**GRADE LEVELS:**

PreK - 12

**EDUCATIONAL SETTING:**

in school and/or out of school

**Award Provides:**

- One complete 3-gallon or 40-gallon Ioponics system *(indicate the desired kit in the additional comments section of the application)*
- 4 hours of professional development with $120 stipend (or sub reimbursement)
- Standard-aligned lesson plans for grades PreK-4, 5-8 and 9-12
- Technical support

**40-gallon System Includes:**

- 40-gallon aquarium
- Plant grow bed
- Base and stand
- LED light
- Timer
- Water pump & tubing
- Air pump & tubing
- PVC piping
- Seeds
- Fish & starter pellets
- Egg crate cover
- Adhesive thermometer
- Fish net

**3-gallon System Includes:**

- Two 3-gallon containers
- Net cups and clay
- Aquarium rocks
- Plants
- Fish

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**2023-2024 STEM Scale-Up Program Summary**

Ioponics, a classroom aquaponics system, based on E.O. Wilson’s concepts of biophilia. The term “biophilia” puts a label on humanity’s innate tendency to seek connections, or attachments, to other living things. Ioponics is an educational tool that easily incorporates biophilia in the classroom with NGSS (Next Generation Science Standards) and AFNR (Agriculture, Food, and Natural Resources) standards into a “living” learning setting. The model provides a hands-on, minds-on approach to STEAM (Science, Technology, Engineering, Agriculture and Mathematics) curriculum. The 3-gallon and 40-gallon Ioponics systems allow for any educational setting to actively engage with living organisms for agricultural and scientific purposes, independent of an outdoor environment. Beyond the STEAM and AFNR lessons, the Ioponics system engages with natural andragogical practices, builds student self-efficacy, strengthens 21st century skills and provides a classroom foundation for other curricular disciplines. Understanding the process of food production develops vested community members and creates engaged and knowledgeable citizens.

Ioponics creates a foundation for students to understand where their food comes from, how it is grown and its integration into curricular disciplines. While plants and animals are common in classrooms, typically they are not part of a food production cycle. The Ioponics systems naturally provide a linchpin which supports the seven NGSS crosscutting concepts and the eight AFNR pathways. The overarching NGSS concepts are: 1) patterns, 2) cause and effect, 3) scale, proportion, and quantity, 4) systems and system models, 5) energy and matter, 6) structure and function, and 7) stability and change. The AFNR pathways (systems) include: 1) agribusiness, 2) animal, 3) biotechnology, 4) environmental service, 5) food products, 6) natural resources, 7) plant, and 8) power, structural, and technical. Ioponics provides a context to address all standards and pathways in one self-contained model.

Ioponics is different from other aquaponics systems because it couples an easily modifiable hands-on unit with academic supports; standard-aligned lessons, systems support network and the ability to add personally created lessons to the composite system. Participating educators can create their own lessons to be shared with the Ioponics community or provide ideas for lessons which will be created by pre-service educators at Wartburg College.

**Requirements to Implement the Program:**

1. Educator must attend a half-day of professional development.
2. Educator must choose between the 3-gallon and 40-gallon system. *(Indicate the desired kit in the additional comments section of the application)*
3. For 40-gallon system (minimum): 1) Square floor/counter space 41” (104 cm) wide by 16” (41 cm) deep, 2) Height availability of 52” (132 cm), and 3) accessibility to an outlet.
4. For participant(s): 1) construct, use, and maintain the system, 2) teach the lessons, and 3) communicate successes and problems with Ioponics.
5. Educator(s) must participate in the STEM Council Scale-Up Educator Survey.
### Additional Cost(s) to Awardee in 2023-2024:
- Travel to training
- Additional aquaponics fish pellets
- Seeds & plants (personal choice)
- Replacement seeds and fish (if harvested)

### Approximate Sustainability Cost After Award Period:
Consumables such as aquaponics fish pellets, fish, seeds, plants, etc.

### Website:
wartburg.edu/ioponics

### ioponics Information Videos:
- [https://youtu.be/FfObQTQ5AHM](https://youtu.be/FfObQTQ5AHM) (2022)
- [https://youtu.be/94RS3T5hBTw](https://youtu.be/94RS3T5hBTw) (2021)
- [https://youtu.be/6TTmC74XcXs](https://youtu.be/6TTmC74XcXs) (2020)

### 40-Gallon Creation (taught during PD):
[https://youtu.be/zIwedycTpC8](https://youtu.be/zIwedycTpC8)

### Social Media:
Open and Private (by year)
Facebook groups for ideas, questions, and support

### Information Webinars
- Wed, Jan. 25 @ 7:30 am
- Wed, Jan. 25 @ 11:30 am
- Wed, Jan. 25 @ 3:30 pm
- Thurs, Feb. 16 @ 7:30 am
- Thurs, Feb. 16 @ 11:30 am
- Thurs, Feb. 16 @ 3:30 pm

Register for all webinars at: wartburg.edu/ioponics

### PK-12 Iowa Standards Alignment (Examples, not exhaustive list):

**K 8.1 PS:** Scientific Investigations: Children gather information and conduct investigations to address their wonderings and test solutions to problems. (pk-4)

**W.6.10:** Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline–specific tasks, purposes, and audiences.(5-8)

**HS–LS2–4:** Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. (9-12)

### Professional Development:
- **Duration:** Morning or afternoon (4 hours face-to-face) on a single day
- **Date(s):** July 31, August 2, August 4, August 7, August 9, or August 11
- **Location:** Up to 12 professional development presentations (with up to 2 in each region) in 6 locations (Northeast, North Central, Northwest, Southeast, South Central, Southwest). Recipients have the possibility to attend professional development in another region but priority is given to recipients in their geographical region.

### Photos:
A 40-gallon system awaits the addition of fish shipped in September. We highly recommend beginning, and sustaining, concentrated plant growth before the introduction of any fish. In this system you can see the beginnings of various agricultural, and house plants while students prepare for arrival with paper models created and painted by students. These systems are found in all age classrooms, pK through twelfth grade.

Some educators choose agriculture plants (tomatoes, lettuce, spinach) while others opt for less demanding varieties (pothos, philodendrons, monstera). Either way, 40-gallon systems have exponential plant growth requiring pruning. Feeding aquatic inhabitants (koi or bluegill) provides necessary nutrition for the plants.

Pre-school aged children observing their 3-gallon system. The completely self-sufficient aquaponics system grows small fish species (i.e., guppies) and plants (common house varieties). Students observe plant roots and fish growing. Once the plant growth has exploded, the system is self-sufficient. The low maintenance system seamlessly applies their understanding of science.

### STEM Scale-Up Program Application Link:
[www.IowaSTEM.org/Scale-Up-Application](http://www.IowaSTEM.org/Scale-Up-Application)