School Gardens Enhance Children's Science Knowledge

School gardens are not a new pedagogical tool. School gardens (along with outdoor and experiential learning more generally) have a long history in a variety of educational philosophies including those of Rousseau, Montessori, and Dewey. However, studies examining the influence of school gardens on learning are often limited by small sample size, lack of a control group, self-selection bias, and other threats to internal validity. This study, a collaboration between Washington State University, Iowa State University, the University of Arkansas, Cornell Cooperative Extension NYC, and Cornell University, uses a true experimental design (or "randomized control trial") in an effort to determine the effects of a garden intervention on science learning.

The School Garden Study

Forty-nine elementary schools in Arkansas, Iowa, New York, and Washington participated in this study examining the effects of school gardens on children's science knowledge. At the beginning of the study, participating schools could not already have a school garden and at least 50% of their students needed to qualify for the federal free or reduced-price meals (FRPM) program. Schools were then randomly assigned either to a group that received a garden intervention consisting of both raised-bed garden kits and a series of 19 lessons or to a waitlist control group that received the garden intervention at the end of the study. Over the course of the two-year study, science knowledge of both groups was measured three times using a 7-question survey on nutrition and plant science.

The Garden Intervention

Naturally, there was some variability in the delivery of the intervention. The "garden intervention fidelity" (or "GIF") variable was created to account for the variability in the "fidelity" or "robustness" of the intervention. The total GIF was used to examine the dose-response effects of the garden intervention as a whole. In addition, two GIF subscales were used to assess the effects of the core components of the intervention: a) the lessons and b) the gardening components (i.e., planting and harvesting). For each of the three variables, the level of intervention was categorized into one of four groups ranging from no intervention (level 1) (which includes the control schools) to a very robust intervention (level 4).

Findings

Children in the group that received the garden intervention showed a significantly greater increase in science knowledge than the children in the control group. Using the seven-question 'Eating from the Garden' survey developed by the University of Missouri, it was determined that on average, the children in the intervention group increased their scores from 3.20 at baseline to 3.84 at the end of the intervention. In contrast, the children in the control group increased their scores from 3.26 to 3.43.

The study also found that the amount, or dose, of the garden intervention had an effect on the extent to which science knowledge improved. As shown below in Figure 1, the classes with no intervention improved approximately 0.15 from baseline, those

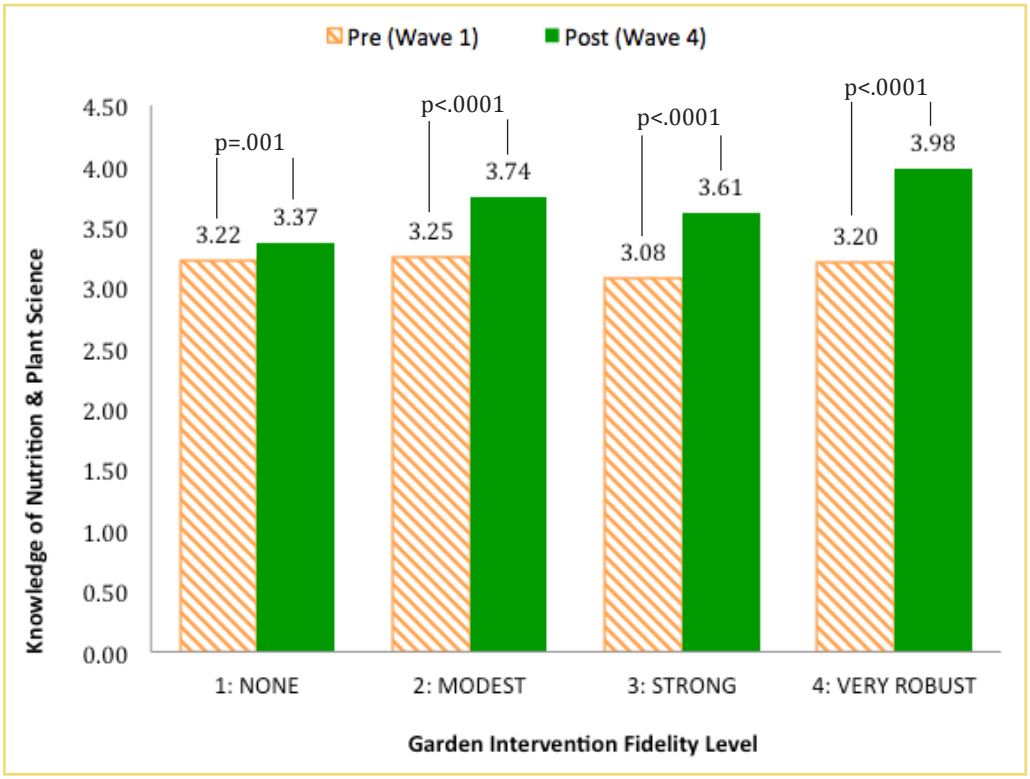

Figure 2. The effects of Garden Intervention Fidelity (GIF-Sum) level on Science Knowledge

with moderate intervention improved by an average of 0.49, and the classes with high to very high levels of intervention increased their science scores by 0.53 and 0.78 respectively.

When using the GIF variable, the study also found that when examining the effects of the lessons and garden components separately, both variables resulted in an increase in students' science knowledge.

Implications

The results of this study indicate that school garden intervention has a positive, although modest, effect on elementary school children's science knowledge in low-income communities. help reduce income-based disparities in science knowledge. This suggests that implementing school gardens in similar communities may be a successful way to impart scientific knowledge to low-income children. Moving forward, if school gardens can be more thoroughly integrated with the curriculum, and implementation can be more robust, they may help to reduce income-based disparities in science knowledge.

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Visit

Washington State University's People's Garden website: http://peoplesgarden.wsu.edu
Wells Lab at Cornell: www.wellslab.human.cornell.edu

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