# DRK-12: Internet of Things (IoT) Pedagogical Ecosystem for Integrated Computer Science and Software Engineering Education for Grades 9-12

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## Key Rationale

Agriculture, Artificial Intelligence, Medical Technologies, Contruction, Food Industry, Military, Transportation, Natural Resources, Health Science, Manufacturing, Communication/ AV, Energy, Engineering & Technology, Security, Public Safety
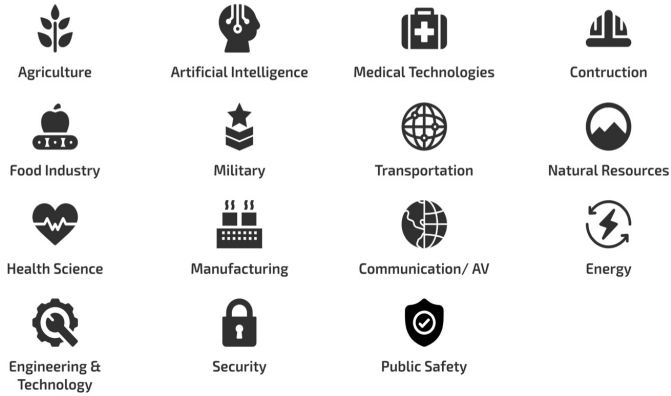
- IoT spans several industry areas

- Provides a wider exposure, depth, and breadth of STEM topics to students when compared to other hardware-based or robotics-based CS and SE education

## Key Thrusts

- Attention-Relevance-Confidence-Satisfaction (ARCS) model of motivation for curricular design to support active learning

- Modern technology stack for building the IoT educational framework

- Multi-methods assessment for capturing quantitative and qualitative data
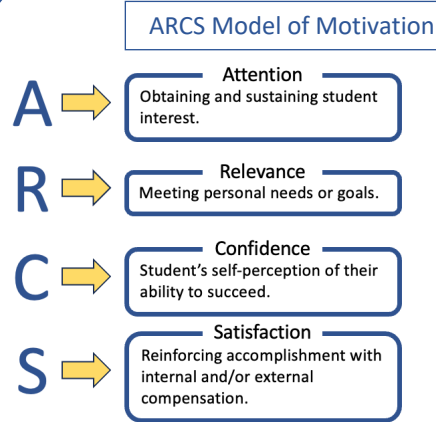
## Key Research Questions

1) What is the impact of IoT-based projects on students' CS, SE, and hardware skills and knowledge?
2) What is the effect of IoT-based projects on students' engagement and teamwork skills?
3) What factors inform students' motivation when engaging in engineering and CS PjBL environments?
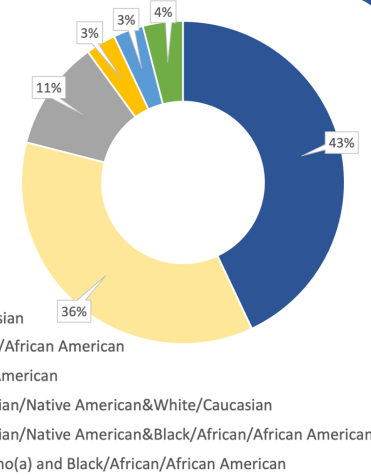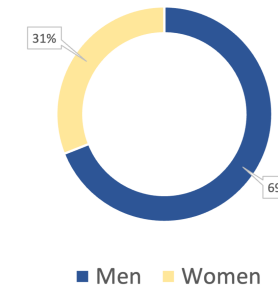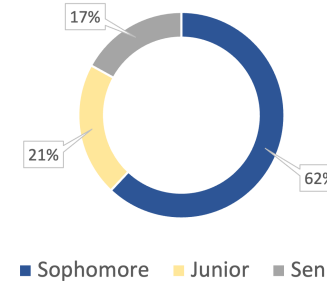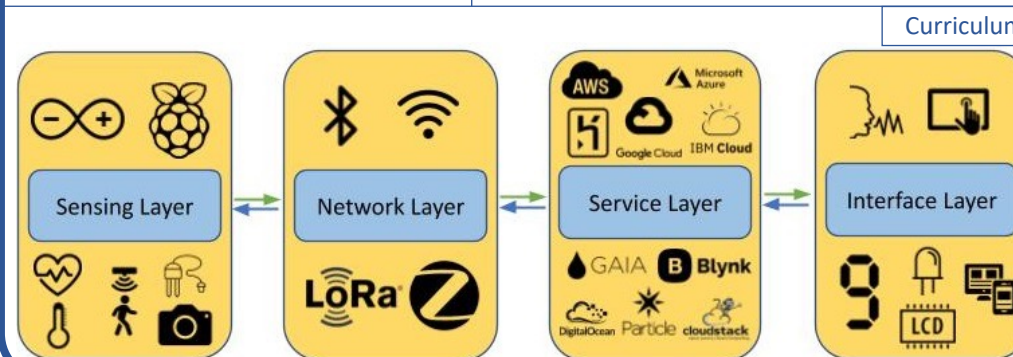
## Key Partners

THE SCHOOL DISTRICT OF PHILADELPHIA

NYC Department of Education

WEST DEPTFORD SCHOOL DISTRICT

THE FRANKLIN INSTITUTE

NEW JERSEY INSTITUTE OF TECHNOLOGY 40 YEARS Center for Pre-College Programs 1979 – 2019

NJ CCC New Jersey Council of County Colleges

## Key Results

### ARCS Model of Motivation

**A** → **Attention** — Obtaining and sustaining student interest.

**R** → **Relevance** — Meeting personal needs or goals.

**C** → **Confidence** — Student's self-perception of their ability to succeed.

**S** → **Satisfaction** — Reinforcing accomplishment with internal and/or external compensation.

### Participants and Setting

Chart 1: Sophomore 62%, Junior 21%, Senior 17%

Chart 2: Men 69%, Women 31%

Chart 3: White/Caucasian 43%, 36%, 11%, 3%, 3%, 4%
- White/Caucasian
- Black/African/African American
- Asian/Asian American
- American Indian/Native American&White/Caucasian
- American Indian/Native American&Black/African/African American
- Hispanic/Latino(a) and Black/African/African American

- A total of 6 focus groups with a total of 32 student participants.
- There were four participating schools from four different states.
- School areas: urban, suburban, rural

### Curriculum | Data Analysis

Sensing Layer → Network Layer → Service Layer → Interface Layer

AWS, Microsoft Azure, Google Cloud, IBM Cloud

LoRa, Z

GAIA, Blynk, DigitalOcean, Particle, cloudstack

LCD

First Cycle Coding:
- In-vivo Coding
- Codebook Formation

Second Cycle Coding:
- Categorization of First Cycle Codes
- ARCS Mapping
- Thematic Descriptions