

Transforming Agricultural Production and Rural Education through Schools

Evidence from Liberia



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In low-income countries where farm productivity is low and students frequently miss school to work on family farms, integrating science and agricultural education tackles a dual challenge: motivating students to attend school while enabling them to spread modern practices to their households and communities.

Through a three-year randomized evaluation in rural Liberia, researchers evaluated whether a school-based agricultural education program at junior high schools increased technology adoption and school attendance among rural households.

The results provide proof of concept that low-income countries can establish a relatively cost-effective system of school-based agricultural education that simultaneously diffuses agricultural techniques and improves school attendance among rural households.

KEY FINDINGS

- The program increased students' and parents' knowledge, knowledge sharing, and adoption of promoted farming practices on parcels outside of school, with greater impacts than programs targeting adults.
- The program improved dropout rates, school attendance, studying hours, livelihood aspirations, and Parent-Teacher Association (PTA) attendance.
- Parental and community engagement were pivotal to the program's positive effects on technology adoption and education.
- The program was relatively cost-effective: Every USD 100 (2026 currency) spent on the program led to an additional 0.30 parent households adopting promoted techniques, 0.18 additional years of education for students, and an increase of USD 8 in students' annual savings.

Introduction

Agricultural extension—the process of sharing new information, techniques, and best practices with farmers—is important for improving the livelihoods of rural households in low- and middle-income countries. However, a shortage of qualified extension officers results in few households receiving services, which limits agricultural innovation. This challenge is particularly evident in Liberia, where yields for staple crops rice and cassava are half the Sub-Saharan Africa average, and just three percent of rural households have access to government extension services. Moreover, to meet household productivity needs, children in Liberia work on the family farm, leading them to often miss school, with 20 percent of secondary-aged children (ages 15-17) out of school in 2019/20 and 84 percent of students in this age group being overage for their grade¹.

This challenge, which is particularly present in rural areas, can make it difficult for youth to improve their livelihoods as they grow older.

School-based agricultural programs present an opportunity to tackle both limited agricultural extension services and student retention. Evidence suggests that bringing agricultural training into schools can improve youth adoption of modern practices and prepare them for a career in farming. In addition, evidence from the environment sector has shown that students can be effective transmitters of knowledge and behavior to their parents and communities. Despite the potential for school-based agricultural training programs, however, questions remain about their broader impact on agricultural technology adoption and rural education.



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The Program

In Liberia's school-based agricultural training program, implemented by the global youth development organization 4-H, teachers are trained in hands-on teaching methods that integrate farming into science lessons, using school farms as science labs. Students are encouraged to develop home gardens, enabling them to spread new agricultural technologies to others. Unlike typical school gardens in Sub-Saharan Africa, this program emphasizes voluntary participation and incorporates improved technologies and an agribusiness focus, allowing students to potentially profit from their efforts.

The Evaluation

Researchers evaluated whether Liberia's school-based agricultural training program increased the adoption of agricultural technologies by students and parents and kept students in school.

A total of 197 schools participated in the study, with 100 randomly selected to receive the program and 97 serving as a comparison group.

¹ Ministry of Education, Republic of Liberia. (2022). Education Sector Plan 2022/23–2026/27.



Since parents lived far away from schools (1 hour on average), and rarely visited school farms (only 44 percent visited in three years), researchers implemented parental and community interventions that were randomized across program schools. These interventions aimed to increase parents' exposure to new technologies and students' diffusion efforts within households.

The first intervention involved promotional video sessions about the program for parents, implemented in 50 randomly selected intervention schools in the first year of the program. The sessions aimed to inform parents about the program (in particular, about the differences between this school-based agricultural training program and typical school gardening programs) and to convince parents about the program's positive impact on students.

The second intervention was an annual farmer field day that invited 25 leaders per school of collective farming groups in nearby communities. This annual farmer field day informed the leaders directly, and in turn other members of the community via word of mouth, about the promoted technologies.

Results

There are two main results: First, when parental and community engagement were included, the school-based agricultural training program was more effective in diffusing agricultural technologies than alternatives targeting adults, and improved students' education and livelihoods. Second, parental and community engagement were pivotal for the program's positive impact on both technology diffusion and rural education.

Increased household adoption of promoted farming practices: By the third rainy season, adoption of promoted farming practices on both students' parcels (outside schools) and parents' parcels increased. The program increased students' adoption of the promoted mix of soil management techniques by 15.7 percentage points and parents' adoption by 13.6 percentage points relative to comparison group schools.

The program's impact on parents was two to three times greater than the impact of other intensive extension programs in the Sub-Saharan African context (such as in Udry et al., 2019; BenYishay and Mobarak, 2019). This means that the program is more

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effective in increasing rural households' technology adoption even though it does not directly train adults. It also validates the claim that a school-based approach can improve upon existing extension systems in Africa.

Positive education and livelihood impacts: Contrary to concerns about potential negative effects of the program on students' education and livelihoods, it improved these outcomes when parental and community engagement were included. School dropouts fell by 4–5 percentage points over consecutive years. In addition, as a result of students' increased entrepreneurial activities on farms, students' annual savings increased by USD 4 (a 21 percent increase).

The program also improved students' aspirations, as the fraction of students who save for attending university increased by 6 percentage points (from 17 percent). There was a particularly strong effect on students' aspirations to pursue an agricultural career, as indicated by an increase in the fraction of students who studied agriculture as an elective by 18 percentage points.

Engagement improved the program's impact on technology diffusion: The program increased students' and parents' technology adoption only in schools that were randomly assigned to the engagement interventions, and had a near-zero effect otherwise. Further inspection suggests that these interventions altered the program's impact via two main channels. First, these interventions improved parents' exposure to new agricultural technologies via their visits to school farms (from 44 percent to 65 percent). As a result, the number of farming practices that parents reported learning from schools increased by 5 times. Parents' beliefs about the number of cassava tubers per plant that students can harvest also increased by 10 percentage points.

These interventions also substantially boosted students' efforts to spread technologies within households. In the absence of engagement, the program had a negligible effect on students who looked after farms, whereas with engagement, it increased this measure by 11 percentage points. There was also evidence that students became much more likely to teach and demonstrate promoted technologies. As a result, parents' scores on a knowledge quiz about the promoted technologies increased by 6.7 percent.

Parental engagement improved the program's impact on education: Engagement interventions reversed the negative impact on education. While the program by itself reduced student attendance by 31 percent, the full version (with parental engagement) increased attendance by 18 days on average over the 2021/22

and 2022/23 school years. Similar positive effects were also observed on students' school enrollment, studying hours, and parents' PTA attendance. These results indicate that while concerns about a school-based extension program diverting students' efforts from studying are valid, they can be addressed through parental and community engagement, which encourages rural households to view agriculture and education as complementary.

Cost-effectiveness

The school-based agricultural training program is a relatively cost-effective intervention for both improving households' adoption of agricultural technologies and strengthening rural education. The program also has the potential to become more cost-effective over time as schools build the capacity to run it independently.

The program cost USD 42 per student over three years of implementation across 100 schools. For each USD 100 invested, an additional 0.30 parent households adopted promoted techniques. These effects are comparable to those of farmer field days in Kenya (Fabregas et al. 2022) and larger than those observed in central training for contact farmers in Mozambique (Kondylis, Mueller, and Zhu 2017). When accounting for likely adoption by non-parent households near program schools, cost-effectiveness improves to 0.38–0.71 households per USD 100. The program also improved school attendance: For each USD 100 invested, students gained 0.18 additional years of education, more than most school participation interventions in Sub-Saharan Africa reviewed by J-PAL in "[Roll call: getting children into school.](#)" In addition, for each USD 100 invested, students gained USD 8 in savings.

Some program costs could be reduced from the outset. Parental engagement sessions, one of the main cost drivers during the evaluation, could be handled by existing field officers, and farmer field days could be hosted by schools at no extra cost. Separately, after three years in the program, schools "graduate" and continue independently with minimal external support, reducing the cost to an estimated USD 6 per student.

For more results, read IPA's [Cost-effectiveness Analysis Brief](#).

Research and Policy Implications

This study provides evidence that the school-based agricultural training program can improve both agricultural extension services and rural education. Moreover, it can be effective relative to existing alternatives.

In view of significant implementation challenges due to high rates of teacher turnover, limited compliance among schools, and the COVID-19 pandemic (only 70 percent of program schools started their farms in the first season), this study should be taken as proof-of-concept for school-based agricultural training programs.

Beyond the parental and community engagement interventions that demonstrated effectiveness, future research should study ways to tackle the challenges with implementation to strengthen impact. This includes improving the program's impact on educational outcomes as well as increasing the school-level impact, as the program is currently limited to 25 to 30 members per year.



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RESEARCHERS: Jimmy Lee

PARTNERS: Agricorps, 4-H Liberia (Implementing Partners)

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AUTHORS: Shahana Hirji

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