

Education, Agriculture, Technology

**Testing the potential for growth through underprivileged youth empowerment in
Chicago**

Alexander Horn - Research Seminar Summer 2011 – E. Benjamin

THE PROBLEM AND ITS SETTING

A: Statement of the Topic to be Explored

While all Americans are created equal, the environment is too often adversarial. "Disparities in health are embedded in the interrelationship of racism, culture and the historical, economic, and political structures that define the experience of African Americans and other racial and ethnic groups in the United States. (Lewis S94)"

This inequity is a predictor for whether a child will fulfill their potential. Low income and ethnic minority children, in particular, are more likely to be obese and have lower academic achievement (Ozer 849). While overall youth obesity has risen 100% over the past 30 years (Aboud et al 168), Black adolescents are twice as likely to be overweight as Caucasians (Wang et al 927). "Obese children and adolescents have a greater risk of social and psychological problems, such as discrimination and poor self-esteem, which can continue into adulthood. (CDC)" Both nutrition and education are unevenly distributed (Ozer 856), and employment is no different (Ihlanfeldt and Sjoquist 255).

This proposal examines the ability of a new form of community garden to counteract these effects among Chicago's urban youth.

B: Statement of the Problem and Subproblems within the Topic to be Addressed

Further examination of the current state of nutrition, education, and employment for underprivileged urban youth demonstrates that nutritional disparity is directly correlated to proximity to healthy food (Gordon et al 697). Proximity to healthy food is, in turn, correlated with race - Blacks in Chicago general have a higher incidence of cardiovascular illness and diabetes than Hispanics or Caucasians (Whitacre et al 115). Childhood obesity has medical consequences including obstructive apnea, hypertension, diabetes, gall bladder disease, cardiovascular disease, and osteoarthritis in adulthood (Rossi 2). "Although there is some evidence to suggest that rates of pediatric obesity have leveled off in recent years, this has not been the case among youth from low socioeconomic backgrounds. (Lubans et al 2)"

“The dramatic increase in obesity in the USA and worldwide over the past two decades is believed to be a consequence of social and environmental factors that favor a positive energy balance resulting from increased energy intake and inadequate physical activity. (Wang 927)” Thus this research seeks to improve diet and increase physical activity.

Employment, however, has little correlation with proximity to jobs (Ihlanfeldt and Sjoquist 255). Instead, race is primary indicator of employment; white youth have greater employment compared to blacks, independent of location (ibid). Summer jobs in particular are hard to come by for youth of all races - thus more so for minorities (ibid).

In addition to nutrition and employment, minority youth are further disadvantaged scholastically. Despite the achievement gap closing 50% in the 1970s and 1980s, minority performance has been on the decline since the 1990s compared to youth population as a whole (Killingsworth 16). The current educational system enlarges achievement gaps (Pesk and Haycock 4). These problems are not unrelated – “attention and academic performance are affected by nutritional intake. (Ozer 856)”

C: Statement of the Question about the Problem that Research will Answer

The question that the proposed research seeks to address is whether it is possible for a single educational technology program to address these factors simultaneously. However entrenched minority education, health, and employment are, there are hints of positive trends in research.

Youth nutrition has been improved in numerous studies (Azuma et al 8; Draper and Freedman 458; Rossi 2). Employment is as simple as generating jobs for youth. Furthermore, "school garden programs that are effective in achieving health and educational outcomes can serve as one relatively low-cost mechanism aimed at reducing health and educational disparities. (Ozer 857)”

While school gardens have grown in popularity (Draper and Freedman 459), the research about these activities is quite sparse. "There are now major gaps between research and practice with respect to school gardens. There is great enthusiasm and commitment ‘in the field,’ and

much anecdotal evidence regarding positive impact. Thus far, evidence from the small empirical literature has not provided similar support. (Ozer 847)" The lack of research to examine this popular trend is one of the motivating factors of this proposal.

What research there is, gives hope. "Some potential effects of school gardens may occur through indirect, mediational pathways, such as the possibility that school gardens could eventually raise academic achievement by improving bonding to school, nutrition, or parental involvement. (Ozer 862)" Community gardens have been shown to increase positive dietary habits regardless of setting or population (Draper and Freedman 458).

D: Statement of the Hypothesis that the Research will Test

With these trends in mind, the research proposed is a multi-component experiment in urban agriculture and educational technology (E.A.T.). The hypothesis to be tested is E.A.T.'s improving of community health and academic performance while providing much needed summer job opportunities for minority youth.

E:Delimitations

The proposed research will not affect education by enhancing tutoring per-subject. Nor will youth participants be matched with jobs outside the study. This proposal does not pursue "sustainability;" while it is a goal for the program to generate a profit and at least partially pay for itself, a full analysis of even that narrow self-sufficient definition of sustainability is beyond the scope of this proposal. Furthermore, this proposal is related to - or more properly a subset of - the larger category of Community Gardens. However the program's gardens are not 'open space' per the U.S. Department of Agriculture definition - they use Earth Boxes and, as such, can grown on any available area without soil. This proposal's community extends only as far collection of students, participating household members, and school staff that interact with the students.

F: Definition of Terms

The proposed study works within the following definitions so that precise results are assured:

Terms relating to Dependent Variables:

- **academic performance:** improved grades and/or increased engagement at school.
- **health:** physical qualities and diet that limits cardiovascular risk and diabetes, in addition to positive psychosocial behavior.
- **employment:** extracurricular labor in exchange for money in accordance with 7a-7p child labor law (9pm memorial through labor day) (IDOL)

Terms relating to Independent Variables (EAT):

- **educational technology:** Earthbox, Android phone, iPod, social network, farming application.
- **educational program:** structured interactive engagement with educational technology through engagement with student, teacher, and family.
- **urban agriculture:** growing produce and selling at farmer's markets, restaurants, food trucks, accounting for all variable, fixed costs and income generated.

G: Assumptions

The co-operation of the studied population is not to be taken for granted; this research should not take place if not seen positively by the intended community. Assumptions include that the enthusiasm for online social networking (Kim 1346) can be leveraged within a hands-on educational setting, as well as that the produce grown by youth will have access to local farmer's markets, restaurants, food trucks, and other vendors and distributors. A safer assumption is that there will remain a need for closing performance gaps between minority academic achievement, employment, and nutrition. Experimental assumptions are that each student will have access to enough water, sunlight, and a minimum of 4x2x8' space to grow vegetables.

II REVIEW OF THE RELATED LITERATURE

A. Major Issues Explored by Scholars who have Researched this Topic and

Problem

Youth community gardening is not a new phenomenon. "Community gardening has been addressing the urban congestion, immigration, economic instability, and environmental degradation since the late 1800s, waxing and waning with the socioeconomic mood of the U.S." (Draper and Freedman 460). Indeed, First Ladies from Eisenhower to Obama have planted the same garden 55 years apart as publicity for their distinct community gardening initiatives (462).

New to community gardening are the scientific study of programs, and the measuring of the indicators to draw conclusions about their effectiveness (Ozer et al 847) - as well as the use of technology to engage students (Kim 1342). Also new are numerous simultaneous expanding federal and state programs, as well as nonprofit partnership and local government leadership.

The U.S. Department of Agriculture, via the 4-H youth education branch of the Cooperative Extension Service, began disseminating the Junior Master Gardener's Program in 1999 and now has approximately 4,000 registered implementers (Ozer et al 847). The U.S. passed 4.5 billion in new youth nutrition funding over 10 years, specifically including 40 million for a farm-to-school initiative to increase presence of fresh produce in the classroom via local farms and school gardens (US Senate Committee on Agriculture, Nutrition & Forestry 2010). The Departments of Education in both California and Louisiana have developed school garden curricula with activities that promote specific state-achievement standards or learning objectives for each elementary grade level (Ozer et al 847). Examples of school and private partnership are The Edible Schoolyard in Berkeley, California (ibid), Earthworks in Boston, Massachusetts (Earthworks), and a 'food desert summit' in Chicago to fast-track grocery stores in needy communities to increase access to fresh produce (WBEZ 2). Chicago's mayor also introduced new zoning for urban gardens within first 100 days of office (ibid). The state of Illinois is supplying extra funding specifically for fresh produce consumption for needy children (WBEZ 1).

So, there is much growth. Yet are there results? "The growth of school garden programs has not been accompanied by systematic assessment of their impact" and "very little research

thus far assessing the effects of school garden programs. (Ozer et al 847)" Yet there is *some* research - as well as much indirect research that has one or more factors of interest for this proposal.

Health and Nutrition

First, do gardens improve health? While youth gardening can improve diet, there is no educational study that has demonstrated that it brings lower BMI, or lesser cardiovascular risk - primarily due to the shortness of the studies which is in turn due to lack of resources and funding. Yet, even beyond community gardening, "there has been surprisingly little epidemiological or experimental research on the relationship between consumption of fruits and vegetables and obesity. (Ozer 848)" However, "inadequate consumption of vegetables among adolescents has been correlated with a range of poorer academic and health outcomes including lower academic performance, alcohol and drug use, being overweight, and weight dissatisfaction. (848)" There is no doubt that preventing obesity in childhood delays chronic health issues later in life (Rossi 2).

Furthermore, student health goes beyond measurable quantities of nutrition and weight, and into the psychosocial realm where variables are harder to measure. Even so, studies of community gardens have shown improved leadership, socialization in youth (Draper 22).

So, there are still health benefits. Youth farming increases vegetable and fruit consumption as well as physical activity (23). Indeed, "the current obesity crisis is focusing attention on [community gardening] programs as a school- based means of promoting nutrition and exercise. (Ozer et al 849)"

In summary, "school gardens as systemic school- level interventions with the potential for (a) promoting the health and well-being of individual students in multiple domains (i.e., areas of functioning) and (b) strengthening the school environment as a setting for positive youth development. (849) "

Education

Do gardens increase academic performance? As with health, academic performance cannot be measured as directly or as quickly as desired. GPA most easily measures academic performance, yet GPA was not collected in any of the reviews studied. Also of note was the

variable extent of embedding the programs into schools or as supplemental extracurricular programs.

Yet just as there is more to life than is taught in school, there are other means of measuring educational value than increasing GPA. " School garden programs and curricula build on models of hands-on, problem-based environmental and science education. They also are a form of community garden, providing a new setting for interactions among members of the school community and potentially promoting the social networks, sense of connectedness, and skills of the community. (Ozer et al 848)"

"Low-income and ethnic minority children are more likely to be obese and have lower academic achievement, with low-SES (socioeconomic-status) schools in economically deprived areas less likely to have parental involvement. (860)" Thus it's these areas that the proposed research will operate within, as they have the greatest need and least resources.

It's worth noting that such programs needn't be resource intensive. A form of nutritional education called 'Minimal Intervention' (Abood et al 174) was 30 minutes twice a week every other week for six weeks. It was a simply a power point presentation - nothing digitally interactive or complex; it's a modern day filmstrip. Yet it still was enough to show a significant difference between pre and post-test groups (174). Furthermore, due to the scale of the problem, applied nationally, even a five percent success rate would improve nutrition and behavior in 2.1 million teens (174).

Youth Employment

Economically, gardens can generate considerable wealth. "A one-acre vegetable garden, established as a component of a diabetes education program on an American Indian reservation, produced 6,000 pounds of fresh produce, in one year... 501 West Philadelphia community gardens produced \$1,948,633 worth of fruits and vegetables in a single year, helping to feed, at a minimum, the 2,812 families directly involved in the gardens (Draper and Freedman 483). And in New York City, "an investment of five to \$10 in plants for a garden plot provides for a profit of \$500 to \$700 worth of fruits and vegetables (483)." "A community garden provided wage-earning opportunities for youth, especially for ones considered at-risk or from low-income families (484)."

As for the availability of work, "applicants for summer youth employment programs in big cities, including Chicago, New York City, and LA, have substantially exceeded the number of available slots. (Sum et al 1)" Proximity is important. "Job access has an important effect on the job probability of central city teenagers. As the length of the required commute increases, ceteris paribus, the probability of the teen-ager having a job declines. (Ihlanfeldt and Sjoquist 258)"

From these studies the conclusion can be drawn that, when organized properly, youth gardening can offset the racial and youth employment bias present in American society by providing much needed jobs in the home, neighborhood, or school and thus easy to get to.

"School garden programs focused on improving student nutrition will be most effective if they can promote (a) positive attitudes toward fresh produce by providing experiences of eating high-quality, fresh produce, some of which they may have helped to grow; (b) knowledge of the health benefits of more nutritious eating and the health risks of less nutritious eating; (c) peer and family norms that are supportive of healthful eating; and (d) environmental conditions in the school and, ideally, at home and in community that provide healthful food options and limit the ready accessibility to less healthful options... It would be important for future research and evaluation to assess the relative effectiveness of garden programs with varying levels of breadth with respect to curricular activities involving the whole school, family, and community contexts." (Ozer 855)

The proposed research seeks to build upon this recommendation by including an economic incentive through employment and profit-sharing, and engagement through new technology.

B. Methodologies Utilized by Scholars to Research this Topic and Problem

Many gardens happen without a proper research framework. However the increasing popularity of gardens has indeed brought with it some amount of peer reviewed scientific works involving gardening's interaction with education, nutrition, and employment.

Health and Nutrition

Studies investigated youth health and nutrition through the full gamut of research methodologies: interviews, surveys, field observations, experiments within both positivist, interpretive, and critical frameworks. (Rossi; Lubans et al; Abood et al; Kemierembe et al, Anderson and Kim; Wang)

Each study performing a survey was also concerned with measuring height and weight

so they could calculate Body-Mass Index (BMI) (CDC). The only exception to this was Abood et al, who were not at all concerned with quantitative health data, but rather interpreting psychological 'health outlook' of the students in pre and post-test.

The most longitudinal study found of diet and nutrition was over 12 years across 17 zip codes, containing 80 percent of the black population in Los Angeles. They gathered data from GIS, census, as well as BMI from driver's licenses, cardiovascular treatment incidence in aggregate from area hospitals to ascertain the health of the community and impact of control variables (going so far as to introduce grocery stores to the community and measure impact) (Lewis S93).

The shortest study was Abood et al, who looked at student's health outlook over the course of one week via pre-test, post test and experiment.

Education

Studies investigated education primarily through surveys and experiments. Pre and post-tests after a form of instruction were common. What varied were the forms of instruction. Instruction ranged from as simple as a 30 min PowerPoint presentation in school (Abood et al 174) to a very structured program over a full year that combined both school and extracurricular (Lubans et al 3).

Timeframes for studies ranged from 30 min in a single week (Abood et al), to 12 hours over 4 weeks (Kemirembe et al 3), to a full year (Rossi 11; Lubans et al 3).

The most in-depth experiment had a "multi-component school-based intervention and includes enhanced school sport sessions, interactive seminars, nutrition workshops, lunch-time physical activities, PA and nutrition handbooks, parent newsletters, pedometers for self-monitoring and text messaging for social support (Lubans et al 3).

The minimal intervention was Present and Prevent, a commercially available PowerPoint program presented in two 30-minute time slots over one week (Abood et al 174).

Of the experimental educational studies, the data gathered was less focused on GPA and more on retention of the material presented (Lubans et al; Abood et al; Kemirembe et al, Anderson and Kim). In fact, not one experimental study reviewed actually gathered student GPA,

thus our research will include it.

Care was also taken to avoid financial burden on a presumably resource-limited lower income school district. "The intervention is focused on the promotion of low-cost lifetime and lifestyle physical activities and will be delivered over four school terms (i.e., 12 months) at no cost to the school or students. (Lubans et al 13)"

Youth Employment

Studies of employment used different methods than education or nutrition. Historical and content analysis was more prevalent, due to the large amount of employment data that already exists (Ihlandfeldt and Sjouquist; NYEC; Sum et al). This is what allowed a sample of 5694 black students and 8394 white students in Chicago (Ihlandfeldt and Sjouquist 262), considerably greater than any other study reviewed.

As a whole, each study had a random selection as a part of the subject selection process; what differed is the method of application. All studies used socioeconomic indicators to choose what location to perform the research, and then used random selection to select school districts and/or which students in the actual school. Only one study did not use a control group (Rossi). This study also had the smallest group of 17 students; the largest was Ihlandfeldt and Sjouquist's analysis of 14088 Chicago area students.

Most research was Descriptive, with the Exploratory (hypothesis-lacking) exceptions being Anderson and Kim, Wang et al; and the Explanatory nature of Ihlandfeldt and Sjouquist's grounded study, looking for reasons for the employment differential.

Ethnographies and grounded studies (Ihlandfeldt and Sjouquist; Kim) were used for exploring a topic and defining terms to be used for future research, while case studies and surveys were popular in experiments (Abood et al; Lubans et al; Rossi; Kemirembe et al). Typically both quantitative and qualitative data were gathered, the exception being Abood et al which was purely qualitative, looking more at student psychology than empirical facts, and Kemirembe et al, which was solely concerned with student retention of facts.

There was the occasional grounded theory where they just played with data and published statistical correlations (Ihlandfeldt and Sjouquist; Anderson and Kim) but those were

very rare compared to actual fieldwork.

There was some content analysis with classifying the advertising and signage on community grocery stores (cigarettes, liquor, type of food, etc) (Gordon et al), as well as a curious use of content analysis on the study itself (Abood et al 170). In this case, the educational technology used in their experiment was made by a 3rd party, and two of the researchers then performed content analysis to validate the theories guiding the content. This appeared to assure internal validity of the study (170). There was one case of historical research where they were concerned with the detailed racial ancestry of the children and parents (Rossi).

Furthermore, every experimental study had some mention of human subject concerns and ethical review board approval with the exception of Rossi who was likely allowed due to the small sample size and the nature of her work (which was a student thesis lacking funding).

Lastly, the use of statistical methods was extremely varied. Ihlandfeldt and Sjouquist were particularly aggressive, devising complex models with over 17 variables. Other statistical treatments were questionable (Rossi) simply due to small sample size. None of the reviewed literature failed to include at least a limited statistical analysis.

The diversity of research methods allows this proposal to select what is most promising and efficient from past efforts.

III. PROPOSED RESEARCH METHODOLOGY

Qualitative data has its advantages for thorough understanding of individuals and communities - but is labor intensive and impossible to automate. Quantitative data can be automated, and high volume and frequency of samples is both inexpensive and informative. Short on-site in-person interventions are effective. If a variable exists and can be included at little or no cost (i.e.; GPA), it should be.

With these factors in mind, the proposed study utilizes technology to engage a sustained intervention and robust data gathering with a minimal team. Pre and post test interviews and surveys combine qualitative and quantitative data gathering at the start and end of the study's growing season with automated real-time quantitative sampling of the population throughout and

a-follow up survey a year afterwards, as well as a control group. This mailed survey represents an extended post-test at very low cost to look for any possible change in longer-term indicators such as BMI, GPA, and continued employment – variables shorter studies have no chance at measuring.

Operationally, the proposed study employs technology (earth box, smart phones, iPod/pedometer) to allow a 'nomadic' and site/context adaptable study. Participants can garden, submit data, participate and sustain program engagement anywhere in the community - empty lots, in schoolyards, indoors, or even at home.

Academically, It's quasi-curricular - the option is there and materials provided for inclusion into school curriculum, but if there is no interest, the study can be purely extracurricular (beyond the pre and post test teacher interviews). Existing civic resources (Chicago Center for Green Technology and City Colleges) will be used to support the study rather than any participating school, requiring no additional resources from the school districts. Sponsors (Google, Apple) will donate the technology.

A The Data to be Collected

1. Description of Data (by variables):

Dependent variables:

- **educational technology:** pedometer, Android phone use / social networking interaction, earth box progress
- **urban agriculture:** crop yield

Independent Variables:

- **academic performance:** improved grades and/or increased engagement and positive behavior at school. Measured by pre and post interviews w/ teachers and GPA, as well as student attitude and engagement in extracurricular activities.
- **health:** dietary log (Android), physical activity (pedometer)
- **Employment:** punch cards (Android)

Description of data (by category):

health:

- age of students
- weight / BMI of students
- activity of students (pedometer)
- weight / BMI of participating families (opt-in)
- dietary log of students (opt-in)
- dietary log of participating families (opt-in)
- family medical history (primarily cardiovascular)
- Gender of participant

academic:

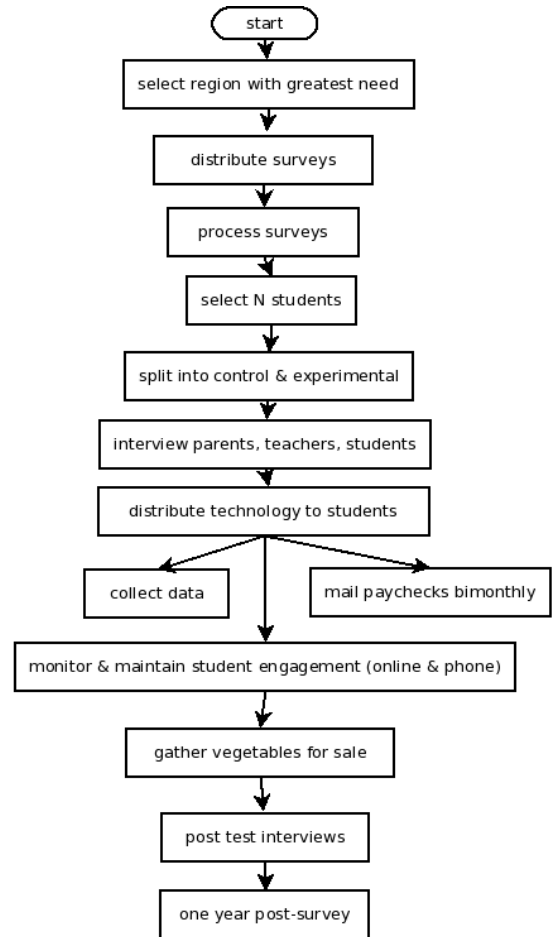
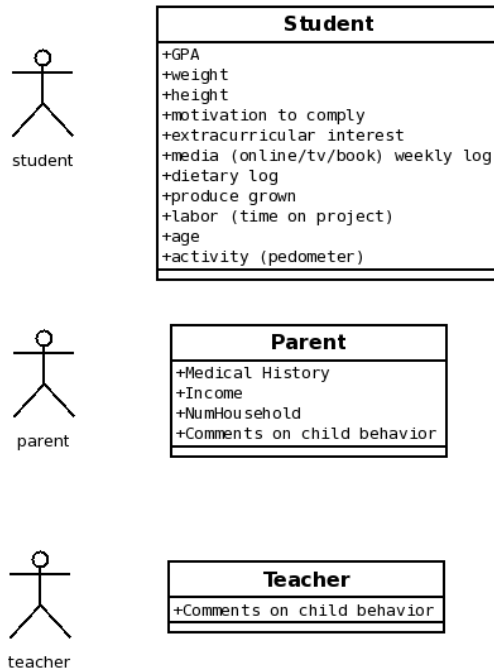
- attendance
- GPA
- teacher interviews and surveys
- parent interviews and surveys
- student interviews and surveys
- (interviews measure (potential) subjective changes in student behavior)
- (interviews can also educate about program)
- Duration of Program Participation

economic / employment:

- labor timecards
- student wages
- past employment history of students and parents
- Amount of Produce Grown during program

2. Location of Data

The data lives within the students, parents, teachers, school administration, as well as within the mobile application and supporting database. IRB approval will be required. The following shows where the data lives, as well as an experimental flow chart.



B. Techniques for Collection of Data

For measuring health, a combination of direct measurement of physical traits (BMI, Physical Activity, Weight, diet), along with a survey and guided interview with parents to gather historical (medical and employment history of student and parent) data will be used.

Academic data will also use a combination of empirical measurement (GPA, attendance, duration of program participation) accompanied by interpretive interviews with parents, teachers, and students. The surveys will be mailed out and returned prior to the pre-test, thus returned surveys may be used to tune the guided interviews. The interviews will serve to both educate about the project, as well as collect subjective qualities that cannot be quantified in the survey. The interviews will take place in a natural setting - at home or at school. For economic, some of

the data will be from the mailed surveys, other will be in the form of timecards and according wages, as well as dividends from sales.

For measuring dietary log, labor, and pedometer, a custom application will be developed for use on an Android-based smart phone and/or iPod nano. The Android phone will record when students are on-site as well as gather dietary logs and weekly progress reports - these will be gathered in real-time. The iPod will gather pedometer activity to be downloaded at the end of the program.

In total, the combination of qualitative and quantitative data gathered primarily at pre-test and post-test, combined with continuous quantitative data throughout the project (timecards, wages, attendance, physical activity, dietary logs), will serve to maximize both the internal and external validity of our research. Two extensive cross-sectional snapshots of quantitative and qualitative data during the pre-test and post-test are illuminated by the longitudinal quantitative data gathered throughout the program.

IV. OUTLINE OF THE FINAL REPORT

The final report will be presented as follows:

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V. EXPECTED OUTCOMES

The aim of the proposed research is three fold. The first goal is to improve the lives of a group of underprivileged children by demonstrating new behaviors, teaching new skills, and providing income. Additionally, the proposed research aims to leverage the existing trends of urban gardening, local/slow food, and online social networking as resource multipliers to allow this work to reach beyond the immediate research subjects. The popular expansion of urban gardening and sustainable sensibilities requires empirical data to refine and inform future efforts to ensure lasting positive social impact.

The proposed research will be of particular use for guiding civic policy and nonprofit outreach locally and globally. Combining positivist and interpretive methods with new technologies allows more precise measurement of the level of (previously demonstrated) interaction between the multiple dependent variables. Thus the final goal of this study is to demonstrate new skills and methodologies for empowerment not only to the subjects, but also to the research community and world at large.

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