct places.

MATERIALS & RESOURCES
See p. 122
**LESSON**

**Preparation:**
1. Review your notes and “Review Worksheet” from the previous class.
2. Prepare enough bikes in stands for students to work in groups of two. Try to choose bikes without chain guards.
3. Write the agenda and the 5½ steps of an overhaul on the board or wall.
   1. Get a rag
   2. Disassemble
   3. Clean
   4. Inspect
   5. Grease and Reassemble
   6. Adjust

**Activity:**
1. Have students explain the 5½ steps of an overhaul in a creative way.
2. Pair up students, two to a bike (use strategies on p. 157–161).
3. Have students put their bikes in the stand non–drive–side facing the class.
4. Overhaul! Make sure to lay all the pieces out on the rag in order. Remind students about parts of the bottom bracket that are reverse threaded! The non–drive–side of the bike is “Backward Land” where everything is reverse threaded.
5. When students are done, have them bring their bottom bracket to an instructor for a “Final Check.”

**MATERIALS**
- Repair stands
- Bottom bracket wrenches
- Large and small adjustable wrench
- Simple green
- Rags
- Grease
- Spanner wrenches
- Pedal wrench
- Screwdriver
- BMX bikes

**RESOURCES**
Review Worksheet (p. 212)

CONTINUED ON P. 125
LESSON (CONTINUED FROM P. 124)

6. If students finish early, have them check all the other things on the bike that you have learned so far—headset, flat tires, front hubs. They can also lubricate the chain and clean the bike.

7. Be sure to leave 15 minutes at the end of class for clean-up and “Final Checks” of each bike.

Follow-up:

1. Fill out the “Review Worksheet” (p. 212). This will help you plan the next class, and the next year.

2. Take a “head count” of the tools and make sure they are all in the correct places.
LESSON

NOTE

Depending on what skill level you are teaching, youth can work on BMX (Beginner) or MTB (Intermediate) bikes.

Preparation:

1. Review your notes and “Review Worksheet” from the previous class.
2. Prepare enough bikes in stands for students to work in groups of two on each bike. If supplies are limited, two groups can work on each bike given it has both a front and rear brake.
3. If possible, have an extra volunteer for this lesson. Brakes are tricky and can get frustrating fast!
4. Write the agenda and the steps to a brake adjustment on the board.

   1. Wheels centered
   2. “Troubleshooting”—Look at every part of the system and replace parts as necessary.
   3. Pad alignments
   4. Cable tension—Remember your barrel adjuster!

MATERIALS

- Repair stands
- Examples of housing and cables
- Cable and housing cutters
- Tri-flow or other chain lube
- Spares for project
- Cables
- Offset brake tools
- 3rd & 4th hand tools (optional)
- Housing
- Cable ends
- Ferrules
- Brake pads
- Y-socket (8,9,10)
- Needle nose pliers
- BMX bikes

RESOURCES

- Review Worksheet (p. 212)
- Brake Types (p. 248)

CONTINUED ON P. 127
Lesson (continued from p. 126)

Activity:

1. Begin by talking about the difference between “troubleshooting” and an “overhaul.” For this lesson we don’t need to take apart every part of the brake, like we would in an overhaul, we only need to look at each part of the system and fix the parts that aren’t working well. This is called “troubleshooting.”

2. Pair up students and assign bikes (use strategies on p. 157–161).

3. Give students enough time for everyone to replace, lube and adjust a cable. Remind students to follow this order:
   - Center wheel.
   - “Troubleshooting:” Inspect entire system—replace parts if necessary.
   - Adjust pad alignment.
   - Adjust cable tension.

4. When students are done, have them bring their bike to an instructor for a “Final Check.”

5. If students finish early, have them check all the other things on the bike that you have learned so far—headset, flat tires, front hubs, bottom bracket. They can also lubricate the chain and clean the bike.

6. Be sure to leave 15 minutes at the end of class for clean–up and “Final Checks” of each bike.

Follow-up:

1. Fill out the “Review Worksheet” (p. 212). This will help you plan the next class, and the next year.

2. Take a “head count” of the tools and make sure they are all in the correct places.
REAR DERAILLEUR
PRACTICE 1 OF 2

Understand components and adjustment of the rear derailleur.
Understand the concept of “troubleshooting” and problem solving.

LESSON

Preparation:
1. Review your notes and “Review Worksheet” from the previous class.
2. Prepare enough bikes in stands for students to work in groups of two.
3. You may want to go around and re-set some of the limit screws or change the cable tension on the bikes so that they are ready for repair.
4. Beware of grip shifts! Try not to replace the cable if you can!
5. This is another good lesson for an extra volunteer in the classroom!
6. Write the agenda and the steps to adjustment on the board.
   1. “Troubleshoot;” Inspect entire system—replace parts if necessary.
   2. Adjust alignment.
   3. Adjust limit screws.
   4. Adjust cable tension—Remember your barrel adjuster!

NOTE

This lesson can be combined with “Front Derailleurs.”

MATERIALS

Repair stands
Examples of housing and cables for all systems
Cable and housing cutters
Tri–flow or other chain lube
Screwdrivers
Spares for project
Cables
Housing
Cable ends
Ferrules
Y-socket (8, 9, 10)
Allen wrenches (4, 5, 6)
Mountain bikes

RESOURCES

Review Worksheet (p. 212)

CONTINUED ON P. 129

Bike Works 2015
LESSON (CONTINUED FROM P. 128)

Activity:
1. Have students tell stories or imagine what might happen if the gears weren’t working properly.
2. Pair up students, two to a bike (use strategies on p. 157–161).
3. Give students enough time for everyone to replace, lube and adjust a cable. Remind students to follow the adjustment steps on the board. Be sure to stress “TROUBLESHOOTING FIRST!” Many times youth will struggle with adjusting a rear derailleur for an hour only to realize they need to replace a rusty cable or their housing is frayed. Those are the things “troubleshooting” should find first!
4. When students are done, have them bring their bike to an instructor for a “Final Check.”
5. If students finish early, have them check all the other things on the bike that you have learned so far—headset, flat tires, front hubs, bottom bracket. They can also lubricate the chain and clean the bike.
6. Be sure to leave 15 minutes at the end of class for clean–up and “Final Checks” of each bike.

Follow-up:
1. Fill out the “Review Worksheet” (p. 212). This will help you plan the next class, and the next year.
2. Take a “head count” of the tools and make sure they are all in the correct places.

NOTE
This lesson has the most potential for the glazed over student factor. Make sure you keep them engaged and talking. Be wary of overwhelming them with unnecessary information by keeping your lesson short and to the point.

MATERIALS & RESOURCES
See p. 128
LESSON

Preparation:
1. Review your notes and “Review Worksheet” from the previous class.
2. Prepare enough bikes in stands for students to work in groups of two.
3. You may want to go around and re-set some of the limit screws or change the cable tension on the bikes so that they are ready for repair.
4. This is another good lesson for an extra volunteer in the classroom!
5. Beware of grip shifts! Try not to replace the cable if you can!
6. Write the agenda and the steps to adjustment on the board.
   1. “Troubleshoot;” Inspect entire system—replace parts if necessary.
   2. Adjust height.
   3. Adjust alignment.
   4. Adjust limit screws.
   5. Adjust cable tension—remember your barrel adjuster!

MATERIALS
Repair stands
Examples of housing and cables for all systems
Cable and housing cutters
Tri-flow or other chain lube
Screwdrivers
Spares for project
Cables
Housing
Cable ends
Ferrules
Y-socket (8, 9, 10)
Allen wrenches (4, 5, 6)
Mountain bikes

RESOURCES
Review Worksheet (p. 212)

CONTINUED ON P. 131
LESSON (CONTINUED FROM P. 130)

Activity:

1. Have students tell stories or imagine what might happen if the gears weren’t working properly.
2. Pair up students, two to a bike (use strategies on p. 157–161).
3. Give students enough time for everyone to replace, lube and adjust a cable. Follow the steps on the board. Remind students to “TROUBLESHOOT FIRST!” Cable tension won’t fix a problem if the housing is blown.
4. When students are done, have them bring their bike to an instructor for a “Final Check.”
5. If students finish early, have them walk around the shop and “tour” different kinds of shifting systems. Can they find a grip shift, downtube shifter, trigger shifter, bar end shifter, and an STI shifter?
6. If students still have time, have them check all the other things on the bike that you have learned so far—headset, flat tires, front hubs, bottom bracket, front derailleur and brakes. They can also lubricate the chain and clean the bike.
7. Be sure to leave 15 minutes at the end of class for clean-up and “Final Checks” of each bike.

Follow-up:

1. Fill out the “Review Worksheet” (p. 212). This will help you plan the next class, and the next year.
2. Take a “head count” of the tools and make sure they are all in the correct places.
LESSON

Preparation:
1. Review your notes and “Review Worksheet” from the previous class.
2. Prepare enough bikes in stands for students to work in groups of two. If you don’t have enough threadless headset bikes, have students work on what you have.
3. This is the portion of the class where students may be falling behind on their bike projects if they had harder bikes to work on or any unforeseen problems—make sure that they get ample time to do their work and catch up if they can.
4. Write the agenda and the 5½ steps of an overhaul on the board or wall.
   ½. Get a rag
   1. Disassemble
   2. Clean
   3. Inspect
   4. Grease and Reassemble
   5. Adjust

MATERIALS
Repair stands
Allen keys
Combination wrenches
Simple green
Rags
Grease
Bearings
Drop gauges
Mountain bikes w threadless headsets

RESOURCES
Review Worksheet (p. 212)
Threadless Headset—Exploded (p. 247)

CONTINUED ON P. 133
Activity:

1. Review the 5½ steps of an overhaul. Be creative! Have students do the majority of the talking during the review.
2. Remind students that the cable routing of bikes with gears will be much more complex than the bikes they have worked on in the earlier classes, have them take a mental picture of the front of the bike before starting their work.
3. Pair up students, two to a bike (use strategies on p. 157–161).
4. Overhaul! Remind students to share the work.
5. When students are done, have them bring their headset to an instructor for a “Final Check.”
6. If students finish early, have them check all the other things on the bike that you have learned so far—headset, flat tires, front hubs. They can also lubricate the chain and clean the bike.
7. Make sure to leave 15 minutes for clean up! If a student pair is really struggling with an adjustment feel free to fix it for them at this point so that it gets back together.

Follow-up:

1. Fill out the “Review Worksheet” (p. 212). This will help you plan the next class, and the next year.
2. Take a “head count” of the tools and make sure they are all in the correct places.
3-PIECE BOTTOM BRACKET PRACTICE 1 OF 2

Practice overhauling a 3-piece bottom bracket.

LESSON

Preparation:
1. Review your notes and “Review Worksheet” from the previous class.
   If possible, remove crank arms and re-assemble before class to avoid a seized crank arm situation.
2. Prepare enough bikes in stands for students to work in groups of two.
3. Challenge the students’ sense of vocabulary by using bicycle language yourself and encouraging them to use precision in their speech.
4. This is a great lesson for extra volunteers!
5. Write the agenda and the 5½ steps of an overhaul on the board or wall.
   - Get a rag
   - Disassemble
   - Clean
   - Inspect
   - Grease and Reassemble
   - Adjust

NOTE

It is very important during disassembly that you have all instructor hands on-deck to ensure that there is no cross-threading happening when removing crank arms.

MATERIALS

Repair stands
Bottom bracket sockets
Large and small adjustable wrench
Allen keys
Simple green
Lockring wrench
Spanner wrenches
Rags
Grease
Crank pullers
Screwdriver
Pedal wrench
Mountain bikes
Bottom Bracket chart

RESOURCES

Review Worksheet (p. 212)
Bottom Brackets (p. 250)

CONTINUED ON P. 135
LESSON (CONTINUED FROM P. 134)

Activity:

1. Have students explain the 5 1/2 steps of an overhaul. Get creative! Assign each person one step in the overhaul process. Have them act out their step without making any words. Have the rest of the students put the 6 actors in order without talking or making any noise!

2. There may be several different types of bottom brackets on the class bikes. Take some time to tour the classroom and look at the different systems. Display the Bottom Bracket chart (p. 250) to show students the various ways to take on and off a 3-piece bottom bracket based on the country of origin for the part/bike.

3. Remind students to look for washers when they remove the cranks/crank bolts!

4. Pair up students, two to a bike (use strategies on p. 157–161).

5. Overhaul! Make sure to remind students to tighten the crank puller in the crank with the adjustable wrench before extracting the cranks.

6. When students are done, have them bring their bike to an instructor for a “Final Check.”

7. If students finish early, have them check all the other things on the bike that you have learned so far, lubricate the chain and clean the bike.

8. Be sure to leave 15 minutes at the end of class for clean-up and “Final Checks” of additional work on each bike.

Follow-up:

1. Fill out the “Review Worksheet” (p. 212). This will help you plan the next class, and the next year.

2. Take a “head count” of the tools and make sure they are all in the correct places.
LESSON

Preparation:

1. Review your notes and “Review Worksheet” from the previous class.

2. Prepare enough bikes in stands for students to work in groups of two. Try to get as many different kinds of brake systems in the stands as possible. Try to group similar types of systems together in the classroom so that students can help each other, and you don’t have to move around as much.

3. Prep the bikes by making subtle or not-so-subtle changes in the brakes that need to be fixed.

4. Write the agenda and the steps to brake adjustments on the board.
   
   1. “Troubleshoot”
   2. Cables and Housing
   3. Canti–Hangers and Straddle Cables
   4. Ferrules and End Caps
   5. Cable Tension
   6. Centering and Springs
   7. Brake Pads

NOTE

In the advanced classes, try to challenge the students’ sense of vocabulary by using bicycle language yourself and encouraging them to use precision in their speech.

MATERIALS

- Repair stands
- Bikes
- Rags
- Simple green Sandpaper
- Tri–flow or other lube
- Cable cutters
- Offset brake tools
- 3rd & 4th hand tools
- Housing
- Cable ends
- Ferrules
- Brake pads
- Y-socket (8/9/10) wrench
- Hex wrenches
- 9/11 & 8/10 brake wrenches
- Screwdrivers
- Examples of cables
- Examples of brakes and pads

RESOURCES

- Review Worksheet (p. 212)
- Brake Types (p. 248)
- Brake Type Flow Chart (p. 249)

CONTINUED ON P. 137
LESSON (CONTINUED FROM P. 136)

Activity:
1. Pair up students, two to a bike (use strategies on p. 157–161).
2. Review the steps on the board having youth explain each part.
3. Have at it! Remind students to “TROUBLESHOOT FIRST!”
4. Have all adjustment brought to an instructor for a “Final Check” before moving on.
5. If students finish early, have them check all the other things on the bike that they have learned so far, lubricate the chain and clean the bike.
6. Give students a chance to work on more than one type of brake. After they have adjusted their bike, have them “prep” it for the next group by making changes that need to be adjusted by the next mechanics.
7. Have a more in-depth discussion about disk brakes, hydraulic brakes and specific tips for “squealy brakes” if you have time.
8. Be sure to leave 15 minutes at the end of class for clean–up and “Final Checks” of each bike.

Follow-up:
1. Fill out the “Review Worksheet” (p. 212). This will help you plan the next class, and the next year.
2. Take a “head count” of the tools and make sure they are all in the correct places.

MATERIALS & RESOURCES
See p. 136
Practice looking at the drive train as a unit and adjusting all the parts together.

LESSON

Preparation:
1. Review your notes and “Review Worksheet” from the previous class.
2. Prepare enough bikes in stands for students to work in groups of two.
3. Make sure to have a bike manual (or several) to use for reference if students start getting frustrated.
4. Prep the bikes by making subtle or not-so-subtle changes in the gears that need to be fixed.
5. Have some extra chain available for trying out the chain tool.
6. Write the agenda and steps to adjustment on the board.

Rear:
1) “TROUBLESHOOT”
2) Alignment
3) Limit screws
4) Cable Tension

Front:
1) “TROUBLESHOOT”
2) Height
3) Alignment
4) Limit screws
5) Cable tension

MATERIALS
Repair stands
Bikes
Examples of housing and cables for all systems
Cable and housing cutters
Tri-flow
Screwdrivers
Cables
Cable ends
Ferrules
Rags
Simple green
Chain checker
Chain removal tool
Allen keys
Y-socket wrench
9/11 & 8/10 wrenches
Freewheel example (off a bike)
Cassette example (off a bike)

RESOURCES
Review Worksheet (p. 212)

CONTINUED ON P. 139
LESSON (CONTINUED FROM P. 138)

NOTE

This class has the potential to get very frustrating for some as derailleurs can be particularly challenging. Help the students with techniques on how to work through their feelings [like Scenic Turnout (p. 175)] and remind why they are doing it in the first place.

Activity:

1. Pair up students, two to a bike (use strategies on p. 157–161).
2. Have at it! Remind students to start by “troubleshooting” the whole system.
3. If students finish early, have them check all the other things on the bike that they have learned so far, lubricate the chain and clean the bike. They can also practice breaking and re–connecting a chain with the chain tool.
4. When students are done, have them bring their bike to an instructor for a “Final Check.”
5. Be sure to leave 15 minutes at the end of the lesson to clean up!

Follow-up:

1. Fill out the “Review Worksheet” (p. 212). This will help you plan the next class, and the next year.
2. Take a “head count’ of the tools and make sure they are all in the correct places.
Practice overhauling a rear hub.

LESSON

Preparation:
1. Review your notes and “Review Worksheet” from the previous class.
2. Prepare enough bikes in stands for students to work in groups of two.
3. Make sure to have a bike manual (or several) to use for reference if students start getting frustrated.
4. Challenge the students’ sense of vocabulary by using bicycle language yourself and encouraging them to use precision in their speech.
5. Write the agenda and the 5½ steps of an overhaul on the board or wall.

½. Get a rag
1. Disassemble
2. Clean
3. Inspect
4. Grease and Reassemble
5. Adjust

MATERIALS

- Repair stands
- Bikes
- Cone wrenches
- Combination wrenches
- Bench vice
- Axle vice
- Freewheel remover
- Chain whip
- Giant adjustable wrench
- Cassette lockring tools
- Grease
- Rags
- Simple green
- Cleaning brushes
- Torque wrench (optional)

RESOURCES

- Review Worksheet (p. 212)
- Rear Freewheel Hub—Exploded (p. 246)

CONTINUED ON P. 141
LESSON (CONTINUED FROM P. 140)

Activity:
1. Review the 5½ steps of an overhaul. Get creative! If students are mature enough to stay positive and not get mean, have them explain the steps while imitating the teaching style of one of their teachers. Have students (and staff) guess which teacher it is!
2. Get to it! Remind students to take extra care when working with freewheels and cassettes.
3. Make sure the students know that they need to get their adjustment checked by an instructor EVERY TIME before fully reassembling their bike. They also need to sign off on each job as they finish—this is an important habit for working in a shop.
4. If students finish early, have them check all the other things on the bike that they have learned so far, lubricate the chain and clean the bike.
5. When students are done, have them bring their wheel to an instructor for a “Final Check” before putting it back in the bike.
6. Be sure to leave 15 minutes at the end of class for clean-up!

Follow-up:
1. Fill out the “Review Worksheet” (p. 212). This will help you plan the next class, and the next year.
2. Take a “head count” of the tools and make sure they are all in the correct places.

NOTE: Make sure students use caution when threading freewheels back onto the wheel as they could turn disastrous if improperly threaded.
Practice concepts of wheel building and truing.

LESSON

Preparation:
1. Review your notes and “Review Worksheet” from the previous class.
2. Prepare one bike for each student. They will true both the front and rear wheels.
3. This class requires special preparation to round up enough truing stands. Plan in advance!
4. Have additional practice wheels on hand for students who move fast or whose wheels don’t need much truing.
5. Have an example of a bent (versus out of true) rim.
6. Write the steps to truing a wheel on the board along with the agenda.
   1. Remove the wheel
   2. Put the wheel in the stand
   3. True laterally with the tire on
   4. True radially with the tire off
   5. Check spoke tension with a tensiometer
   6. Check wheel dish with a dishing tool
   7. Clean the wheel

MATERIALS

Truing stands
Spoke wrenches
Dishing tool
Tensiometer
Tri-Flow
Rags
Demo wheels, rims, hubs, spokes

RESOURCES

Review Worksheet (p. 212)
Parts of the Wheel (p. 245)

CONTINUED ON P. 143
LESSON (CONTINUED FROM P. 142)

Activity:
1. Remind students to work in SMALL increments. A quarter turn at a time is enough. In addition, they’ll have to go back and forth between radial and lateral truing a few times.

2. If students finish early, have other wheels they can work on. Throw a bent rim in the mix and talk about why it can’t be trued. What can you do in this instance?

3. When students are done, have them bring their wheels to an instructor for a “Final Check.”

4. Be sure to leave at least 15 minutes at the end of class for clean-up and any additional adjustments.

Follow-up:
1. Fill out the “Review Worksheet” (p. 212). This will help you plan the next class, and the next year.

2. Take a “head count” of the tools and make sure they are all in the correct places.
ADDITIONAL ACTIVITIES
Quick Notes

Youth classes don’t always go according to plan. Sometimes it’s raining on the day you want to go riding or you finish an Earn–a–Bike class to learn that no one knows how to ride a bike. In addition, sometimes students will be absent, and it’s great to plan in some make-up time to everyone gets a chance to learn all the material.

We suggest planning in at least one make-up day for every 6–ish classes and definitely one on or before the last day of graduation. These classes are important for many reasons. They allow students to miss a class and still graduate with all the skills. They allow students to have time to work on particularly challenging parts of their bike without rushing. And they provide an opportunity for youth to teach each other in a teach-back format.

These classes should follow the same pedagogical guides as all our other units, and this is a great time to make these four guides known to the youth who will be doing much of the teaching.

- Ask twice as many questions as you answer.
- Emphasize a hands-on approach to learning.
- Focus on “problem solving” and “troubleshooting.”
- Safety is part of every lesson.

A helpful tool for these classes is the idea of “mentor mittens.” These can be actual or metaphorical mittens that peer teachers should wear while working with fellow students. As a peer teacher, youth should not be doing any repairs that they couldn’t do with mittens on. Let the student do the repair and use words to help them along. Suggest this idea to students when they are teaching each other. Emphasize explaining the work, not doing the work for someone.
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**CHAIN TOYS**

Learn how to use the chain tool. Make keep-sakes and old toys.

---

**LESSON**

**Bracelets and Key Chains:**
This is a great way to practice using the chain tool, to talk about “stiff links” and to make something that youth can take with them. A “stiff link” is when a pin doesn’t roll smoothly within the chain. It often happens because of rust or dirt, but you can create them by pushing the pin a tiny bit with a chain tool. Create “stiff links” with the chain tool to create a star, heart, circle, and more! You can also spray paint them gold or other colors with enamel spray paint.

**Chain Widgets:**
Make a “chain widget” by connecting 4 pieces of chain into a little toy that can move back and forth. This is a great toy for students who have trouble keeping their hands off the tools during explanation time. Encourage youth to keep their to pull out their chain widget to keep their hands busy while you are talking.

**Gifts:**
This is particularly fun to do around the holidays. Have students make any of the above widgets or keychains and create little pouches out of innertubes in order to give them as gifts.

**Rewards:**
Make some stars, widgets or other designs. Spray paint them gold and hand them out as rewards! You can do rewards daily for “hardest working”, “best at dealing with frustration”, “most helpful” etc. At the end of the day have the winner from yesterday chose who to pass it on to today. Or make a bunch and hand them out at graduation!

---

**MATERIALS**
Old (or new) chains
Cleaning supplies
Simple Green
Toothbrushes
Tub of water
Rags
Chain breaker

**RESOURCES**
None

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**FRAMEWORKS**
Additional Activities

---

BIKE WORKS 2015
THE "I CAN"

Encourage positivity in the classroom!

LESSON

1. Introduce the bland can at a time when the students seem plagued with the thought that “I can’t do this.”

2. Anytime someone says, “I can’t...” they then receive the “I Can” and must carry it on their body until someone else says “I can’t!”

3. If the group stops saying “I can’t,” celebrate by opening the can and indulging in the contents.

4. It might be good to precede the introduction of the “I Can” with a discussion about the difference between “Can’t” and “Won’t.”

MATERIALS

Can of candies or something sweet with the label removed and a carrying loop attached.

RESOURCES

None
LESSON

On a particularly nice day, after standardized tests, or whenever you need to change the energy of a group, it can be great to get out of the shop! Use the Outside Scavenger Hunt/Jugar a los Escondidos (p. 218) or make your own!

1. Have youth form groups or have them work in one large group.

2. Hand out one scavenger hunt paper to each group along with a pen or pencil and a digital camera if possible. Youth can also use their phones to “document” findings. Make it clear if a picture is necessary for a find to “count.”

3. Assign boundaries. For example, “Stay between MLK Jr. Drive and Rainier Street and don’t go farther east than Bike Works or farther west than the coffee shop.”

4. Assign a time to meet back at the classrooms.

5. If you have enough staff you can send a staff with each group, but be sure to let students work out team roles on their own.

6. Once you all meet back at the classroom, share what you found and tally up points. (Or call everyone a winner and have a snack.)

MATERIALS

Scavenger Hunt sheets
Pens or pencils
Digital camera for photographing finds (optional)

IMAGES

Outside Scavenger Hunt/ Jugar a los Escondidos (p. 218)
Explore the community and how it interacts with the class. Learn/Review how to use community resources like maps and public transportation for travel by bike.

COMMUNITY MAP PROJECT 1 OF 2

LESSON
This is a good way to familiarize youth with bike maps, multi-modal transportation and route planning. It’s also a great project if you were planning on riding bikes and it is raining, snowing, 100 degrees or otherwise a terrible day to be outside.

NOTE
This can be adapted for different skill levels. If you have older students, you might want to give each of them their own bike map. If you have younger students, it might be good to all work together on one map. Keep in mind also, many youth are used to maps on computers and may need a refresher/introduction to orienting a map, how to use the key and scale.

1. Using the individual maps or group maps, have students put a dot on the map where they live, or places they often visit. Also be sure to put a dot on your current location. Stickers can work well, or markers.

2. If time and weather permit, go outside and use the map to walk around the area. Notice the different codes for streets according to the key on the map—what does a “bike trail” look like as opposed to a “sharrows” (chevrons) street or a specified “bike lane.” Try to see as many different kinds of roads as possible. (This may take some prior planning on the part of the staff to craft a short but diverse route.)

3. Next, take some time to plot the best routes from students’ homes to the location of the class. Set a reasonable radius—probably less than 3 miles for biking. If students live outside that radius, talk about multi-modal transport—can they take the light rail or subway somewhere nearby? Is the bike share system an option? What about the bus system? How do you carry bikes on each of these transit options?

CONTINUED ON P. 153

MATERIALS
Community bike maps (if available)
Other maps of the area:
Topographic maps
Street maps
Train maps
Bus maps
Any other maps you can find
Stickers (optional)
Markers

SOURCE
WE Bike NYC
LESSON (CONTINUED FROM P. 152)

4. Practice picking up bikes, walking up and down stairs and standing bikes up on the rear wheel in tight spaces.

NOTE

If you carry a bike rear wheel first, arm OVER top tube, seat on shoulder going up the stairs, you won’t strain your back. To go down the stairs, go front wheel first, seat on shoulder, arm over top tube.

Be creative with your maps—have students plan a ride for the group to take. Or make a “school—after school—home loop” for each student. Pick a location and have groups work together to make a route from the class to the location. Compare maps—what was the group’s priority? To stay on bike lanes? To take the fewest turns? To avoid hills?
Opportunity for leadership and peer-teaching. Review key concepts.

Lesson
It is likely that some students will miss some classes. For this reason it is a good idea to build in AT LEAST one class for every 6 classes that is a “Make-Up Day.” This is a great way to get a feel for how students are doing as well as provide a leadership opportunity.

Depending on how many students missed what class, this can be done in several ways.

Small Group Presentations (15 min)
If a large portion of the class was out the same day (class field trip, day before a holiday, etc.) you can use the day with few students to prepare a lesson they will teach the class later.

Expert Stations (30 min)
If there are a few students out at different times, keep track of who missed what class(es). Then set up “teach-back stations.” If you have had five classes, set up five stands and assign a topic to each stand. Then assign an “expert” to each stand to teach that skill. You can pair students up based on what classes they missed, or do a round-robin where each student is at each station for a few minutes, learning key ideas, before moving on to another station. Peer teaching is a great way to foster leadership. In particular, allowing students to present to each other in small groups helps build confidence in a low-stakes setting.

Materials
Tools and bikes necessary for the lessons you are reviewing.

Resources
None

Source
YMCA “GOLD” program
David P. Weikart Center for Youth Program Quality

CONTINUED ON P. 155
LESSON (CONTINUED FROM P. 154)

ROVING EXPERTS (30 MIN)

Another way to do teach-back stations is to have a series of stands set up with an instructor at the first stand.

1. Have the rest of the group play a game such as “Earth People” (p. 58) while the instructor teaches a student about the task at that stand—for example “brakes” for about five minutes. This should be mostly a review, so five minutes should be enough.

2. Then have student A stay at stand #1 while the teacher moves to stand #2.

3. Have another student (Student B) go to Stand #1 and learn the five minutes of information from Student A.

4. Then have Student A move on to stand #2, while student B stays to be the expert at stand #1.

5. Continue until all the students have gone through all the stands having a chance to be the student and the expert.

TEAM STATIONS (30 MIN)

Set up the stations in a round-robin format and have students travel in pairs or small groups to each station. There they can work together to complete a task or teach each other the skill for that station.

END OF DAY TEACH-BACKS (5 MIN)

Have one student boil down what was learned that day into 1-2 sentences. This can be a great daily ritual if you save time for it!

Teach-backs can be incredibly valuable for catching up students who have fallen behind, reviewing for students who may have forgotten, and providing opportunities for students to lead and teach one another.

CONTINUED ON P. 156
LESSON (CONTINUED FROM P. 155)

JIGSAW (30 MIN)

1. Begin with students in small groups of 3–5. Determine which subtopics you want small groups to discuss. For teach–back, these may be the lessons that have been covered so far in the class.

2. Have small groups “count off” up to the number of subtopics.

3. Assign one subtopic per number and have youth with that number meet with others of that number.

4. Give the new small groups enough time to become “experts” in their subtopics.

5. Have the original small groups re–form.

6. Provide time for each youth to share the information they learned while in his or her “expert” group with their original group.

MATERIALS & RESOURCES

See p. 154

MAKE-UP ACTIVITIES 3 OF 3
WAYS TO BREAK INTO GROUPS 1 OF 5

Help youth break into groups using these fun ideas!

LESSON

FAMOUS TRIO

1. Before the activity decide how many different groups you need and create sets of cards that reflect famous trios. Each card should have one member of the trio on it. You can use words or pictures.

2. As you begin the activity, distribute one card to each participant.

3. Explain, “Your card contains one member of a famous trio. Find the other two members of your trio to form groups of three for the next activity.”

4. Go around and make sure that groups are forming correctly.

BIKE VARIATION:

Instead of using cards, have a set of bike parts—bottom bracket, cranks, pedals; headset, handlebars, grips; etc. It is also possible to use tool and part combos—cone wrench, hub, bearings; 10mm wrench, 10 mm nut, matching bolt; etc.

CONTINUED ON P. 158
LESSON (CONTINUED FROM P. 157)

FIND YOUR MATE
This is great for youth who don’t yet know each other!
1. Give each participant a slip of paper or index card with the name of another participant designated as his or her partner.
2. Ask participants to introduce themselves to others in the room until they find the person listed as their partner.
3. Partners all sit down once they have found each other.

VARIATION: UNIQUE FACTS
At the end of one class, have each participant write something unique about themselves on an index card. At the beginning of the next class, hand out the index cards. Participants must interview each other until they find the person who has the unique skill or trait listed on their card.

CHALKBOARD
This works well when youth are staggered when finishing a task.
1. Explain, “When you finish you individual work and are ready to work in a trio, write your name on the chalkboard. If someone has already written their name, write your name under it and then go and sit with that person. If two names are already there, erase both names and go sit with those two people and begin your trio work. The next person writes his or her name to begin a new trio group.”
2. Monitor the groups as they form to make sure that youth follow the instructions and no one is left out.

CONTINUED ON P. 159
**LESSON (CONTINUED FROM P. 158)**

**ANIMAL SOUNDS/ MOVE LIKE A...**

1. Decide on the number of groups you need and the number of youth per group.
2. Create cards based on certain categories.
3. Distribute cards to participants.
4. Give everyone an opportunity to think about their category.
5. Instruct participants to wander around the room representing what is on their card with their movements. Noises are OK but no words should be spoken.
6. After a minute or so, instruct participants to find peers who are acting out the same category.
7. Check to make sure groups were formed correctly, and then proceed with the activity.

*Example categories:*

- Animals (either specific animals- i.e. find another pig, or categories like reptile, mammal, bird, etc.)
- Professions (medicine, construction, food industry, law, education, etc.)
- Musical genres (hip-hop, rock, country, classical, etc.)
- Written genres (poetry, novels, comics, news, etc.)
- Types of bike (mountain bikes, road bikes, BMX, etc.)

**COUNT-OFF**

The old stand-by! Have the group count off by 3’s, 4’s, and 5’s to fit your needs. Have each number re-group somewhere in the classroom.

**CONTINUED ON P. 160**
LESSON (CONTINUED FROM P. 159)

FOLD THE LINE
1. Determine how many groups you need and what size they should be.
2. Instruct youth to form a line. You can be creative here—have students like up by height, birthday, age, rainbow t-shirt color, etc.
3. If there are an even number of participants, instruct the youth at one end to “fold the line” by moving to stand across from the youth at the other end of the line. The rest of the line follows, with each youth facing another youth in the line.
4. If there is an odd number of participants, have the person exactly in the middle step out of the line and join a group after everyone is paired off.
5. Form your groups by separating off groups of participants from the folded line. Those across from each other can be partnered or put into groups based on the size the facilitator would like, pairs and fours work best.

GROUP BY CATEGORIES
1. Determine how many groups you need and what size they should be.
2. Determine what category you want to form groups by.
3. Instruct youth to form groups based on the given category.
4. Instruct youth to talk about what it’s like to be a member of that particular category before moving on to the main activity.

Example categories:
- Age groups
- Season or month born
- Extracurricular interests/activities

CONTINUED ON P. 161
WAYS TO BREAK INTO GROUPS 5 OF 5

LESSON (CONTINUED FROM P. 160)

INDEX CARD PUZZLE

1. Cut index cards in half creatively (or thirds or quarters)—so that only those two parts match.
2. Pass out one half-card to each student.
3. Instruct students to find the matching half of their card.

TONGUE DEPRESSOR NAMES

1. Keep a can of tongue depressors with the name of every student on a depressor.
2. Choose two depressors at a time; they are partners.

MATERIALS & RESOURCES

See p. 157
SAFETY
Safety should be part of EVERY lesson, but these are a few modules that can stand on their own—and make things fun! In addition to physical safety, it is our job as educators to create an environment that feels safe emotionally. That means a “No Tolerance Policy” for bullying or hateful language. It also means providing youth with the skills and support to work through conflicts and disagreements. At Bike Works we use the V.O.M.P. method (p. 174) for conflict resolution. It empowers youth to share their feelings, take responsibility for their actions, think about where the other person is coming from and make a plan for the future. By practicing and using this type of framework we help youth work through their own conflicts, without always asking a staff member to resolve issues. There are many conflict resolution methods out there, and we encourage you to use whatever works for you. The important thing is to practice conflict resolution before there is a conflict. That means introducing these models and working through scenarios when youth are working well together. In addition to the activities below there are a million great safety activities online, in particular at the National Highway Traffic Safety Administration site: www.nhtsa.gov. Remember, if we don’t model what we are teaching, we are teaching something else.
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**ABC QUICK CHECK**

An easy to remember bike safety check for every ride!

**LESSON**

Before EVERY ride run through the ABC Quick Check and “Head to Toe” (p. 168) to be sure everyone is ready to go.

**Air**  
Pinch the side of the tires; they should be firm.

**B brakes**  
Make sure brakes work and aren’t rubbing the tires.

**Crank/chain**  
Make sure the bike pedals smoothly and the chain is tight.

**Quick releases**  
Quick-release levers and/or axle bolts (on wheels) should be tight.

**CHECK**  
Listen for any strange noises or looseness.  
You know your bike. Does anything feel “off”?

**VERSIÓN EN ESPAÑOL:**

“Si seguro quieres viajar, llantas, frenos y cadena tienes que revisar.”

**MATERIALS**

Kids and bikes!

**RESOURCES**

None
HEAD TO TOE
An easy to remember personal safety check for every ride!

Before EVERY ride run through the ABC Quick Check (p. 167) and “Head to Toe” to be sure everyone is ready to go. Encourage youth to check each other and themselves!

HEAD
Start at the top. Is your helmet on? Is it strapped? Does it fit properly? (p. 169)

EYES
Do you have sunglasses on? These cut down on glare and also keep out wind and bugs!

BODY
Do you have sunscreen on? Don’t forget the tops of your ears!

HANDS
Do you have riding gloves on? These are a great way to save skin on hands if someone is to fall. If you are able, keep a stash of gloves for youth to borrow.

TOES
Are your shoes tied? Are all your laces tucked in? No “Bunny Ears!”

MATERIALS
Kids and bikes!

RESOURCES
None
HELMET FITTING: EYES, EARS, MOUTH

An easy to remember helmet fitting technique.

LESSON
Have students check their own helmet and each other's before EVERY ride.

EYES
Helmet should sit level on your head and rest low on the forehead, one to two finger widths above the eyebrows. A helmet pushed up too high will not protect the face or head well in a fall or crash.

EARS
The straps should be even, form a “Y” under each earlobe, and lay flat against the head.

MOUTH
The buckled chin strap should be loose enough so that you can breathe. There should be enough room so you can insert a finger between the buckle and chin. It should be tight enough that if you open your mouth, you can see the helmet pull down on top.

MATERIALS
Kids and helmets!

SOURCE
Bicycle Coalition of Maine
Seattle Children's Hospital
Community Education Program
LESSON

1. Start by talking to youth about their biking habits. Do they wear a helmet when they bike? Do other people they know wear helmets? Why do students think people wear helmets? Why not? (Be careful about getting into story-telling about people who have been in a crash. The idea is to stress that wearing a helmet is important, not to scare youth away from riding.)


3. Set up the demonstration as a way to show how effective helmets can be. Here are a few statistics from the NHTSA:
   - Helmets are 85– to 88–percent effective in reducing head and brain injury.
   - Wearing a bicycle helmet is the single most effective way to reduce head injuries and fatalities resulting from bicycle crashes.
   - A properly worn bicycle helmet cushions the head when it hits a hard surface such as a road or sidewalk, even from hard impacts on grass and dirt. The inner portion of a helmet is a crushable liner that absorbs and reduces the force of impact to the head.
   - Always wear the proper helmet for bicycling; there are varying types of helmets for different sports. Each helmet is designed based on the particular sport. There are some helmets designed for multi-sport use; make sure the helmet label reads the helmet is suitable for bicycling.

MATERIALS

Helmet
Large honeydew melon
Markers
Ladder or high place to drop stuff from (like a playground structure)
Tarp
Paper towels
Knife for cutting up melon (or extra, pre-cut melon)

SOURCE

National Highway Traffic Safety Administration

CONTINUED ON P. 171
LESSON (CONTINUED FROM P. 170)

4. Prepare the melon! Give it a name, draw a face and hair! Get silly!
5. Properly fit the helmet on the melon.
6. Stand on a chair or ladder and drop the melon (helmet side down) onto the tarp.
7. What happened? The melon most likely did not break because the helmet absorbed the force of the fall. If it does brake, note that we can be injured even when wearing a helmet!
8. Drop the melon without the helmet next.
9. What happened? Most likely, the melon broke. If the melon did not break, it was bruised. Look for a soft spot on the melon and explain that this will be a larger bruise in a few days. Explain that the same happens with a head. Brain bruises are called ‘concussions.’
10. Mention that a helmet should be replaced once it has been in a crash. In addition, any time a youth hits their head on a ride, they should tell an adult—even if they feel fine.
11. Cut up the melon and enjoy a delicious treat!
SHOP SAFETY 101: THE RULES

Shop safety guidelines.

LESSON

You can present these rules however you see fit. Often it’s good to have students brainstorm the rules they think are important and then just add in the ones that were not touched upon. See the Group Contracts activities (p. 27–33) for more ideas.

Below are the rules that are used at Bike Works. Yours may be different. Focus on creating “positive rules” that encourage specific behaviors, as opposed to saying “don’t” or “no.”

CLASSROOM RULES

1. RESPECT... yourself, instructors, classmates, the shop, tools, and all bikes.
2. Act safely and responsibly.
3. Practice safe riding habits- always wear a helmet when riding to or from Bike Works.
4. Clean up your workspace and the shop.
5. Waste nothing!
6. Leave all tools and parts in the shop.
7. Ask questions.
8. ENJOY YOUR WORK AND BE PROUD OF YOUR ACCOMPLISHMENTS.

**Bike Works needs to be a safe place for everyone. Any violence or discriminatory language based on race, gender, sexual orientation, age, class, ability, nationality, or religious belief will not be tolerated.**

MATERIALS

Printed list of rules or big sign

RESOURCES

None
10 THINGS TO BRING ON A BIKE RIDE

Equipment list for a successful and safe ride.

LESSON

**Get creative! There's no wrong way to teach this list.**

Brainstorm

Have the youth brainstorm as many things as they can think of to bring and then narrow it down to 10.

Charades

Pass out cards with each of the 10 things on them. Have each person act out their object without using words while the rest of the youth guess.

What's in my backpack?

Pass around a backpack and have each student take out one thing. Talk about why it is one of the “Big Ten” and what other variations they could bring. For example, if someone takes out a cliff bar, what other food could you substitute instead? Is chocolate the right kind of nourishment? What things will last through a long hot ride without getting squished, spilling, melting or going bad?

The Big Ten

1. Food
2. Water
3. Helmet
4. Extra clothing/ rain gear
5. Multi tool/ repair tools
6. Patch kit
7. Pump
8. Sun glasses
9. Wallet/ Spare money and ID
10. Map

MATERIALS

List of “10 Things”

RESOURCES

None
V.O.M.P.  
CONFLICT RESOLUTION

Conflict resolution model for youth (and adults!).

LESSON

Emotional safety is an important component of creating a safe space. Be sure to have a way of dealing with conflict in the classroom. At Bike Works we use this model because it encourages youth to take responsibility for their actions, feelings and futures.

VOICE

Have each student voice what is happening for them. i.e. “He threw water on my face!”

OWN

Own your feelings! Encourage each student to rephrase their frustration. “I am upset because the water on my face made me cold and it hurt my feelings that it was thrown at me.”

MILE

Walk a mile in the other person’s shoes. Have the students vocally express what they think it would feel like to be the other person. “I suppose he was trying to cool me down because I looked really hot.”

PLAN

Make a plan. Have the students work together to come up with a solution to the problem. For example, “Next time you should ask before you splash your water on me.”

MATERIALS

None

RESOURCES

None
SCENIC TURN-OUT: FRUSTRATION TOLERANCE

Technique to help youth deal with frustration in a healthy way.

LESSON

Working on bikes can be incredibly frustrating. The more frustrated a person is, the more likely he or she is to hurt themselves or others with a careless mistake. One of the most rewarding skills we can teach youth is how to deal with this frustration in a safe, productive way. One way to help youth cope is through a “scenic turn–out.”

A “scenic turn–out” is just like on the highway when you take a break from driving 60 miles per hour to stop and see a beautiful view. In the same way, a “scenic turn–out” invites youth to take a break from what they are working on and enjoy the view.

Encourage youth to take this break whenever they need it.

They should put down their tools, take their hands off their bikes and look around at the rest of the class. They will probably notice that some people in the class are struggling, while others are moving along easily.

Youth can take this time to appreciate the work that each participant is doing and send their good-vibes to those who are having a tough time. In this way, it allows youth to switch focus from “I’m so frustrated!” to encouraging their peers. This encouragement is usually best when it is silent—“Just think it, don’t say it. It still works.”

The great thing about this method is that it re–connects youth to the rest of the class, whereas, methods like “taking a walk” or “close your eyes and take a deep breath” disconnect kids and encourage them to look inwards. Different youth will benefit from different strategies, so here is one more to add to your list!

MATERIALS

None

RESOURCES

None
LESSON

This lesson is really a skills assessment dressed up as a game. It is your chance to watch youth ride and evaluate their skills, think where you might want to put them in the line on a ride, and plan what to work on next.

Overview:

Start out with Helmet Fitting (p. 169), Head to Toe (p. 168) and ABC Quick Check (p. 167). Discuss bicycle fitting. Seats will probably start lower than you expect for newer riders.

1. Discuss safe cycling.
   What does this look, sound and feel like?
   What are the rules of the road in your area? Where it is safe to ride? How do you identify hazards while you are riding? What does “scanning the road” mean?

2. Hand Signals.
   Ask everyone to demonstrate the hand signals for left and right turns as well as “stopping” and “hazard.”

CONTINUED ON P. 177
**LESSON (CONTINUED FROM P. 176)**

**Activities:**

**DRIVEWAY RIDEOUT**

1. In advance draw a short line marking the end of the driveway, a short line marking the end of the street at the intersection, and a long line connecting the two.

2. Have everyone line up single at the beginning of the ‘driveway.’

3. Have students roll down their ‘driveway’ stopping at the end. After looking both ways and calling out “clear!” they can continue down the ‘road’ in a straight line.

4. Before reaching the intersection they will perform the signal for stopping, yell out “stopping!” as they come to a complete, foot-down stop.

5. One instructor will be at the end of the intersection and tell them which way to go.

6. Students will look both ways again, yell out “clear!” signal the direction they are going, yell “going right/left!” then go that direction and circle back in line.

7. Make sure everyone has the opportunity to go twice.

**SCANNING**

1. Draw one long line with chalk for this activity or use a line on the blacktop.

2. Have students line up and take turns riding in a straight line.

3. One instructor will run behind them on the left side holding a sign with an image on each side. At Bike Works, we have a cow one one side, and a bus on the other. Staff can also hold up a number fingers if they don’t have a sign. When the instructor yells “now!” the student will do a ‘shoulder check’ and should be able to demonstrate maintaining their straight line while glancing behind them.

4. The other instructor will be at the end of the line and the student will tell them what they saw.

**CONTINUED ON P. 178**
LESSON (CONTINUED FROM P. 177)

ROCK DODGE
1. In advance set up the cones so that they are spaced out in a line roughly four feet apart.
2. Students will take turns weaving in and out of cones.
3. Once everyone has successfully completed it, and if time allows, you can have the more skilled students who chose try to ‘split the cone with their bike’ by rolling over a cone with only one wheel. Have an instructor demonstrate before this activity.

TIGHT TURNS
1. In advance create a series of four connected boxes with one open end. The first box should be very large, about 6 feet wide, the second 4 feet, the third 3 feet and the last 2 feet.
2. Students will get in line and be asked to ride in and out of the first big box without touching any lines. If they do it successfully they can move on to the next box, one size smaller. Let youth progress all the way to the end so long as they are able to roll in and out of the boxes without putting their foot down or touching any lines.
3. This activity is VERY difficult to complete and most students won’t make it past the second or third boxes.

SLOW RACE
1. Have students line up on a line for a race. Make sure they have plenty of room between them.
2. Mark another line about 20-40 feet away.
3. The goal is to be the LAST person to get to the line.
4. Participants must ride in a straight line and keep both feet on the pedals. If a foot touches the ground, that student is out.

CONTINUED ON P. 179
FOOT DOWN

1. Identify the boundaries for a very large box using chalk or cones.
2. Have all of the students begin slowly riding within the boundaries of the box after explaining the rules.
3. Once the referee/instructors yells “3, 2, 1, Foot Down!” the game begins.
4. Students are not allowed to put their foot down or go outside of the boundaries.
5. The goal of the game is to be the last one riding—so people are encouraged to try and force each other out of the box.
6. There will be no contact, bike, person or otherwise and any intentional contact results in getting out.
7. Once a student is “out” make sure they sit on the sidelines and watch (no free riding!) Youth who are “out” can help referee the rest of the game.
8. Once there are only 2 people remaining, have them enter the Circle of Doom, a small circle in the middle of the court to continue playing. Have fun!
Reflection activities give structure and closure to your lessons, allow higher level thinking, and neatly package up take home lessons. These activities are often used at the end of each day, or the end of a course to help youth think about what they did that day, and learn from other youth about their experience. Reflection activities are only as good as the facilitator. If the facilitator is uncomfortable, or not taking the activities seriously, youth will follow his or her lead. The more successful your reflection activities are, the more the class transforms from a bike mechanics class, to a youth development event.

Here are a few notes on group facilitation:

**The facilitator's job is to:**

- Create a trusting atmosphere
- Relax the group
- Clarify comments
- Listen and question
- Support people
- Lead discussions

**Appropriate facilitator behavior includes, but is not limited to:**

- Asking open ended questions
- Inviting everyone to participate (drawing out quiet members)
- Periodically summarizing the discussion
- Staying quiet sometimes and waiting for a response (listening)
- Repeating back to someone what you heard them say to build understanding or clarity
- Staying attentive and interested
- Managing disagreements (focusing on issues, not personalities)
- Keeping the group on track
- Supporting group members equally

**What facilitators do not do:**

- Avoid topics, downplay ideas, refute people, or take sides
- Push personal agendas or assume that they have the “right” answer
- Control the group
- Permit ganging up on any individual

Use these guidelines as well as your own personal strengths to guide youth towards a deeper and broader understanding of themselves and one another. Bikes are an activity, but the goal is to build leadership, self-reflection, teamwork and problem solving skills. Reflection activities help youth connect the work they do on bikes, to the work we would like them to do within themselves and in the world.
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**Reflection Quick Questions**

Provide opportunities to share ideas, concepts or feelings with the group.

**LESSON**

At Bike Works we circle up for introductions and a Quick Question every class. Sometimes adults lead the questions, sometimes students come up with ideas.

*Examples of Quick Questions:*

1. Describe why you think community service and your work here is an important contribution to the world.
2. What is one thing you learned today that you did not know before? It can be bike related or not.
3. Where do you see yourself in 5 years?
4. On a scale of 1-10, where is your energy level? 1 = I want to sleep for a thousand years. 10 = I don't think I can sit still for the rest of this sentence.
5. If you had one superpower, what would it be?
6. What is one thing that was hard for you today? How did you get through it?
7. What is one thing you are REALLY good at?
8. What is one thing that most people are surprised to learn about you?
9. Share one thing you can do that most other people cannot do. Demonstrate. Then have the group attempt to do the thing.
10. What is one word that describes how you feel right now?
11. Give a compliment to someone in the group or the group as a whole.
12. Have everyone demonstrate with a “thumbs up”, “thumbs down” or “thumbs middle” how they feel the day went, their comfort with a certain task/skill or any other question.
13. What is your goal for this week? For next class? For this program? Etc.
14. Go around the circle asking each student to put forth one thing s/he’s scared of in the adventure to come and one thing s/he’s excited about.

**MATERIALS**

None

**RESOURCES**

None
BOUNCE THE BALL
A way to add movement into question time.

**LESSON**

1. Clear a space so that no one is injured and nothing is broken.
2. Have participants stand in a circle.
3. Begin with a question, such as, “What is something you liked about the session today?” and bounce the ball to a youth who then answers. The catcher then bounces the ball to someone else who answers. It is important to use a large-sized bouncing ball so that everyone can easily catch it. A smaller ball is more difficult and the “misses” can be a distraction to the process as well as leave the individual with a sense of failure.
4. Participants continue bouncing the ball around the circle to each other and answering the question. Participants can answer more than once. After folks run out of things to say, you can add a new question.

**NOTE**
It is important to use a large-sized bouncing ball so that everyone can easily catch it. A smaller ball is more difficult and the “misses” can be a distraction to the process as well as leave the individual with a sense of failure.

**MATERIALS**
A large ball

**RESOURCES**
None

**SOURCE**
David P. Weikart Center for Youth Program Quality

**LENSON TIME**
15 min

**STUDENT AGE**
all

**STUDENT LEVEL**
beg

**STAFF LEVEL**
1

**GOOD FOR GROUP**
yes

**TOOL KIT**
none
MENTAL WALKTHROUGH

Review processes or steps taken during the day.

1. Ask participants to mentally “walk through” the steps or process of an experience, or the process of carrying out a new skill they have learned.
2. Either have youth think quietly through the steps on their own or guide them (or have one of the youth guide them) through the walk through out-loud.
3. Clarify any remaining questions or issues that arise during the walkthrough.

MATERIALS
None

RESOURCES
None

SOURCE
David P. Weikart Center for Youth Program Quality
ROSE, BUD, THORN

Check-in with the group and see how everyone is feeling.

LESSON

1. Have participants write or say one of each of these in regards to the activity. They can share these with the adult supporter, a partner, in a small group or the whole group.

ROSE

Something that was positive, something they are proud of, something they liked.

BUD

A new idea they hope to develop or something they are looking forward to in the future.

THORN

One thing that was challenging, that they would have liked to be different or something they did not enjoy.

MATERIALS

None

RESOURCES

None

SOURCE

David P. Weikart Center for Youth Program Quality
LESSON

1. In a large open area use ropes to make three concentric circles large enough for all the participants to stand in the center one. (You can use your foot to draw in the dirt if you don’t have ropes.)

2. Introduce the concept of comfort zones to the group. The Comfort Zone is where we feel most safe and secure. When we choose to step out of our Comfort Zone to try something new, we are in the Growth Zone. If something is beyond our ability and becomes too scary or too threatening then it is in the Panic Zone.

3. Describe how important it is to stay within the Growth Zone while on a new adventure, for we do not learn in our Panic Zone.

4. Start asking questions to the group regarding how they feel about certain things (ex: spiders, sleeping outside, being away from home, rock climbing, etc.) and have the participants physically place themselves in the zone appropriate to their own feelings about each activity.

Example questions:

1. How do you feel about performing an overhaul on a front hub?

2. How do you feel about working in pairs with a diverse variety of people—including people with repair skills at a different level than your own?

3. How well do you feel you’ll be able to take the knowledge and experience that you’ve gained in this class and apply it outside of this class (e.g. repair your bike, your mom’s bike, etc.)?

4. How likely are you to ride your bike to the library, a friend’s house or school?

5. How interested are you in taking another bike repair class sometime in the future?
GREEN LIGHT, YELLOW LIGHT, RED LIGHT

Review group norms and make changes if necessary.

LESSON
1. Post a piece of large paper (easel paper works well) or use a whiteboard, and draw three columns.
2. In column one: “Green Light,” participants list the things that they would like to start doing in the group.
3. In column two: “Yellow Light,” participants list the things that they would like to continue doing in the group (with or without modifications.)
4. In column three: “Red Light,” participants list all the things they would like to stop doing in the group.
5. This can lead to a discussion about norms, decisions and ultimately a plan based on the lists they generate.

This is a great time to use sticky notes. These allow students to move around, to add things somewhat anonymously and to move ideas from column to column during group discussion.

MATERIALS
Large paper
Markers
Pencils/ pens
Sticky notes (optional)

RESOURCES
None

SOURCE
David P. Weikart Center for Youth Program Quality
POST-IT PLANNING

Include youth in program planning.

LESSON

1. Decide on a theme, project or idea. Be as general or specific as you like.
2. Distribute sticky notes and ask youth to take turns writing tasks related to the theme, project or idea.
3. When the list of tasks is exhausted, have volunteers, with the help of the group, rearrange the notes to put them in order (chronological, priority, etc.)
4. Make any additions or changes to the tasks.
5. Document the final list.

VARIATION #1: LESSON PLANNING

This is a great way to allow students to arrange class sessions. After learning the parts of the bike, ask students to write down what they would like to work on and to put them in an order they would like for the class “flow.”

VARIATION #2: LEARNING AS WE GO

If you want, you can have students fill in additional steps as they learn them. For example, if the class writes “steering” on the first day as something they would like to learn how to fix, after the class on “headset overhauls” you can change the name of the class on the sticky note and fill in the 5½ steps to an overhaul. Leave these notes up on a wall in the classroom so the students can see what they have learned, refer back to notes for clarification in the future, and make changes as the class progresses.

MATERIALS

Large paper
Markers
Pencils/ pens
Post-it notes (optional)

RESOURCES

None

SOURCE

David P. Weikart Center for Youth Program Quality
GENIUS QUESTIONS

Provide an opportunity for youth to ask each other questions, review topics and share knowledge in a silly way.

LESSON

1. Have three volunteers stand up in front of everyone.
2. Introduce them to the rest of the group as one person, a genius in a particular field, who is so smart that they have three brains.
3. The other participants then take turns asking the genius questions.
4. The genius must answer by having each person say one word at a time so that the three build sentences together. When one person feels the answer is done, they stop talking and play continues to the next question.

Example:

Angie: What do snails eat?
Susan: Snails
Shari: eat
Sam: grubs
Susan: when
Shari: they
Sam: are
Susan: hungry.

MATERIALS

None

RESOURCES

None

SOURCE

David P. Weikart Center for Youth Program Quality
DEBRIEF HAND

Easy to remember way to provide peer feedback.

This is a quick group debrief activity and provides students a chance to give concise feedback. Each student holds up all five fingers and goes down the line:

**THUMB**  Something good, “Thumbs up!”

**POINTER**  Something you want to point out.

**MIDDLE**  Something that didn’t work or that needs improvement.

**RING**  Something about the group dynamic. (“You are married to this group” is a good way to remember this one.)

**PINKY**  A little detail you noticed.

**MATERIALS**  None

**RESOURCES**  None
PATS ON THE BACK

Provide an opportunity to praise and encourage each other. Good way to close an experience in a positive way.

LESSON
1. Tape an 8.5 x 11 sheet of paper on the back of each participant.
2. Give each participant a pen.
3. Ask each person to write something meaningful and special about each other on their papers (like a yearbook). Encourage youth to comment about things that “can’t be seen with your eyes,” or “something you noticed and appreciate about this person that others may not see.”
4. When everyone has signed and written to each person, then they can look at their own and read them.

MATERIALS
- 8.5 x 11 paper
- Pens for everyone

RESOURCES
- None

SOURCE
- David P. Weikart Center for Youth Program Quality
CELEBRATION

Easy to remember way to provide peer feedback.

LESSON

1. Break the group into pairs.
2. Have partners create some way to celebrate—high-fives, a dance, a cheer, or some other expression.
3. Throughout the day, when someone yells “Celebrate!” each student must find his or her partner and celebrate together. This is a great way to break up particularly stressful classes like Brakes and Gears.

Give students guidelines for creating small goals and let them celebrate with their partners when they complete them.

For example:

   When you disconnect the brake cable—Celebrate!
   When you correctly adjust the brake pad position—Celebrate!

NOTE

Make sure that celebration pairs are not in the same working group, and that they only celebrate when their partner or themselves calls it! It can get silly, fast, so you may want to put a limit on the number of celebration calls per group.

MATERIALS

None

RESOURCES

None

SOURCE

The Caring Classroom
STUDENT LED TEACH-BACKS

Opportunity for youth to lead the class, share knowledge and take on leadership. Check-in about what knowledge sunk in and what needs to be reviewed.

LESSON

These can be quick end–of–day teach–backs or revolve around a whole day. See “Make–Up Activities” (p. 154–156).

Ask a student to come to the front of the class and teach a specific part of what was learned that day, for example, the 5½ steps of an overhaul or how ball bearings work.

If you work this into the end of every class, students can be creative in how they present information—could be a song, charade, drawing, etc.

MATERIALS

None

RESOURCES

None
INTERESTING OBJECTS

Opportunity for youth to share something more personal about themselves.

LESSON

1. Before class, fill a box with a variety of objects. The box should contain many more objects than there are people in the group to give ample choice for the participants.
2. At the beginning of class, have each participant select an object from the box.
3. Once each participant has selected an item that is interesting to him or her, ask him or her to share how that object represents some aspect of themselves, the workshop, or program.

MATERIALS

A box of objects—can be bike related or not

RESOURCES

None

SOURCE

David P. Weikart Center for Youth Program Quality
LEARNED SO FAR

Review what has been learned in the class. Evaluate what youth still want to know.

LESSON

1. Give each participant two different colored index cards.
2. On one card ask them to write one thing they’ve learned.
3. On the other card they write a question they still have.
4. Collect the cards and either redistribute them to the group or review them on your own.

MATERIALS

Two different colored index cards
Pens/ pencils

RESOURCES

None

SOURCE

David P. Weikart Center for Youth Program Quality
STANDING IN THE SHADOW OF OUR SUCCESS

Invite youth to recognize and celebrate their own successes.

LESSON

1. Review the goal of the group or session.
2. Ask participants, one by one, to physically go to the place in the room where they felt the most successful in moving the group towards its goals. If the group is stuck, review some of the things that have happened to help stimulate their reflection on their success.
3. Invite participants to say a sentence or two about their contribution.

MATERIALS

None

RESOURCES

None

SOURCE

David P. Weikart Center for Youth Program Quality
THINK, PAIR, SHARE

Review what has been learned in the class.
Evaluate what youth still want to know.

LESSON

1. Young people review or consider a question, a video clip, article, or other prompt. You might have youth write down their initial responses. It’s a good idea to let them know that they will be sharing their responses with others.

2. Using a grouping strategy (p. 157–161), have youth form pairs.

3. Allow youth to discuss their thoughts with their partners.

4. Have volunteers share a summary of their discussion with the whole group.

MATERIALS
None

RESOURCES
None

SOURCE
David P. Weikart Center for Youth Program Quality
CONCENTRIC CIRCLES

Provide an opportunity for youth to get to know each other on a deeper level.

**LEsson**

1. Divide participants into two groups. Ask one group to become an inner circle and the other an outer circle. Members of the inner circle face outward while members of the outer circle face inward so that inner and outer circle members are facing each other. Make sure there are equal members in each group—if you have an even number of participants, everyone should be standing across from a partner; if you have an odd number, one can wait around or there can be a group of three.

2. Pose a question for participants to ask or answer with the person facing them.

3. When you call for the group to switch, the inner circle stays in place while the outer circle shifts one person to the right. Each person should be facing a new partner. You can then pose a second question.

4. The exercise continues for several rounds or until the original partners meet each other again.

**VARIATION: SOCIAL JUSTICE EMPHASIS**

This activity is often used to explore social justice within groups that already know each other.

*Examples of social justice themed questions:*

- Share your first memory of gender/race/class.
- Share an experience of oppression in your life.
- What do you think when you hear the word diversity?
- When else have you intentionally talked about diversity/social justice.
- What makes someone an ally?

**NOTE**

You will want to debrief this activity through a group discussion as it can be intense for some folks. Make sure you are ready to do this as the last step.
WORD WEBBING

Visually connect related concepts and ideas.

LESSON

1. Write the main concept in the center of a large sheet of paper.

2. Youth write ideas, facts and related concepts around the main concept and connect these to the central concept with lines. It is often more effective when many young people are engaged in writing ideas and making connection lines. Laying the paper out on a table or on the floor can facilitate this type of participation.

3. The process continues using one or more of the related ideas, facts, concepts and more connection lines. The final product is an intricate web of lines, facts, issues, and ideas.

MATERIALS

Big paper
Markers

RESOURCES

None

SOURCE

David P. Weikart Center for Youth Program Quality
K-W-L: KNOW, WANT TO KNOW, LEARNED

Understand what the group already knows, wants to know, and wants to learn. Helpful for lesson planning and review.

LESSON

1. Have youth label three columns on a sheet of paper: Know, Want to Know, and Learned. Alternatively, use pre-printed forms.

2. Have youth fill out the first column with what they know about the topic they are about to read about or experience. Allow youth to share what they know with each other.

3. Have youth brainstorm things they want to know about the topic they are about to read about or experience and record them in the second column. This can be done aloud, as a group, or by individuals.

4. After the text or experience, have youth record the answers to their questions, or additional information they learned in the third column.

MATERIALS

Pre-made K-W-L paper
Pens/pencils

RESOURCES

None

SOURCE

David P. Weikart Center for Youth Program Quality
LESSON

1. Begin with stating the specific goal of the brainstorming session.

2. Make sure to establish the rules of brainstorming:
   - No idea is a bad one.
   - Don’t discuss the merits or details of any one idea.
   - Get as many ideas listed as quickly as possible.

3. It often works well to have one youth designated as “recorder” to write all the brainstormed ideas out on a board, big paper or letter paper. If you use a chalk board or white board, be sure to snap a photo of the final brainstorm before it gets erased!

4. At the end of the session, the leader guides the group in narrowing down the options raised.

MATERIALS

Big paper
Markers

RESOURCES

None

SOURCE

David P. Weikart Center for Youth Program Quality
GRADUATION CELEBRATION

Celebrate youth and their accomplishments. Opportunity to involve larger community.

LESSON

1. Start the day with some time to finish up the bikes the youth have been working on. Make yourself available to all students, don’t get head–down into any projects!
2. Before students arrive, write on the white board a list of remaining tasks for them to finish on their bikes during the last day. These tasks include cleaning, fixing any flats, pumping up tires, replacing grips/saddle/pedals and lubing their chains.
3. Once you inspect these final tasks, students can move on to decorating their bikes with stickers and duct tape, etc.
4. When the finishing touches are complete, fit each student to their bike by helping them adjust seats and handlebars. As people finish, have them help other youth so that everyone can be caught up and ready to move on together.
5. With finished bikes, demonstrate the ABC Quick Check (p. 167). Discuss Helmet Fitting (p. 169) and give them a bike map of your city.
6. Be sure to leave a little extra time for in–depth cleanup and a longer reflection activity at the end. Pats on the Back (p. 194) is a good one!
7. Once the bikes are done, and the classroom is clean, take time to recognize each student, allow them to show off their bike, and give them a certificate! If you want, invite parents to come 15 minutes early to watch this part of the class!
8. Don’t forget to talk about ways in which people can continue to be involved in your program and have on hand some program material they can take home.

MATERIALS

Bike projects from the course
Bike decorating materials (stickers, duct tape, colored straws cut up as spoke beads, pipe cleaners etc.)
Markers

RESOURCES

Graduation Certificate (p. 233)

SOURCE

David P. Weikart Center for Youth Program Quality
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<th>Teachers</th>
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<th>Date</th>
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### Opening Activity

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### Set Context and Review Agenda

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### Activities

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### Clean Up

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### Review and Teach Back

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<thead>
<tr>
<th>Time</th>
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</table>
### Planning Section

**COMMUNITY BUILDER** (includes groupings, ways groups will be made, ice breakers, name games)

**OPEN-ENDED QUESTIONS ABOUT TOPIC**

**REFLECTION ACTIVITIES** (includes reflections done during group as well as at the end, includes feedback as well as learning reflection)

### Reflection Section

<table>
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<tr>
<td>Positive interaction</td>
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<td>low</td>
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|                           |     |       |     |
| Percent of group fully participating | 100 | 75 | 50  |
| Percent of group engaged in group conversation | 100 | 75 | 50  |
| Percent sharing info about themselves | 100 | 75 | 50  |

### WHAT WENT WELL DURING CLASS TODAY?

### WHAT DID I LEARN TODAY?

### PLANS FOR THE NEXT CLASS BASED ON TODAY'S CLASS

### TEACHER:  TIME STARTED:  CO-TEACHER:  TIME FINISHED:  TOTAL TIME:
Bike Works Contract

I understand that there are rules that I must follow in order to work at Bike Works and take part in Earn-A-Bike and other programs. I promise to arrive at class on time and ready to participate, to work cooperatively with all others, and to understand and follow the Shop Rules below.

I agree to:

1. **RESPECT...**
   - ...myself
   - ...my instructors
   - ...my classmates
   - ...the shop, tools and all bikes.

2. Act safely and responsibly with myself, my instructors and my classmates.

3. Practice safe work habits and safe riding habits. Always wear a helmet when riding to, from or on Bike Works programs.

4. Clean up my workspace and help clean up the shop.

5. Waste nothing!

6. Leave all tools and parts in the shop.

7. Ask any question that I might have.

8. **ENJOY MY WORK AND BE PROUD OF MY ACCOMPLISHMENTS.**

I understand that working at Bike Works is a privilege. It is my responsibility to ride and behave safely at all times. I also understand that Bike Works needs to be a safe place for everyone and that any violence (including hitting, abusive anger and threats) as well as any discriminatory language based on race, gender, sexual orientation, age, class, ability, nationality or religious belief will not be tolerated and is grounds for removal from the class or program.

Signed: __________________________________________________ Date: _______________
Personal Crests Template
8 Things to Remember as a Mechanic

1. **PRACTICE!**
   Repetition is your friend. The more times you complete a task the more skilled you become at it. You also become faster and more efficient.

2. **INSTALL BY HAND, TIGHTEN BY TOOL.**
   Always install nuts, screws and bolts by hand before using a tool. If you are having trouble installing by hand, be sure the threads are both cleaned and well-greased and you are threading the item on with the threads in line with one another. Doing this will help to ensure you do not cross thread. Cross threading can damage bicycle components and tools beyond repair.

3. **UNDERSTAND MECHANICAL ADVANTAGE.**
   How can I use tools to help make the job I am doing easier? Can I use leverage? Also, how can I use my body to help make a job easier? Can I change my position in relation to the task to make installation or removal easier?

4. **KNOW THE PROPER TERMINOLOGY OR NOMENCLATURE.**
   This will make your job of understanding or needing to be understood that much easier. “That thing holding the handlebars” is not nearly as clear as saying “the stem.”

5. **A CLEAN ORGANIZED WORK SPACE MAKES YOUR JOB QUICKER AND EASIER.**
   Have only the tools you need to complete a task at hand. Working on a headset and having crank pullers and combination wrenches will clutter and confuse you. Remember we have limited space and other students who may need the tools. If you are not using a tool it should be hanging on the bench/put away in a box.

6. **CREATING & HAVING A SYSTEM OR ORDER IN WHICH YOU COMPLETE A JOB IS CRUCIAL.**
   Each mechanic has their own system which they use when completing a task. This is how you will know where you are at in a process, what has been done, and what still needs to be done. It also becomes your system of checks.

7. **BICYCLES ARE PRECISION MACHINES.**
   They have differences in standards as small as .1mm, have components which need to be adjusted to within a distance of 1mm and have recommended torque (ft./lb.) specifications. Doing something by eye or feel may work fine 99% of the time, however a properly dialed bike will be built to ‘spec.’ It can take years of experience to “fine tune” your fingers and eyes to feel or see the difference in adjustments or settings on a bicycle.

8. **WHEN WORKING ON A NEW SYSTEM IT IS ALWAYS A GOOD IDEA TO LOOK AT IT FIRST.**
   Getting a good visual understanding of the system and being sure to ask questions or read a tech guide on the component in question will help you in repairing, adjusting, removing or installing the system.
Blank BINGO Cards

Name ___________________________        Date______________

<table>
<thead>
<tr>
<th>BICYCLE PART BINGO</th>
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<tr>
<td></td>
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<tr>
<td></td>
</tr>
<tr>
<td>FREE/</td>
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<tr>
<td>LIBRE</td>
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### BINGO Card Images

<table>
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<tr>
<th>Frame / Cuadro</th>
<th>Fork / Tijera</th>
<th>Handlebar / Manubrio</th>
<th>Stem / Poste</th>
<th>Headset / Telescopio</th>
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<tr>
<td><img src="image1" alt="Frame" /></td>
<td><img src="image2" alt="Fork" /></td>
<td><img src="image3" alt="Handlebar" /></td>
<td><img src="image4" alt="Stem" /></td>
<td><img src="image5" alt="Headset" /></td>
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<tr>
<th>Saddle / Asiento</th>
<th>Seatpost / Tubo de Asiento</th>
<th>Crank / Estrella Central</th>
<th>Crank Arm / Biela</th>
<th>Pedals / Pedales</th>
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<tr>
<td><img src="image6" alt="Saddle" /></td>
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<td><img src="image8" alt="Crank" /></td>
<td><img src="image9" alt="Crank Arm" /></td>
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<table>
<thead>
<tr>
<th>Hub / Masa (Bujes)</th>
<th>Spokes / Rayos</th>
<th>Bottom Bracket / Caja de Pedalier</th>
<th>Rim / Rin</th>
<th>Tires / Llantas</th>
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<td><img src="image12" alt="Spokes" /></td>
<td><img src="image13" alt="Bottom Bracket" /></td>
<td><img src="image14" alt="Rim" /></td>
<td><img src="image15" alt="Tires" /></td>
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<th>Cassette / Piñon</th>
<th>Chain / Cadena</th>
<th>Front Derailleur / Cambio Frontal</th>
<th>Rear Derailleur / Cambio Trasero</th>
<th>Shifters / Palanca de Cambios</th>
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<tr>
<td><img src="image16" alt="Cassette" /></td>
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<td><img src="image18" alt="Front Derailleur" /></td>
<td><img src="image19" alt="Rear Derailleur" /></td>
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<th>Suspension / Suspensión</th>
<th>Cruiser Bike / Bicicleta de Paseo</th>
<th>Top Tube / Tubo Horizontal</th>
<th>Seat Tube / Tubo Oblicuo</th>
<th>Quick Release / Cierre Rápido</th>
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<td><img src="image23" alt="Top Tube" /></td>
<td><img src="image24" alt="Seat Tube" /></td>
<td><img src="image25" alt="Quick Release" /></td>
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<th>Chainstays / Vainas</th>
<th>Dropouts / Punteras</th>
<th>Mountain Bike / Bicicleta de Montaña</th>
<th>Road Bike / Bicicleta de Carretera</th>
<th>BMX Bike / Bicicleta BMX</th>
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<th>Brakes / Frenos</th>
<th>Brake Levers / Palanca de Freno</th>
<th>Tube / Cámara</th>
<th>Helmet / Casco</th>
<th>Downtube / Tubo Diagonal</th>
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<td><img src="image34" alt="Helmet" /></td>
<td><img src="image35" alt="Downtube" /></td>
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</table>
Outside Scavenger Hunt
Jugar a los Escondidos

You must stay with the group! Tienen que quedarse con el grupo todo el tiempo!

- A bike locked correctly/ Una bici asegurado bien
- A bike locked incorrectly/ Una bici asegurado incorrectamente
- A 3-speed bike (large rear hub)/ Una bici con masa de 3 velocidades (masa grade detras)
- A bike with a coaster brake (large rear hub with arm)/ Una bici con frenos de pedales (masa grade detras con arma)
- A mountain bike/ Una bicicleta de montaña
- A road bike/ Una bici de pista
- A BMX bike/ Una bici BMX
- A bike lane (What street was it on?) / Una via de bici en la calle (Cuál calle?)

- A dangerous intersection (What intersection was it?)/ Una interseccion peligrosa (Cuales calles?)


- A person wearing a helmet/ Una persona con casco
- A bike with all three mandatory safety accessories: front light, back light, bell/ Una bici con los tres cosas de seguridad mandatorio por ley: luz en frente, luz detrás, campaña
- Someone breaking a law on a bike (What were they doing?) Una persona rompiendo un ley por bici (Qué estaban haciendo?)

Keep a tally of all the bikes you see on our walk. Qué tipo de bicis vieron en nuestro camino?

<table>
<thead>
<tr>
<th>Road / Pista</th>
<th>Mountain / Montaña</th>
<th>Kid’s / Niños</th>
<th>BMX</th>
<th>Other / Otros</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tbody>
</table>

_____________________________________________________________________________________________
_____________________________________________________________________________________________
_____________________________________________________________________________________________
Tests

• Before passing out the test give students the opportunity to ask you ANYTHING they would like to know.

• Frontload before administering the test that they are welcome to ask questions, but they will need to do so quietly in the other room with an instructor. Be aware that tests are anxiety producing for many youth. Try to talk about the test throughout the entire course, so that it is not a surprise at the end.

• This is a silent test and there will be no talking.

• Let them know that the essay part of the test is worth 50% of the grade and that they need to answer all of the questions, even if they are making an educated guess.

• Give out the “Graduation Test”.

• After students finish, have them turn in the tests to you so that you may look them over before passing them back. This is your time to assess their competency level.

• Go over the test with the entire class afterwards, so they can learn where they went wrong.

• Everyone will want to know what is “passing”—make something up and ask the group how they feel they did. Are they worried about passing? Do they feel totally confident? Inform them that if they volunteer to read the essay portion of their test, they will get an automatic pass. Encourage everyone to get up and read—it is rare that one person adamantly refuses. Applaud each person as they finish. The important point is to use this test as a gauge for them and for us, and where we can review one last time as a class.

• Make sure that you tell youth how many bikes they fixed up over the course of the class time, and where they went, what a difference they made, etc.

• This is also a good time to talk about other opportunities at your program—more advanced classes, rides, drop-in activities, etc.


PART I. Multiple choice. Circle the correct answer.

1. The best tool you can use to remove a tire from a rim is:
   A. A screwdriver
   B. The handle of an old spoon
   C. Tire levers
   D. An adjustable wrench

2. After you have found and marked the hole in an inner tube, the next step is to:
   A. Hold the tube underwater
   B. Stick a patch over the hole
   C. Put the wheel back on the bike
   D. Roughen the tube lightly with sandpaper

3. On a bicycle, the letters “P.S.I.” stand for:
   A. Please Stop Inflating
   B. Perfectly Solid Interior
   C. Pounds per Square Inch
   D. Pennsylvania Seem Interesting

4. Which of the following are not found in the hub?
   A. Rim strips
   B. Cones
   C. Cups
   D. Bearings

5. The purpose of ball bearings is to:
   A. Reduce friction
   B. Slow the bike down
   C. Look very clean and shiny
   D. Keep the grease from falling out

6. Finish this sentence: “If my brakes are properly adjusted ----”
   A. “---- my brake pads should strike the tire”
   B. “---- my levers should touch the handlebars when I squeeze them”
   C. “---- the pads will make a very loud squealing noise”
   D. “---- the pads will be very close to the rim, but won’t touch until I squeeze the lever”
7. What are the 5½ steps to an overhaul? (in correct order please...)

½.

1. 

2. 

3. 

4. 

5. 

8. Which is the correct definition of the word “overhaul”?
   A. To transport a heavy load by bicycle or truck
   B. To remove a defective part and throw it away
   C. A special type of clothing worn by working men and women on the job
   D. To take something apart, clean it thoroughly, and then reassemble it

9. The headset is an important part of the bicycle because it:
   A. Allows you to keep in contact with headquarters
   B. Protects your skull in a crash
   C. Makes it possible to steer the bike
   D. Keeps the front wheel from falling off

10. Which part of the bike is called the drive side?
    A. The front
    B. The left
    C. The right
    D. Trick question, none of the above
PART II. Matching. Draw lines from the pictures of the tools to their name

1. Pedal wrench
2. Cone wrench
3. Combination wrench
4. Headset wrench (BFW)
5. Spanner tool
6. Allen Y-wrench (or Allen key)
7. Cable cutters
8. Phillips Head screwdriver
9. Flat Head screwdriver
10. Rubber Mallet
PART III. Essay Question

Imagine that it is the year 2050 and there is no more gasoline for cars. As a renowned bicycle educator, you have just received a letter from the President of the United States asking for your professional opinion. She is planning to build BIKOPOLIS, the world’s first car-less city. She would like to hire you to design and build it, but wants to hear your ideas first. Write a letter describing how your city will look and work.

Remember: All transportation must be done on bikes or other human-powered vehicles.

Dear President Hernandez,

Signed: ________________________________
Intermediate Test

Name ____________________________________________        Date ___________________

PART I. Multiple choice. Circle the correct answer.

1. What are the 5½ steps to an overhaul? (in correct order please...)

½.

1.

2.

3.

4.

5.

2. If you have 2 chainrings on your crankset and 6 cogs on the freewheel, how many speeds does your bike have?

A. Eight
B. Twelve
C. Ten
D. Eighteen

3. Which of the following is required by law for people who ride bikes in Seattle?

A. Fenders
B. A rear view mirror
C. Helmet
D. Rubber tires

4. Most nuts and bolts are tightened when you turn them clockwise (to the right). Why does the left pedal go the other way?

A. So that it doesn’t loosen, but tightens itself with the rotational direction of pedaling forward
B. It makes the pedal harder to steal
C. It drives bike mechanics crazy
D. It allows the bike to go in reverse

5. Finish this sentence: “Four wheels bad, two wheels ----“

A. “---- filthy”
B. “---- good action”
C. “---- tight”
D. “---- nice”
6. Which of the following should not usually be used on brakes?
   A. The pressure gauge
   B. The 3rd Hand tool
   C. The cable cutter
   D. The Y wrench

7. What is the name of the largest bike race in the world?
   A. The Indianapolis 500
   B. The Tour de France
   C. The Boston Marathon

8. If the rim of your bicycle was bent, the best way to straighten it would be:
   A. Inflating the tires
   B. Jumping up and down on it
   C. Tightening and loosening certain spokes
   D. Putting the wheel in the TAB Rim Rejuvenator and setting the dial to “HIGH”

9. What do you call the part that you turn on a derailleur to set how far it can move?
   A. Handlebar
   B. Quick release
   C. Ashtabula
   D. Limit screw

10. What is the most important thing to remember when removing a dust cap from a hub?
    A. They come in a variety of colors, so choose wisely when replacing one!
    B. They can bend easily, so use a flat head screwdriver and pry them out evenly all around!
    C. They can bend easily, so when removing, use a magnet, some Simple Green and a little luck!
    D. They are all made in Italy, so have your Italian phrasebook handy!

11. What is a major difference between threaded and threadless headsets?
    A. Threadless headsets don’t need bearings
    B. Threaded headsets are stitched together while threadless headsets are glued together
    C. Both allow the handlebars to turn side to side, but threadless headsets allow the handlebars to turn up and down too
    D. With a threaded headset the stem fits down into the frame, while with a threadless headset the stem is involved in the bearing adjustment

12. If you want to get the cranks off of a 3-piece bottom bracket, what special tool do you need?
    A. Crank puller
    B. Crank bender
    C. Crank driver
    D. Crank spinner
PART II. Matching. Draw lines from the pictures of the tools to their names.

1. Adjustable wrench

2. Hammer

3. Third hand tool

4. Pliers

5. Crank puller

6. Chain tool

7. Drop gauge

8. Lockring wrench

9. Fourth hand tool

10. Freewheel tools
PART III. Identify parts of the bike.

1. ____________________________ 5. ____________________________
2. ____________________________ 6. ____________________________
3. ____________________________ 7. ____________________________
4. ____________________________ 8. ____________________________

___ Cassette  
___ Rear Derailleur  
___ Brake Lever  
___ Hub  
___ Handlebar  
___ Stem  
___ Pedal  
___ Crankset  
___ Tire  
___ Chain  
___ Brake Caliper  
___ Front Derailleur  
___ Saddle  
___ Spokes  
___ Rim
Advanced Test

Name ____________________________________________        Date ___________________

1) Describe the process (in as much detail as you can) for tightening a quick-release lever.

2) Before you put a new or patched tube in the tire you should:

3) How much air should you put in a tire?

4) What does it mean to ‘toe-in’ a brake pad?

5) When should you replace your brake pads?

6) Scenario: You are riding your bike along, and you squeeze your brake levers to come to a stop. When you attempt to ride forward again you discover your rear brake is stuck. Troubleshoot three possible things that could have gone wrong with the system to make this occur:
7) How do you know when a chain needs to be replaced? What are the possible problems that could arise from not replacing your chain soon enough?

8) What is the difference between BMX chains and chains for bikes with derailleurs?

9) What is the difference between a cassette and a freewheel? What tools do you need and what is the process to take each off?

10) One job of the shift lever is to move the derailleur, and hence the chain, from one cog or chainring to another. What is the other job?

11) What does indexed shifting mean?

12) There are two distinctly different types of cable housing and it is vitally important to know the difference between the two. Why is it important and what are the two types/how are they different? What is each used for and how do you identify them?
13) What is the “drivetrain” on a bicycle? Name 5 components that make up the drivetrain.

14) In what direction would you install something with a right-hand thread? What direction for a left-hand thread? (Note: the answers “right” or “left” are unacceptable).

15) When working on an adjustable style bottom bracket, what part is making the adjustment? How is the adjustment held in place? (i.e. spindle, bearing, crank bolts, etc.)

16) In a headset, which way do inverted bearings fit into the cup?

17) Why is it important to have a well-adjusted headset?

18) On a quill stem, why is there a minimum insert line?

19) What is the proper order of parts in a bearing system?
20) A hub with a solid axle is properly adjusted when . . .

21) Overhauling a rear hub differs from a front hub because . . .

22) Explain the importance of having a properly adjusted hub.

23) A hub with a quick release is properly adjusted when . . .

24) What does it mean for a wheel to be out of dish? How is this fixed?

25) What are indicators that a rim has been damaged and the wheel is not just out of true?

26) What are the 5½ steps to the overhaul?
27) True or False: when installing a part, first thread it on with a tool, and then follow up by hand.

28) Why do we put down a rag before starting an overhaul? Please draw a picture of how your rag should look once you have a front hub completely disassembled and ready for cleaning.
Fedak: May 21, 2013

Beginning Mechanics Course

To certify completion to satisfaction

Is hereby granted to

CERTIFICATE OF COMPLETION

BIKE WORKS 2015
Earn-A-Bike "Bike Check" Tag

When students are earning a bike, they attach this tag. It helps them keep track of their hours as well as examine every part of the bike.

Front of Tag

Name: ______________________________

BIKE WORKS PROGRAM BIKE

Frame Size: _________________ Wheel Size: _________________

Make: ______________________________

Model: ______________________________

Color: ______________________________

Serial #: ______________________________

Date In: _________________ Date Out: _________________

Back of Tag

<table>
<thead>
<tr>
<th>Clean Bike</th>
<th>Front Brake</th>
<th>DATE</th>
<th>HOURS</th>
</tr>
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<tbody>
<tr>
<td>Check for Frozen Seat</td>
<td>Replace Cables/Housing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post / Stem</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Front Wheel</td>
<td>Adjust Calipers/Pads</td>
<td></td>
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</tr>
<tr>
<td>Fix/Replace Tubes</td>
<td>Rear Brake</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Replace Tire</td>
<td>Replace Cables/Housing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>O/H Hub</td>
<td>Adjust Calipers/Pads</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rear Wheel</td>
<td>Front Derailleur</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fix/Replace Tubes</td>
<td>Replace Cables/Housing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Replace Tire</td>
<td>Adjust Shifting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>O/H Hub</td>
<td>Rear Derailleur</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Headset O/H</td>
<td>Replace Cables/Housing</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
These tool kits are meant to be used as guides. The costs are approximate and reflect retail prices as of August 2014. Many bike tool distributors are willing to offer discounts to 501c3 organizations, or you may want to find a shop to work with to try to buy closer to wholesale.

These items can be bought through bike supply stores, or many can be found—for less—at home improvement or hardware stores.

### Tool Kit: Bare Minimum for a Fix a Flat Class
*Numbers based on class of 8*

<table>
<thead>
<tr>
<th>Item</th>
<th>Number Needed</th>
<th>Cost Per Item</th>
<th>Cost for Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tire levers (2 per person or group)</td>
<td>8</td>
<td>$3.00 / 3 levers</td>
<td>$9.00</td>
</tr>
<tr>
<td>Patches</td>
<td>8</td>
<td>$30 / 100 patches</td>
<td>$30.00</td>
</tr>
<tr>
<td>Glue/ vulcanizing fluid</td>
<td>4</td>
<td>$3.00</td>
<td>$12.00</td>
</tr>
<tr>
<td>Sand paper</td>
<td>1 in square / student</td>
<td>$2.70 / 5 sheet pack</td>
<td>$2.70</td>
</tr>
<tr>
<td>Alternative: 8 patch kits (include patch, glue, sandpaper)</td>
<td>8</td>
<td>$4.00</td>
<td>$32.00</td>
</tr>
<tr>
<td>15 mm wrench (for removing <em>most</em> wheels)</td>
<td>1</td>
<td>$3.00</td>
<td>$3.00</td>
</tr>
<tr>
<td>Allen key multi-tool (for disconnecting brakes if necessary)</td>
<td>1</td>
<td>$10.00</td>
<td>$10.00</td>
</tr>
<tr>
<td>Any pump!</td>
<td>2</td>
<td>$20.00</td>
<td>$40.00</td>
</tr>
</tbody>
</table>

**Total Bare Minimum Kit Cost** $138.70
## Tool Kit: Level A

All of Bare Minimum Tool Kit PLUS the following items

*Numbers based on class of 8*

<table>
<thead>
<tr>
<th>Item</th>
<th>Number Needed</th>
<th>Cost Per Item</th>
<th>Cost for Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metric combination wrench set (8mm-19mm, 10 piece)</td>
<td>4</td>
<td>$20.00</td>
<td>$80.00</td>
</tr>
<tr>
<td>12” adjustable wrench</td>
<td>1</td>
<td>$14.99</td>
<td>$14.99</td>
</tr>
<tr>
<td>Rags, “shop towels”</td>
<td>20</td>
<td>$4.98/20</td>
<td>$4.98</td>
</tr>
<tr>
<td>floor pump (Park PFP-8)</td>
<td>2</td>
<td>$33.50</td>
<td>$67</td>
</tr>
<tr>
<td>Repair stands (PCS-4-1)</td>
<td>4</td>
<td>$269.96</td>
<td>$1,079.84</td>
</tr>
<tr>
<td>Simple green</td>
<td>2</td>
<td>$4.98/32oz</td>
<td>$9.96</td>
</tr>
<tr>
<td>Grease</td>
<td>1</td>
<td>$14.36/16oz tub</td>
<td>$14.36</td>
</tr>
<tr>
<td>Allen key L set</td>
<td>2</td>
<td>$22.50</td>
<td>$45.00</td>
</tr>
<tr>
<td>Small Philips screwdriver</td>
<td>4</td>
<td>$1.00</td>
<td>$4.00</td>
</tr>
<tr>
<td>Large Philips screwdriver</td>
<td>4</td>
<td>$1.00</td>
<td>$4.00</td>
</tr>
<tr>
<td>Small Flathead screwdriver</td>
<td>4</td>
<td>$1.00</td>
<td>$4.00</td>
</tr>
<tr>
<td>Large Flathead screwdriver</td>
<td>4</td>
<td>$1.00</td>
<td>$4.00</td>
</tr>
<tr>
<td>Y socket 8/9/10</td>
<td>4</td>
<td>$13.50</td>
<td>$54.00</td>
</tr>
<tr>
<td>Tri Allen wrench 4/5/6</td>
<td>4</td>
<td>$10.00</td>
<td>$40.00</td>
</tr>
<tr>
<td>Tri flow or other chain lube</td>
<td>2</td>
<td>$10/ 6oz</td>
<td>$20.00</td>
</tr>
</tbody>
</table>

**Previous Level Cost** $138.70  
**Total Level A Kit Cost** $1,584.83
**Tool Kit: Level B**

All of Tool Kit Level A PLUS the following items

*Numbers based on class of 8*

<table>
<thead>
<tr>
<th>Item</th>
<th>Number Needed</th>
<th>Cost Per Item</th>
<th>Cost for Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>13mm Cone wrench</td>
<td>4</td>
<td>$8.10</td>
<td>$32.40</td>
</tr>
<tr>
<td>14mm Cone wrench</td>
<td>2</td>
<td>$8.10</td>
<td>$16.20</td>
</tr>
<tr>
<td>15mm Cone wrench</td>
<td>4</td>
<td>$8.10</td>
<td>$32.40</td>
</tr>
<tr>
<td>16mm Cone wrench</td>
<td>2</td>
<td>$8.10</td>
<td>$16.20</td>
</tr>
<tr>
<td>17mm Cone wrench</td>
<td>2</td>
<td>$8.10</td>
<td>$16.20</td>
</tr>
<tr>
<td>18mm Cone wrench</td>
<td>1</td>
<td>$8.10</td>
<td>$8.10</td>
</tr>
<tr>
<td>19mm Cone wrench</td>
<td>2</td>
<td>$8.10</td>
<td>$16.20</td>
</tr>
<tr>
<td>Drop gauge/ ruler tool</td>
<td>1</td>
<td>$8.10</td>
<td>$8.10</td>
</tr>
<tr>
<td>30/32 headset wrench</td>
<td>4</td>
<td>$17.10</td>
<td>$68.40</td>
</tr>
<tr>
<td>36/40 headset wrench</td>
<td>4</td>
<td>$15.30</td>
<td>$61.12</td>
</tr>
<tr>
<td>10in Channel locks</td>
<td>1</td>
<td>$14.97</td>
<td>$24.97</td>
</tr>
<tr>
<td>12in adjustable wrench (another one)</td>
<td>1</td>
<td>$14.99</td>
<td>$14.99</td>
</tr>
<tr>
<td>Pedal wrench</td>
<td>2</td>
<td>$12.50</td>
<td>$25.00</td>
</tr>
<tr>
<td>Pin spanners</td>
<td>2</td>
<td>$19.20</td>
<td>$38.40</td>
</tr>
<tr>
<td>Cable/ housing cutters</td>
<td>2</td>
<td>$22.00</td>
<td>$44.00</td>
</tr>
<tr>
<td>Offset brake tool OBW-3</td>
<td>2</td>
<td>$8.00</td>
<td>$16.00</td>
</tr>
<tr>
<td>8/10 brake tool CBW-1</td>
<td>2</td>
<td>$6.00</td>
<td>$12.00</td>
</tr>
<tr>
<td>9/11 brake tool CBW-4</td>
<td>2</td>
<td>$6.00</td>
<td>$12.00</td>
</tr>
<tr>
<td>3rd hand tool</td>
<td>1</td>
<td>$22.00</td>
<td>$22.00</td>
</tr>
<tr>
<td>4th hand tool</td>
<td>1</td>
<td>$30.00</td>
<td>$30.00</td>
</tr>
<tr>
<td>Needle nose pliers</td>
<td>1</td>
<td>$9.97</td>
<td>$9.97</td>
</tr>
</tbody>
</table>

**Previous Level Cost**   **$1,584.83**

**Total Level B Kit Cost** **$2,109.48**
## Tool Kit: Level C

All of Tool Kit Level B PLUS the following items

*Numbers based on class of 8*

<table>
<thead>
<tr>
<th>Item</th>
<th>Number Needed</th>
<th>Cost Per Item</th>
<th>Cost for Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lockring wrench</td>
<td>2</td>
<td>$15.50</td>
<td>$31.00</td>
</tr>
<tr>
<td>Crank puller</td>
<td>2</td>
<td>$15.80</td>
<td>$31.60</td>
</tr>
<tr>
<td>Bottom bracket socket wrench CCW-5</td>
<td>2</td>
<td>$10.35</td>
<td>$20.70</td>
</tr>
<tr>
<td>Chain checker CC-3.2</td>
<td>1</td>
<td>$9.86</td>
<td>$9.86</td>
</tr>
<tr>
<td>Chain breaker CT-3.2</td>
<td>2</td>
<td>$33.50</td>
<td>$67.00</td>
</tr>
<tr>
<td>Bench vice</td>
<td>1</td>
<td>$35.00</td>
<td>$65.00</td>
</tr>
<tr>
<td>Chain whip SR-2.2</td>
<td>1</td>
<td>$36.00</td>
<td>$36.00</td>
</tr>
<tr>
<td>Cassette lockring tool FR-5G</td>
<td>1</td>
<td>$8.50</td>
<td>$8.50</td>
</tr>
<tr>
<td>Freewheel Tool FR-2</td>
<td>1</td>
<td>$9.00</td>
<td>$9.00</td>
</tr>
<tr>
<td>Freewheel Tool FR-6</td>
<td>1</td>
<td>$14.80</td>
<td>$14.80</td>
</tr>
<tr>
<td>Bottom Bracket Tool BB-22</td>
<td>1</td>
<td>$17.50</td>
<td>$17.50</td>
</tr>
<tr>
<td>BB Adjustable Cup HCW-11</td>
<td>1</td>
<td>$14.50</td>
<td>$14.50</td>
</tr>
<tr>
<td>Axle vice AV-1</td>
<td>1</td>
<td>$14.50</td>
<td>$14.50</td>
</tr>
<tr>
<td>Truing stand TS-2.2</td>
<td>2</td>
<td>$234.00</td>
<td>$468.00</td>
</tr>
<tr>
<td>Tensiometer TM-1</td>
<td>1</td>
<td>$72.50</td>
<td>$72.50</td>
</tr>
<tr>
<td>Dishing Tool WAG-5</td>
<td>1</td>
<td>$30.00</td>
<td>$30.00</td>
</tr>
<tr>
<td>Spoke wrench SW-7</td>
<td>4</td>
<td>$8.54</td>
<td>$34.16</td>
</tr>
</tbody>
</table>

| Previous Level Cost            | $2,109.48     |
| Total Level B Kit Cost         | $3,054.10     |
Parts of the Bike—English/Spanish

Source: www.commons.wikimedia.org/wiki/File:MountainBikePartsEnglishAndSpanish.jpg

1. cuadro frame
2. tijera fork
3. amortiguador shock absorber
4. manubrio handlebar
5. poste stem
6. telescopio headset
7. asiento saddle
8. tubo del asiento seatpost
9. estrella central cranks
10. biela rod
11. pedales pedals
12. masa hub
13. rallos spokes
14. rin rim
15. llantas tires
16. piñón cassette
17. cadena chain
18. cambio frontal front derailleur
19. cambio trasero rear derailleur
derailleurshifters
20. palance de cambios derailleurshifters
21. frenos brakes
22. palanca de freno brakes levers
Parts of the Bike—Student Worksheet

Sections of the Frame

1. __________________________  5. __________________________
2. __________________________  6. __________________________
3. __________________________  7. __________________________
4. __________________________

Components

___ Cassette
___ Rear Derailleur
___ Brake Lever
___ Hub
___ Handlebar
___ Stem
___ Pedal
___ Crankset
___ Tire
___ Chain
___ Brake Caliper
___ Front Derailleur
___ Saddle
___ Spokes
___ Rim
Partes de la Bicicleta
Student Worksheet Spanish

Partes de la Cuadra

1. _____________________________ 5. _____________________________
2. _____________________________ 6. _____________________________
3. _____________________________ 7. _____________________________
4. _____________________________ 8. _____________________________

Componentes

___ Piñón
___ Cambio Trasero
___ Palanca de Freno
___ Masa
___ Manubrio
___ Poste
___ Pedal
___ Estrella Central
___ Llanta
___ Cadena
___ Freno
___ Cambio Frontal
___ Asiento
___ Rayos
___ Rin
Parts of the Bike—Student Worksheet

ANSWER SHEET

Sections of the Frame

1. Top Tube
2. Seat Tube
3. Fork
4. Chain Stay
5. Head Tube
6. Down Tube
7. Bottom Bracket Shell
8. Seat Stay

Components

1. Frame
2. Handlebar
3. Brake Lever
4. Brake Caliper
5. Hub
6. Pedal
7. Crankset
8. Tire
9. Chain
10. Saddle
11. Front Derailleur
12. Rear Derailleur
13. Cassette
14. Chain Stay
15. Saddle
Partes de la Bicicleta
Student Worksheet Spanish

Partes de la Cuadra

1. Tubo Superior
2. Tubo del Asiento
3. Tijera
4. Vaina Inferior
5. Tubo de Dirección
6. Tubo Inferior
7. Caja de Pedalier
8. Vaina Superior

Componentes

14. Piñón
13. Cambio Trasero
3. Palanca de Freno
7. Masa
2. Manubrio
1. Poste
8. Pedal
10. Estrella Central
6. Llanta
12. Cadena
4. Freno
11. Cambio Frontal
15. Asiento
9. Rayos
5. Rin
Exploded Bicycle Diagram

Source: www.monsieurpetit.com/bikeExplodedView/velo_vueEclatee.html
Parts of the Wheel

Completed Wheel Contract
Front Hub—Exploded

Dust Cap

Locknut Spacers Cone Axle Cone Spacer Locknut

Rear Freewheel Hub—Exploded

91 90 92
Threadless Headset—Exploded View

- Cap Bolt
- Top Cap
- Stem
- Spacers
- Compression Ring
- Adjustable Race
- Bearing Cartridge
- Upper Head-tube Race

Source: www.slideplayer.us/slide/1678189/
Brake Types


- **49mm Dual-Pivot**
  - Up to 28C

- **57mm Dual-Pivot**
  - Up to 28C plus fenders.

- **64mm Dual-Pivot**
  - Up to 38C plus fenders

- **Linear Pull**
  - Up to 2.1"

- **Cantilever**
  - Up to 2.1” plus fenders.

- **Dsic Brake**
  - No tire size limit.
Brake Type Flow Chart

Can you coast without your cranks spinning?
- yes
  - Can you backpedal freely?
    - yes
      - FIXED GEAR
    - no
      - Where does your brake cable/housing lead to?
        - disc attached to hub
          - DISC
        - rim
          - RIM BRAKE
      - cylinder attached to hub
        - DRUM/BAND
  - no
    - How many bolts attach the brake to the frame?
      - one
        - Are the brake pads above or below the pivot point?
          - below
            - Is there a cam and rollers?
              - no
                - U
              - yes
                - ROLLER-CAM
          - above
            - Is there a link wire/yolk or a noodle?
              - noodle
                - LINEAR-PULL CANTILEVER
              - yoke
                - (TRAD.) CANTILEVER
            - side
              - How many pivot points are there?
                - two
                  - CENTER-PULL
                - one
                  - DUAL PIVOT SIDE-PULL
      - two
        - Does the cable pull from the center or the side?
          - center
            - CENTER-PULL
          - side
            - LINEAR-PULL CANTILEVER
          - above
            - Is there a link wire/yolk or a noodle?
              - yes
                - U
              - no
                - ROLLER-CAM
References & Resources

PUBLICATIONS


Ramaswami, Ravi et. al. *David P. Weikart Center for Youth Program Quality* Ypsilanti, MI: Forum for Youth Investment, 2011 www.cypq.org

*Wisdom from the Field: A Curriculum Guide to Women’s and Girl’s Centered Programming* Seattle, WA: Passages Northwest, 2005

ORGANIZATIONS

Bicycle Coalition of Maine, Portland, ME. www.bikemaine.org

Bikes Not Bombs, Boston, MA. www.bikesnotbombs.org/

Community Cycling Center, Portland, OR. www.communitycyclingcenter.org

Neighborhood Bikeworks, Philadelphia, PA. www.neighborhoodbikeworks.org


WE Bike NYC, New York, NY. www.webikenyc.org

WEBSITES

Local Motion.  www.localmotion.org/programs/bikerecycle/resources
Seattle Children’s Community Education.  www.seattlechildrens.org/safety-wellness/bike-helmet-safety
Sheldon Brown’s Bicycle Technical Information.  www.sheldonbrown.com

IMAGES

Brakes, Waterford—www.waterfordbikes.com/w/ordering/function/
Exploded Bike Diagram, Velorution—www.wiklou.org/index.php?title=Accueil,
www.monsieurpetit.com/bikeExplodedView/velo_vueEclatree.html
Parts of the Bike—www.commons.wikimedia.org/wiki/File:MountainBikePartsEnglishAndSpanish.jpg
Threaded Headset—www.slideplayer.us/slide/1678189/

For more information please contact

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Seattle, WA 98118
206.695.2522
info@bikeworks.org
www.bikeworks.org
ABOUT BIKE WORKS

Building sustainable communities by educating youth and promoting bicycling.

At Bike Works we bring core values like youth engagement, community development, and environmental stewardship to the work of recycling bicycles and running a bike shop. Our bike shop is the place to go if you’re shopping for a quality, recycled bicycle.

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