USA BMX Track Modeling Program

Teacher Lesson Plan

Project Overview:

- Students design, model, and create a scale BMX track.

Project Outline:

- Students form teams – ideally between four (4) and eight (8) students. No more than eight (8) students.
- Project-based on NGSS Three Dimensional Learning model http://www.nextgenscience.org/three-dimensions
- Final projects will be judged by local panel and students
- Uploading or sharing photos or video to social media is encouraged. Please tag USA BMX Foundation:

  Facebook/Instagram: @USABMXFoundation
  Twitter/Pinterest: @USABMXSTEM

- Winners will be chosen and prizes awarded. Projects will be judged in four (4) categories:

  Students Choice Award
  - Prize: Individual trophies

  3rd Place
  - Prize: Individual trophies

  2nd Place
  - Prize: Individual trophies

  1st Place
  - Prize: Individual trophies

Materials Provided	Materials Not Provided	Student Handouts Provided
● Track Dirt (bulk – delivered) ● 24” x 48” Plywood base ● Tongue depressors ● Water in cans – unopened still filled with water ● Elmer’s glue ● White vinegar ● Bendy straws ● Foam cups ● Funnels ● Spray bottles ● 5 Gallon buckets ● Stickers	● Pencil and paper ● Beautification supplies ● Water ● Ruler/Measuring Stick	● Track Terms ● Track Build Requirements ● Soil Sheets ● Track Visit Worksheet ● Reflection

Soil Tac Mixture (used on Day 5)

Our recommendation is six (6) parts water, two (2) parts vinegar, two (2) parts glue. We find it works best to add glue to two (2) parts water and warm it in the microwave for one (1) minute. This thins the glue and allows it mix better with the vinegar and water. Mix this well, put into spray bottles using the funnels provided. I would have each group spray their tracks with at least two (2) coats of Soil Tac, at least one (1) hour in-between each application.

If spray nozzles clog, use warm water or an opened paperclip to clean.

OVERVIEW FOR THE WEEK:

Lesson Segment	Learning Activity	Questions for Students
DAY 1: Project overview, brief history of tracks  **HANDOUTS FOR DAY 1:** • **Track Scale and Ratio** • **Track Drawing Examples** • **USA BMX Track Terms Sheet** • **Track Build Requirements** • **Engineering Design Process** • **UCI BMX Track Guide**	Provide students an overview of the project and how the week will look. Define, introduce and discuss the concept of scale and ratio Use the next 30 minutes to watch the following four videos. They give excellent perspective and inspiration.  https://youtu.be/n6Q_8Ee3UsU The video above is the 10-year old National Championship in Tulsa, OK. **The majority of these racers are 4th graders.** Note: this is an *indoor* track.  https://youtu.be/kYX3udMC2Tg This video is the 2008 Olympic Finals for both Men and Women. It gives great perspective of the speed and scope at this level of racing. Note that the track here is almost 25% longer than the other track seen on the other video yet look at the time around the track. Also, note the beautification of the track and the different features.	Reference **Track Scale and Ratio** PDF in Day 1 folder 1) Why do the riders today stand up the whole time? 2) What are they wearing in each video? 3) What are the main differences between the four tracks represented in the videos? 4) Compare and contrast the tracks, ages and abilities along with observations from the students.  IMPORTANT SUGGESTION: Do not “google” BMX videos. Many of the videos that are more popular are the crashes or the extreme side of BMX or BMX Freestyle that is not directly related to racing our sport. While crashing happens (as seen in the Olympic video), they are fairly mild, the athletes are well protected, and everyone walked away.

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	https://youtu.be/e3K-Z1W2JzY This is from ESPN circa 1983. How has the sport changed? What about the gear, tracks, bikes, etc. https://youtu.be/iMaABzjQXQQ This is the semi-finals from the 2012 Olympics in London. The video is 1 hour 20 minutes so please do not watch the whole thing. I recommend watching 2 women's races and 2 men's races. From the initial shot you can catch some great footage of the track. This track had some of very unique features. If you have additional time, have students count how many different countries are represented.	Hand out one "**track drawing example**" to each table so that students have an opportunity to use them as inspiration. Please explain that we are not looking for copies of these tracks, however they may use elements of the tracks. Note the one track has dimensions included in the layout. When appropriate, please put up the images of the "Cajun panorama" track. This is the only track of its kind in the world. What is the unique feature you see on this track? How does it work? Have a student explain the flow and how you would ride this track.

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Description of features	**Handout USA BMX Track Terms Sheet** Review and discuss each feature (i.e. straight, step down, roller, etc.) Go back and watch the videos again to see how many features they can identify and how the riders interact with the features.	What are the unique features from the London track? Make sure the students notice the following: 1) Different sets (routes) for men + women 2) Women's set has a tunnel 3) Men's set has a jump in the turn
Requirements, start of design	**Handout Track Build Requirements** Review and discuss. Have the students work on these independently at first, giving them 10 to 15 minutes to complete. Google "BMX Track Beijing" and click on "Images". *Scroll to the 2008 Beijing Track schematic so that they can compare the drawing of the track to the actual track seen in the video*. Here is the direct link: https://www.pinkbike.com/photo/2378491/ With the videos still up on SmartBoard, students should take time to sketch out track ideas independently, outside of their groups. After 20 minutes of independent time, encourage students to form teams of 4 to 8 for the project. If time remains, have students start to exchange ideas and collaborate with the group.	1) Anything the students notice in the drawing vs the video? 2) As you scroll through the tracks, any favorites? 3) What sticks out? Have the students discuss roles and responsibilities required within the groups. 1) What are the required roles in the groups? 2) What process should students use to determine who plays what roles? 3) What is a Project Manager and what role do they play in the process? **4) Some classrooms have introduced "the democratic process" allowing students to discuss and vote on roles within their groups.**

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Design revisions, compile and submit questions for BMX committee, soil composition & analysis, questions for track visit ⚠ Before end of Day 1, ensure that all students have returned their permission slips for the Track Visit on Day 3.	Go back into groups and finalize track ideas, roles and responsibilities. We strongly encourage groups to form roles and responsibilities. It can be as formal and defined as you want, but we have found the use of roles cuts down on conflict within groups. There is a strong social and emotional learning (SEL) component to the program, particularly as the week progresses and their designs are brought to life. We want to encourage students to: • recognize and manage their emotions developing caring and concern for others • establish positive relationships • make responsible decisions Most conflict within groups will stem from frustration; either certain design elements are not being used or one or more team members are not seen as "pulling their weight". We have seen success when groups use a democratic process (voting). Decisions are made by the project manager and then, if there is conflict, the group votes on it.	Introduce **Engineering Design Process** from Day 1 folder Students are using the process in their teams as they build their tracks. Can you give another example of how they could use the Engineering Design Process in life?

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	Decide on a preliminary track design with the group incorporating elements from each students own design. Decide on additional materials needed for the track build and who is responsible for the procurement of the materials, by when. Take design to teacher for approval. As a group, take 20-30 minutes to discuss questions for Track Build Committee. Have students write down all questions. They should vote and decide on the top 2 questions from their discussions. Go around the room and have each group read their top 2 questions to the class. Write the questions on the board and vote as a classroom which are the top 5 or 6 questions collectively. Please email those questions to Mike DuVarney miked@usabmx.com that evening. The Track Build Committee will respond to each question that evening. See sample questions in Day 1 folder.	Additional materials are not required. Students are strongly encouraged to repurpose anything they use vs buy something. If you have time, I strongly encourage you to reference the **UCI BMX Track Guide** in the Day 1 folder. It gives amazing detail about track building design requirements as well as a look into additional structures and suggestions. Going through the suggested toilet to spectator ratio guide could be an all-day discussion on math and engineering in itself.

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DAY 2: Dirt analysis, BMX rider Q & A, responses from track build department  **HANDOUTS FOR DAY 2:** • **Hand Texturing of Soil Worksheet** • **What is Soil Made of Worksheet** • **Soil Texture Triangle Worksheet**	Using the white foam cups, invite groups outside to collect one scoop of dirt and bring it inside. On their board or on a sheet of paper, have the students dump out their dirt for analysis. Using the **soil worksheets**, have students discuss their samples and fill out their work sheets.  NOTE: there are student versions and teacher versions of the soil sheets. While in their small groups start to formulate questions for track visit. Pull up the local BMX track (the one you plan on visiting) on a Smart Board to get ideas for questions. Bring up Google images of tracks with remaining time. Discuss beautification ideas or any potential items to bring from home to enhance track.	Questions about dirt: 1) What kind is it? 2) Why have we selected this kind of dirt? 3) What if the dirt was all sand? 4) What if the dirt was all clay? 5) How much does your cup of dirt weigh? 6) How many cups of dirt will it take to build your track? 7) Based on the scale of the track, how many cups of dirt would it take to build a life-sized track and how much would that weigh? It might be helpful to have a weight scale for your students to weigh the cups.
Q & A with BMX Elite Rider	If possible, have a representative from each team come up and ask their questions or give the questions to the teacher ahead of time and have him/her read them. Students should be taking notes if possible because they will be incorporating the responses in their designs.	We can use Google Hangout, Skype or Facetime Plan on 30 to 40 minutes total of Q & A

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Review responses from track build team ⚠ **On Day 2, we ask that you split the students into three (3) even groups for the track visit. Students should know their groups in advance of the field trip. We find it helpful to label the groups – colors preferred.** ⚠ Remind students they will be riding bikes. Wear tennis shoes. No sandals or heavy boots. Wear jeans – no shorts or skirts. Wear long sleeve shirts. Bring iPads, phones, or cameras to capture pictures.	Your responses will be sent via email by 9:00am EST. There are two ways to handle responses; you choose the method that works best for your classroom. After reviewing responses, allow teams to gather, review, and revise their design based on their new information. While still in their groups, have teams discuss everything they learned today and possible effects it could have on their design. Encourage students to ask relevant questions specifically related to their track build. "How long have you been riding BMX" "How much money does a BMX rider make" "Do you have any pets" While, interesting for sure, these questions will not give you an advantage with your track build.	Option A: Read all responses to the entire classroom Option B: Give each team their own response and do not share responses with the classroom The pros/cons here are the "sharing" of great questions and their respective responses eliminates any advantages. If groups "borrow" other groups ideas, is that good or bad? Sample discussion questions: 1) After interacting with the soil, should we make any adjustments on our final design? 2) The BMX rider said "XXXX". How do we incorporate that into our existing design? 3) The track build team said "XXXX". He uses a bulldozer and skid steer. What tools can we use to make those changes?

Lesson Segment	Learning Activity	Questions for Students
DAY 3: BMX track field trip, track visit worksheet, final design approval  **HANDOUTS FOR DAY 3** (after field trip)**:** • **Track Visit Worksheet**	 2nd reminder: Remind students they will be riding bikes. Wear tennis shoes. No sandals or heavy boots. Wear jeans – no shorts or skirts. Wear long sleeve shirts. Bring iPads, phones or cameras to capture pictures. Once at the track, students will be split into their pre-determined groups and start their rotations of three (3) stations: 1) Track Ride 2) Track Tour 3) Track Walk and Observations Groups will rotate through each station from riding the track to the tour, to the observations. Post field trip have teams make any final changes to their design based on the observations from the track. Once their design is finalized and approved by a teacher, we encourage them to start with laying out the design on the board and how it will work. We recommend that the teacher brings the dirt inside using the 5-gallon bucket. Dirt and water are mixed in the bucket to achieve the ideal ratio and all students in the classroom use the same dirt mixture.	Once back from the track have students complete the **Track Visit Worksheet**  We find that the most successful track builds start with students laying out their track design on their boards in pencil. This ensures that they like their layout and don't run out of space. If students have extra time, have them work on the actual track build.

Lesson Segment	Learning Activity	Questions for Students
DAY 4: Review plan and layout, track build basics ⚠ You should have received one (1) certificate for each student via FedEx prior to the start of the program. Should you need additional **Certificates of Accomplishment,** they are in the Day 4 folder. They are designed to be personalized for each student and handed out on Day 5.	Students should spend the entire day building their track and experimenting with their design concepts + procedures. • Tongue depressors should be used to cut and shape the track • Filled water bottles or something similar should be used as "rollers" to compact and smooth the track ⚠ • Students should not be applying soil tac until their track is completed and finalized (Day 5)	One concept to work out is how the entire group could be building and working on the track build at the same time. How would this work? Solution: have groups of 1 or 2 start at each corner working inward until the groups meet.
DAY 5: Finalize track build and beautification. Reflection worksheet. Judging final projects. 📄 **HANDOUTS FOR DAY 5:** • **Reflection Worksheet** • **Track Modeling Judging Scoresheet (for judges only)** • **Certificate of Accomplishment**	Students should be finalizing their tracks, adding soil tac and final beautification features. ⚠ Upon completion of their track, groups should take photos of their track and the team. All completed tracks need to be inspected by the judging team. Have students start to work on the **Reflection Worksheet** in the Day 5 folder independently, outside of their group while waiting for others to finish. Once all teams have finished and completed the reflection worksheet, discuss the project overall as a classroom.	Reflection questions: Discuss with students what they are reflecting on and why they are thinking about thinking (metacognitive skills). Remind them this is an individual exercise and they are encouraged to keep their thoughts to themselves. We want their thoughts on the overall experience in and out of their groups. Teacher feedback is encouraged.

Lesson Segment	Learning Activity	Questions for Students
	For judging: We encourage you to form a "panel" of judges. Often times schools invite a representative or rider from the local BMX track, a district administrator, a local business, etc. You want at least three (3) judges. We have also seen schools where the teachers + principal judge the projects. Have each judge use the provided **Track Modeling Judging Scoresheet.** For the Students Choice Award, this should be a vote by the students. After all teams are done with their projects and reflection worksheets, we encourage you to have students tour the other classrooms and view other students work. It is important to capture the student's reflections before they look at other designs. Most schools compile the Student Choice award votes by putting a cup on each Track Board and giving each students a pebble, marble, penny, etc. This ensures each student has one vote and the board with the most votes wins. A 1st, 2nd, or 3rd place team may also win the Student Choice award.	