Water Infrastructure Operations 2030

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KPS
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Baby Boomer Retirements Leave a Widening Employment Gap In Water Sector

Now retiring after 27 years as a water resources manager, Kathleen Cahall says they're having difficulty filling her position

By **Giles Lambertson**
July 23, 2018

Kathleen Cahall is retiring after 27 years as water resources manager for the city of Bremerton, Washington. (Photos By Stephen Brashear)

Millions of jobs will soon be done by robots. And they don't pay taxes

The Boston Globe. November 30, 2017

McKinsey&Company

MCKINSEY GLOBAL INSTITUTE

A FUTURE THAT WORKS: AUTOMATION, EMPLOYMENT, AND PRODUCTIVITY

JANUARY 2017

MCKINSEY GLOBAL INSTITUTE

RESEARCH. INSIGHT. IMPACT.

Seth Clevenger | Managing Editor, Features   February 6, 2018 11:00 AM, EST

Embark Self-Driving Truck Completes Coast-to-Coast Test Run

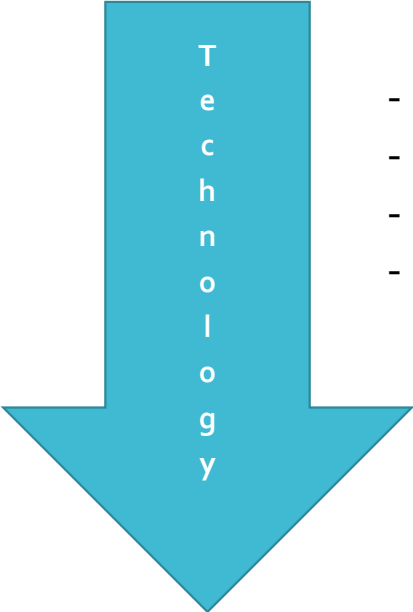*Embark*

- replacement workers

Displacement → Water Infrastructure Careers ← Retirements

- too challenging
- unappealing
- uncompetitive

Technology

- automation
- process control
- sensors and data analysis
- robotics

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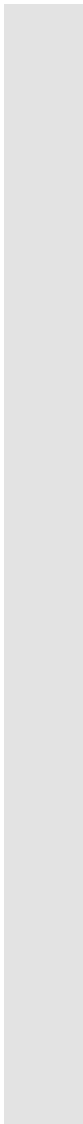
Outline

1

RENEWING THE WATER WORKFORCE

Improving water infrastructure and creating a pipeline to opportunity

JOSEPH KANE AND ADIE TOMER, JUNE 2018

B | Metropolitan Policy Program at BROOKINGS

- 2016: 1.7 million workers – designing, constructing, operating and governing US water infrastructure.

- Higher than average wages, particularly on lower end of income scale.

- Less formal education – 53% have high school diploma or less. Requires extensive OJT and specialized technologies.

- Tend to be older and lack diversity:
  - engineering managers: 49 yo
  - machinists: 48 yo
  - Operators: 46 yo

- 14.5 M infrastructure jobs translate well.

"The water sector captures a vast array of industries—from engineering and design firms to construction companies and contractors—and each rely on a different mix of occupations and workers"

Age range of workers in water occupations vs. all occupations
2016
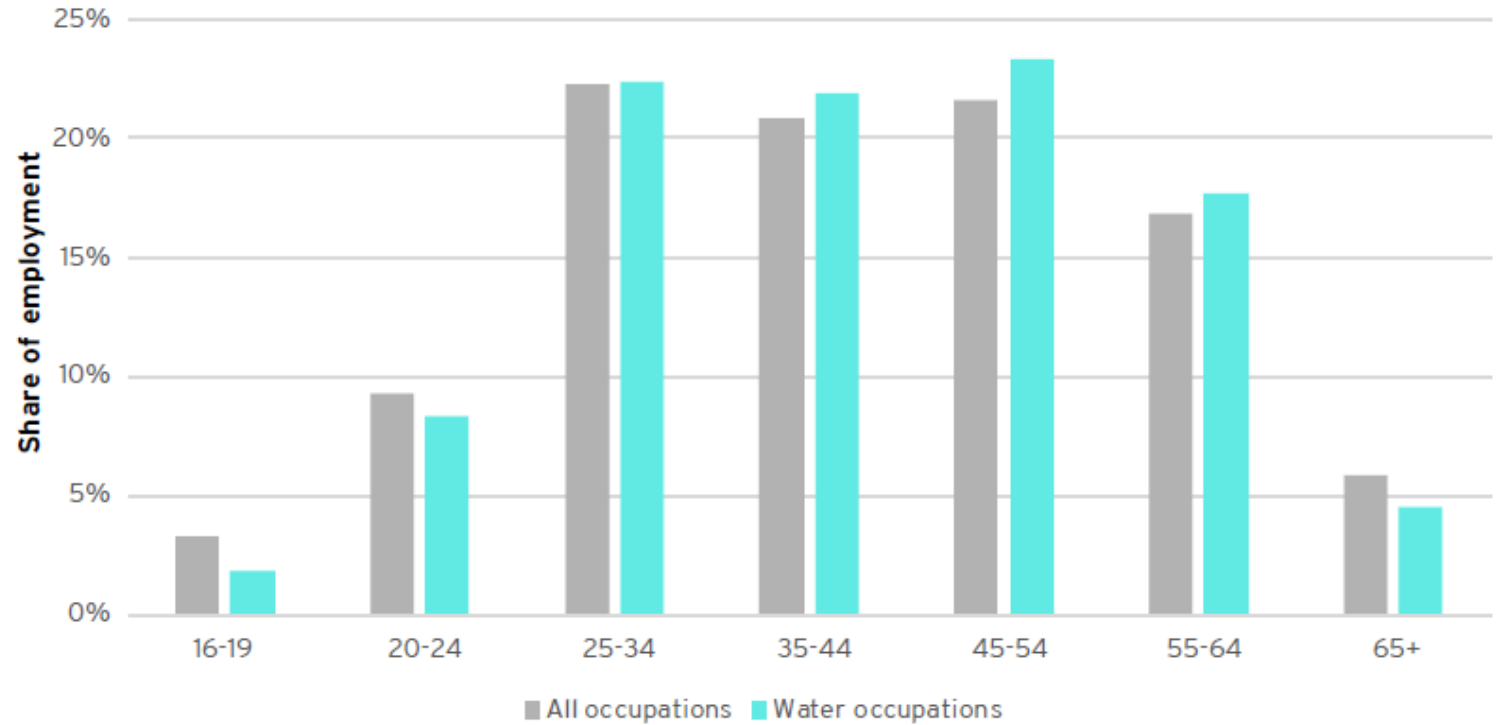
Source: Brookings analysis of BLS Occupational Employment Statistics and CPS data

Pay vs. Utility Benefits and Stability

MAJOR NEEDS IN WATER WORKFORCE DEVELOPMENT

- ✓ Acknowledge the varying scale and capacity of different communities—and utilities across urban and rural areas in particular—to expand the water workforce opportunity

- ✓ Emphasize that the water workforce needs greater public visibility, especially when trying to reach younger workers and other prospective job candidates

- ✓ Consider barriers to support a more diverse water workforce, including the importance of looking for talent in places that may not traditionally have attracted as much attention

- ✓ Investigate why identifying and hiring skilled workers remains a struggle for many utilities and other water employers, including the lack of proactive recruitment strategies

- ✓ Note the need for more extensive work experience and on-the-job training in the water sector, including the frequent difficulty to equip workers with hard and soft skills

- ✓ Examine the ongoing need to retain and grow talent within the water sector, including the development of new competencies and adapting skills to new demands and technologies

2

Online Discussion
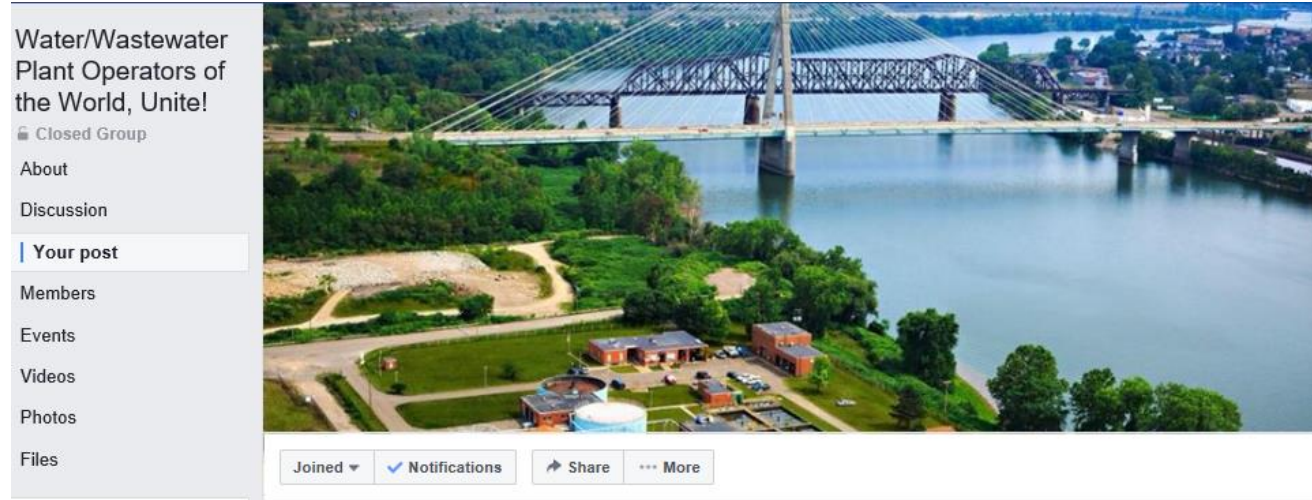
I am looking for answers (opinions and especially data) to the following questions:

1. How will wastewater operations change in the next 10-years? 20-years?

2. How has automation impacted operations jobs in the past 10-years?

3. How will automation impact operations jobs in the next 10-years? 20-years?...

4. What would you advise young operators to do to be creative and productive in the next 10-years?

Thanks,

Dave Kinnear

1. Major changes beyond biological treatment to include pharmaceuticals and micro plastics.

2. Where I work, automation is only in new mechanical plants. Currently automation is focused on drinking water.

3. Automation will do to wastewater what it did in the last ten years to water.

4. Be as familiar with data flow as water flow. Learn SQL, visual basic, programming language of your scada. Also train as an automation tech. Also, get your hands dirty doing things the way the old guard does it.

Andrew McNeil
Drayton Valley, Alberta
Canada

"Automation is here we have an MBR system that couldn't work without it."

Mike Gambino

"...like everywhere as rule of thumb humans will perform only work that robots can't. The contracting of maintenance and managing will increase. For the young lads are getting in this business it is a losing battle. There are already treatment plants W and WW were AI is silently learning from human operators. Very interesting topic."
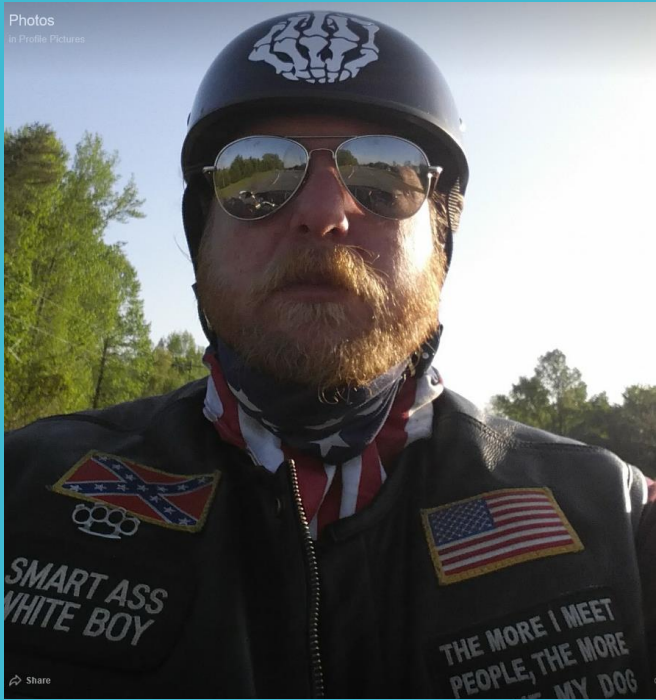
"Is anybody thinking can compete with a robot when it comes to specific tasks or learning? You can learn SQL, python, Java, perl, C/C++, OOP or OODB but an robot (or a cluster) will do an upgrade in a matter of seconds eh?"

"keep in mind the robots, do not retire nor get sick or need benefits, house or vacation. Perfect match with the municipalities minimizing operating costs."

Brad Thompson
Wastewater Operator
Ottawa, Canada

 "I would know that if it is all over the EU 😂 😂 . Especially for AI, as I am working on this subject 😉 Automation is very advanced and there is almost no plant which cannot be controlled more or less entirely by the SCADA. Still, controlling can be improved taking in account actual real time loads."

Martin Brandenberger
Process Engineer
Poryry Schweiz AG

"work work work work work.....

The best way to be creative in a field is to first know as much as possible. Don't pass up any task. No task is beneath an Operator. Remember that outside the lab, nothing is "by the book" all the time and there are multiple solutions to any problem. The key is finding the best one for the situation at hand."
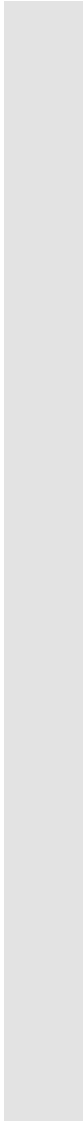
John Pruitt
Indian Head, MD

"Robots can not derag a pump, prime a pump, troubleshoot electrical motors or electrical systems they can not manually operate a plant when the PLC crashes so many things on an average 3 to 5 MGD plant"

"Also they could not readily adapt to design or control system changes as I had to deal with of the last 40 years from EM drives to liquid rheostatic slip ring variable motors to VFD's bubbler controls to ultrasonic and so forth"

David Bridges
Fruitland Park, FL

"When they have a robot that can pull rags out of a pump, I will retire."

"Robots/automation is only useful when the instrumentation is functioning properly. There will always be a need for operators to flip an "HOA" switch and take the wheel when instrumentation fails…"

3

Current Automation

Automation – the use of largely automatic equipment in a system of manufacturing or other production process.

Artificial Intelligence - computer systems able to perform tasks that normally require human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages.

> **Machine Learning** – electromechanical and other systems with the ability to automatically learn and improve from experience without being explicitly programmed.

> **Deep Learning** – machine learning from unsupervised, unstructured or unlabeled observations or data.

Robot - a machine capable of carrying out a complex series of actions automatically, especially one programmable by a computer.

Definitions

Water Infrastructure Automation

- Clarifier operation

- Pump control – pressure, flow

- Flow measurement and logging – charts to SCADA

- Composite sampling

- Valve operation

- Blower control

- pH measurement

- Temperature measurement

- Examples?

Activated Sludge Process Control
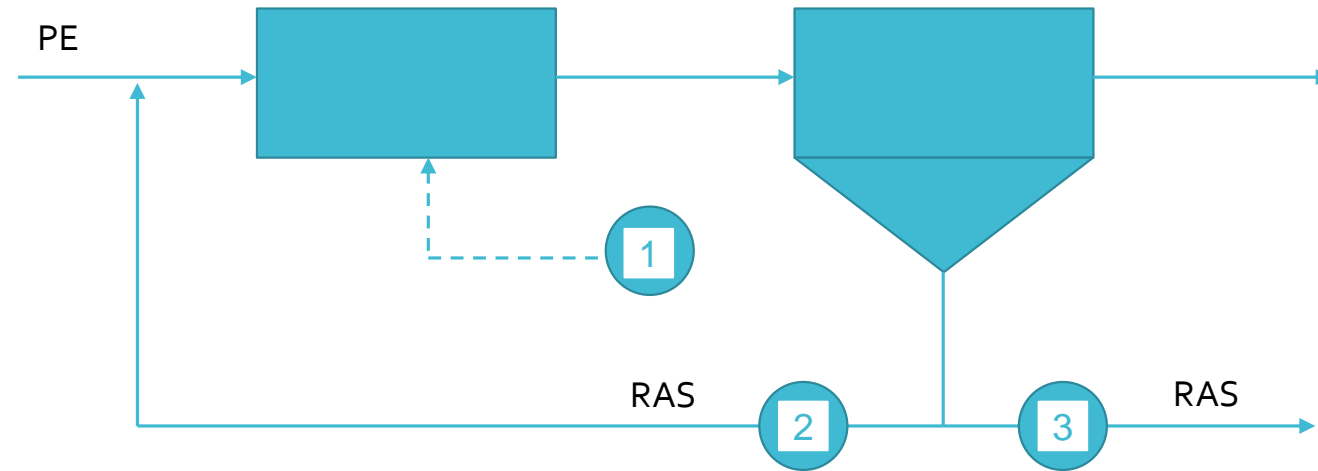
Design Controlled	Operations Controlled	Uncontrolled
Basin Volumes	1. Airflow Rate (blower)	Flow
Basin Configuration	2. RAS (pump)	Solids Properties
Equipment	3. WAS (pump) (SRT)	
	4. Chemical Feed?	

4

Future Automation

United States Government Accountability Office

Report to the Chairman, Subcommittee on Interior, Environment, and Related Agencies, Committee on Appropriations, House of Representatives

January 2018

WATER AND WASTEWATER WORKFORCE

Recruiting Approaches Helped Industry Hire Operators, but Additional EPA Guidance Could Help Identify Future Needs
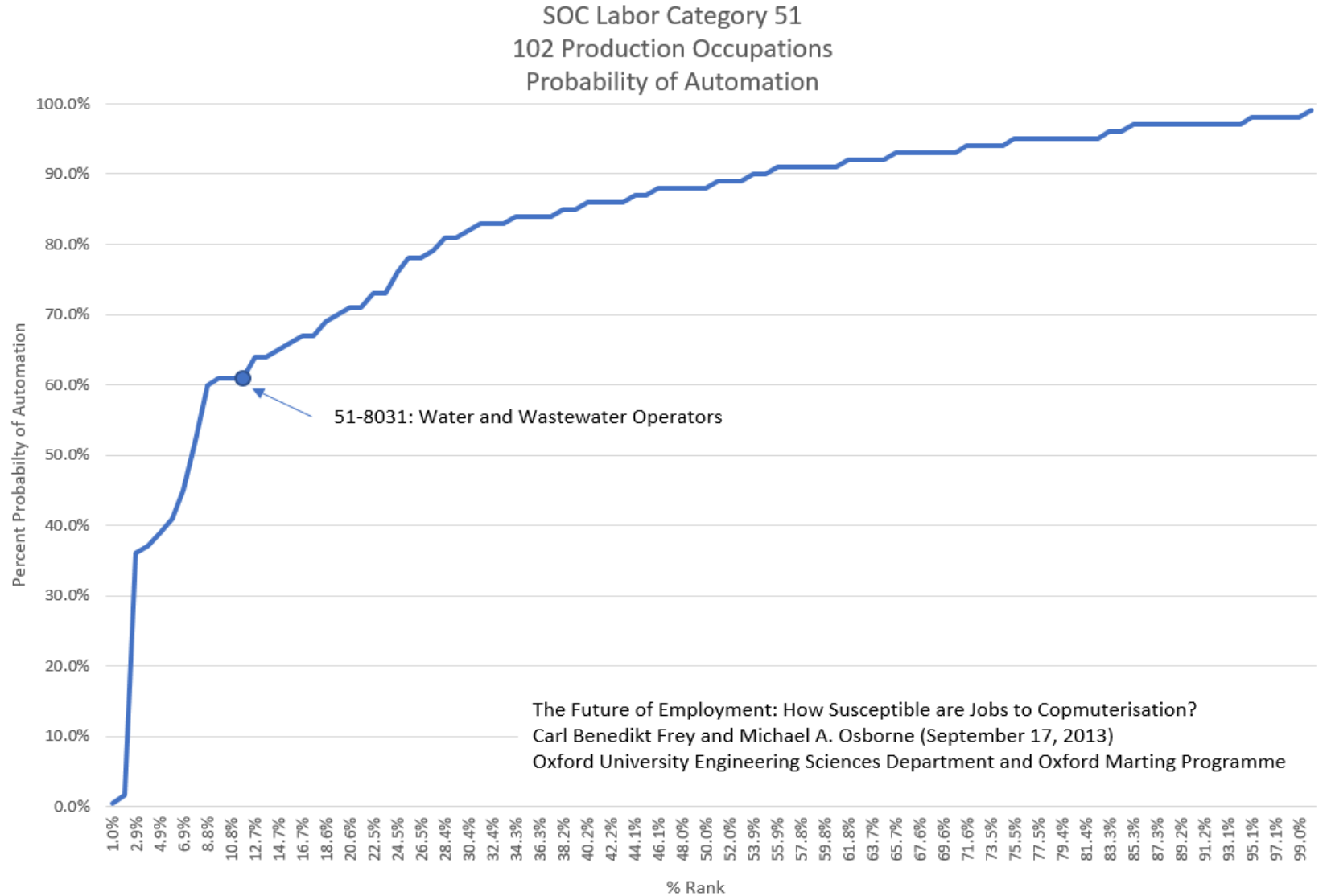
GAO-18-102

Automation – Tasks not Jobs

- No job is completely automatable – in the short term (10-years).

- Tasks will be automated reducing the number of operators required at each treatment plant to focus on the difficult to automate tasks.

- Automation will also reduce the number of people required to do certain tasks within most jobs.

- Job descriptions will change to those more easily augmented with machines.

- Individuals more experience in being leveraged by machines will be more valuable.

- Utilities also have a lot of retirements which will outweigh automation in the next 10-years.

Water Infrastructure Future Automation

- Pump deragging?
- Launder cleaning?
- Digester cleaning? (Scantron Robotics) [www.scantronusa.com]
- Sample collection – completed operation with sensors?
- Sample collection – completed compliance with sensors?
- Data analysis – DMR reporting?
- Employee supervision?

- Examples?

Water Infrastructure Automation Prediction

SOC Labor Category 51
102 Production Occupations
Probability of Automation

51-8031: Water and Wastewater Operators

The Future of Employment: How Susceptible are Jobs to Copmuterisation?
Carl Benedikt Frey and Michael A. Osborne (September 17, 2013)
Oxford University Engineering Sciences Department and Oxford Marting Programme

5

Water Infrastructure Operations 2030

- "The best way to be creative in a field is to first know as much as possible." David Bridges

- Know the basics – wastewater treatment

- Teach the basics – wastewater treatment

- Learn control systems/electromechanical systems
  - Raspberry Pi (https://www.raspberrypi.org/)
  - Arduino (www.arduino.cc)

- Learn 3D Printing

- Learn Biotechnology

- Learn Coding – Python or SCADA, Tensorflow (machine learning)

- Education disruption moved education online. You don't need full-time dedication or a classroom setting.

Questions

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