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Using Hydroponics to Teach the Effects of Climate Change

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This pilot study uses hydroponics, the science of growing plants without soil, to teach the effects of climate change. Climate-literacy's key concept evolves around the influence of climate upon our lives as our activities influence the climate; which isn't difficult to imagine, but isn't easy to learn experimentally. This is why we work with a small tank growing leaf lettuce with white LED lamps via the commercial hydroponic kit, "Green Farm (UH-A01E1)" made and distributed by U-ING in Japan.

The objectives of this pilot study are to verify the feasibility of a commercial hydroponic kit with its assorted small devices as for educational purposes for monitoring temperature, humidity, light, CO_2, O_2, consumed electricity and so on. We use: "LabQuest" and sensors from Vernier Software & Technology, "NODE+clima" from VARIABLE, weather station from Netatmo and CO_2 sensors from VAISALA.

It took only three weeks from seedling to harvest; and hence, we can perform multiple experiments within one semester. We could can monitor temperature and humidity but and we can control the minimum and maximum temperatures using an air conditioner. We can monitor the ambient CO_2 level due to human activities but we can not detect the change of CO_2 level due to photosynthesis of lettuce.

We estimate the amount of lettuce's carbon fixing by measuring the weight and water content of lettuce. It turned out that there is an optimum irradiation time i.e. 14 hour daily. We study the LED light spectrum's effect on photosynthesis via assorted color-cellophane filters. We have learned that hydroponics is a good lab activity for learning the carbon-fixing cycle and the effects of climate change upon that cycle.

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