

# BUILD IT

## Lesson Plan for Vertical Challenge

### Materials

For each student

- NXT Lesson 5

For each group

- Mind Storms NXT Base Set
- Custom BUILD IT NXT cable
- Parts from Technology Set and Educational Resource Set
- Three or more propellers
  - The vertical propeller(s) could be the airplane propeller(s) if desired
- Three slow motors
- Computer with NXT-G software
- USB cable or Bluetooth enabled on computer
- Two towels – one at desk/table to work on robot and one to carry around and wipe robot immediately after testing

### Procedure

1. Go through NXT Lesson 5 30 – 45 min
2. Introduce Vertical Challenge 10 min

Rules:

  - Similar to the Figure 8 Challenge, but under the water instead of on top.
  - Two buoys equally spaced from the end of the pool and each other.
  - Two pieces of tape about 2 feet apart at one end of pool, close to one of the buoys.
  - Bot starts at the edge of the pool, somewhere between the two marks. The bot may be at any height in the water.
  - When teacher says go, bot is released.
  - Bot has 1 second to get under the surface or off the bottom of the pool.
  - Bot must go around the first buoy, cross through the middle of the two buoys, around the second, cross the middle again in the opposite direction, around the first buoy once more and back to the start. Should trace out something like a figure 8.
  - If at any time, the bot breaks the surface of the water or hits the bottom of the pool, a penalty is added to the time. (5 seconds is suggested, but feel free to try something else.) If the bot cannot get back under the water or off the bottom within 1 second, another penalty is added. For each additional second above the water or touching the bottom, another penalty is added.
  - Touching buoys is ok, but moving them too much can mean disqualification.
  - The cable may not be used to help the bot sink or rise, or to help it remain stable. There should always be some amount of slack in the cable. Also, pool floats may not be attached to the cable in an effort to have the bot “hang” from the float in order to keep it at a fixed height.
  - At the end of a run, the total penalties are added to the time, and the resulting fastest time wins.
3. Build and testing time. 90 – 120 min
  - Groups may need extra time for this challenge due to the difficulty of getting the buoyancy and stability right.
  - Suggested demos: Buoyancy; Stability
4. Conduct challenge. 20 – 30 min
5. Logs, presentations, and review 15 – 30 min
  - Allow time for students to finish logs.
  - Optional – have a presenter from each group show their bot and discuss what they did.