Extending K-12 Education: Issues Facing Informal Learning Programs

A report presented to the University of California, Office of the President

by

The Solana Beach Coalition for Community Education

Report prepared by:
Honorine Nocon
Katie Van Thillo
Allison Weston

with supporting materials from:
Linda Colby
Lori Hayes
Sarah Thomsen

and the support of:
Michael Cole
Noah Finkelstein

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ABSTRACT

Informal, after school learning programs represent a useful tool for extending and enhancing K-12 education for all students and especially for students from traditionally marginalized populations who can benefit from more individualized attention than the public schools' resources and design can provide. Our community-university collaborative has been supporting UC Links informal, after school programs for four years. During this time, we have become aware of two key issues which undermine our attempts at "pursuing more substantial funding" for "our long term, comprehensive campus and community efforts." These are: representing the characteristics and special needs of those children who grow up in enclaves of poverty surrounded by affluence; and defining, measuring, and reporting quantifiable social and cognitive outcomes for these children from participating in specially designed after school programs. Based on a one-year study funded by the Office of the President of the University of California, our community-university collaborative has found 1) children from low-income households in affluent areas, while often invisible to funding agents who measure need based on geographic areas such as zip code areas or school districts, share the acute needs and many characteristics of their socio-economic peers who reside in less affluent areas; and 2) measurement of outcomes of informal education programs must include qualitative measures as well as quantitative measures.

Background

The study reported here was undertaken by a community-university collaborative consisting of an elementary school resource teacher, and youth club program director, and the director of a Head Start center along with faculty and researchers at the University of California, San Diego. Prior to engaging in this study, the members of the collaborative interacted for several years in the process of supporting informal education programs in the community of Solana Beach, California, located on the Pacific coast approximately ten miles north of the university.

Demographics

On January 1, 1999, the population of Solana Beach was 14, 152 persons, of whom 19% were Latino, 3% were Asian, and 77% were white. Among children ages 0-14, 29% were Latino. The median household income was $64,860 (SANDAG 1999b, 2000). According to the 1990 census data (SANDAG 1999b), among residents age 25 years and older, 49% hold a Bachelor's degree or above. Housing costs in this affluent and highly educated jurisdiction are high, the median home value in 1990 was $371,543 and the median rent was $826. (Both values have risen substantially in the last decade.) Amid this affluence, 4.6% of families (but 10% of the population) in Solana Beach were living

below federal poverty levels. For children, ages 0-17, the figure rises to 12.7%. Additionally, 9% of the adults ages 25 and over had not completed high school. Half of these had not completed grade school. Among those with low household incomes and low levels of education in Solana Beach, the majority is Latino.

Collaboration in Providing Informal Education

The Laboratory of Comparative Human Cognition, (LCHC), at the University of California, San Diego, (UCSD) has been providing after-school education programs in collaboration with local community partners in Solana Beach since 1987. Based on a model of university-community reciprocity, community institutions provide space and staff support while the university provides trained undergraduates to work with children and youth ages three to eighteen. UCSD students and researchers are afforded opportunities to research human computer interaction and individual, group, and organizational development. These programs provide community children and youth with opportunities to engage with adult students in joint problem solving using commercially available computer games that have been selected to provide practice with various academic competencies. Literacy practice is incorporated through a game-like structure that organizes reflection on the various computer games and other activities around a quest to achieve the status of child expert, or master of 20 activities/games. (See Appendix 1.) In achieving mastery of the games, children work with math, science, social studies, art, telecommunication, and literacy. As they learn strategies for problem-solving from the college students, the children also gain exposure to the university and the possibility of higher education. Because the children attend the programs over a longer period than the different classes of college students, the children are placed in the confidence building role of teacher as well as the role of co-learner.

Coalition for Community Education

Since 1996 our collaboratively run programs have been supported in part by the Solana Beach Coalition for Community Education, an ad hoc association of university, K-12 teachers and community members. The Coalition has been meeting for four years in order to sustain our campus and community efforts by pursuing more substantial external funding.

Convinced that there is strength in collaboration, the Coalition members make coordinated and creative use of existing community resources and seek new resources to respond to changing community education needs. These efforts have been stymied by the socio-economic circumstances of the Solana Beach area as well as the informal nature of the Coalition's programs, as described above. (See also Cole 1995a, 1996; Stanton-Sálazar, Vásquez, and Mehan 1995; Vásquez 1993, 1994, 1996.) The Coalition's projects do not readily qualify for funds such as state monies designated for after school programs because the general income levels in Solana Beach are too high. (The local elementary school, for example, does not have adequate numbers of children receiving free lunches, a fact which effectively disenfranchises those at the school who

do receive such support.) At the same time, the Coalition members have found it difficult to apply for foundation funds which require quantitative measures of program outcomes. This is so because the UCSD approach to these programs has emphasized qualitative methods and research with conditions that do not permit the use of random assignment of participants. Because of these two issues, sustaining and expanding upon the local UC Links programs has been a difficult problem for the Coalition.

Changing Contexts

One of the key features of the model from which our programs are derived is ongoing evaluation and continuing development of the programs in response to changing social and educational needs. The present study has been directed at just such changes at the local community level. A practical and urgent need has arisen in the last two years due to California education policy regarding bilingual education, standardized testing and the end of social promotion. In 1998, California voters overwhelmingly passed Proposition 227, which eliminated bilingual education from state K-12 curricula. Also in 1998, the California Legislature passed a bill (AB 1626, Chapter 742) requiring that school districts adapt policies directed at ending social promotion. The legislation required the State Board of Education and all public schools in California to adopt minimum levels of pupil performance based on universal use of standardized tests in reading, mathematics and English language arts for grade level promotion. In 1999, the California Senate passed the Public Schools Accountability Act, which provided for ranking California's public schools according to pupils' performance on the standardized tests (Stanford Achievement Test, Ninth Edition, or SAT 9) as well as other measures included in an Academic Performance Index.

The passage of this legislation changed the educational, political, and social contexts in which our after-school education programs were operating. The change in the educational context represented by the move to standardization and quantification had immediate impact on the efficacy of the design of the university-community informal education programs. The programs are based on the Fifth Dimension Model, an informal, collaborative teaching/learning model originally designed to serve children ages 6-12 as an auxiliary or "enrichment" learning environment located outside of school. The choice to place the experiments in non-school settings is directly related to research that supports the conclusion that the lack of success in school, in the case of children with no physical barriers, is at least in part due to the culture of schooling (Cole 1996, LCHC 1982). These programs eschew school-like measurement of academic competence. Rather, informed by Vygotsky's theory of the Zone of Proximal Development (1978, p. 86), they focus on children's learning potential, avoiding quantitative measures and their propensity for ranking children according to standards of academic success and failure. Progress in our programs has been measured using longitudinal qualitative data.

The political aspects of the state (and national) move to standardization and quantification have had an impact on the process of generating funding for the informal programs. Potential funding agents, local, state, and national, have begun to seek

quantitative measures of program outcomes, basing awards on the use of such measures. This political pressure has been felt by the local non-profit Boys and Girls Club, local Head Start, and LCHC at UCSD, both individually and collectively in regard to their collaboratively run after-school programs. For the local schools this pressure is exacerbated by the requirement to respond to the process and potential threat of state ranking of schools.

The change in the social context is associated with the new needs of the university-community programs' client children. A program that seeks to improve children's social and cognitive skills by providing them with confidence-building experiences of productive learning and success with academic content can not ignore the children's need to pass the SAT 9 at their grade levels. The potential of retention in grade and its associated stigma is very real for the children in the university-community after-school programs, many of whom were Latino and/or from low-income households, and many of whom were not native English speakers.

Our community-university research collaborative, which is comprised of a subset of Coalition members, was formed in these changing contexts in order to jointly seek a more informed approach to dealing with the changing needs of our collaborating institutions and the children they serve.

Research Study

The present study has represented an important opportunity to research two key issues that emerged from our community-university collaboration. Both issues deal directly with "long-term, comprehensive campus and community efforts..." and giving "these growing efforts a track record for pursuing more substantial external funding." The first research issue is to understand and describe the special needs of children and youth who live in pockets of poverty surrounded by relative affluence. The second is how to define, measure, and report the outcomes of community-university collaborative and informal educational activities.

Our community-university research collaborative has chosen to address these two issues separately with methods appropriate to each question. In the following sections we present first that part of the study which has looked at the characteristics and special needs of children from low-income households in affluent areas. Following a brief review of the literature and a description of the methods used and the findings, is a discussion of implications. After this we present the second part of the study which looked at measuring the social and cognitive outcomes of our informal education programs. After a brief literature review, a description of methods, findings and a discussion of their implications, we present a discussion of the implications of the study as a whole.

Part 1: Poor Children Raised in Affluent Communities

Research on children living in poverty in the U.S. has looked almost exclusively at the needs and characteristics of children living in inner-city ghettos or economically depressed rural areas. According to Jencks and Mayer (1990), this has been based on the assumption that poverty is contagious and, by implication, more likely to infect those who live in areas of dense poverty. In 1966, a Report to the House Committee on Education and Labor (in Meissner 1966), argued that "poverty breeds poverty (p. 49)" because low incomes correlate with high risk of untreated illness, limitations on mobility, and limited access to education, information and training. The assumption was that the effects of poverty were magnified in areas of dense poverty due to peer influence and the poverty area's limited political and economic power. The effects of poverty neighborhoods were still being questioned in 1990 when the National Research Council's Committee on National Urban Policy investigated whether living in a ghetto exacerbated the problems associated with being poor. Contrary to the general assumption, the committee found that

> The research literature provides some evidence that neighborhood effects are stronger for children, although the evidence is not strong. The effects of living in a poor neighborhood on a number of behaviors of interest have not been extensively examined: Examples are the cognitive development of preschool and grade-school children, sexual and family formation practices, the transition to employment, and school attendance habits of high-school age youth. Nevertheless, the main point is that children who are minority members, poor or raised in female-headed families dependent on welfare typically fare poorly in school, marriage, and employment—wherever they live. (National Research Council 1990, p. 3)

The council's research supports earlier findings by Coleman (1966) that suggest that there is no general pattern of school effects on children from low-income households who attend schools characterized by mean high socio-economic status. In addition, Jencks and Meyer (1990), who contributed to the report, conclude that there is also no general pattern of neighborhood effects on the problems associated with poverty. Based on their study, they hypothesize that

> When neighbors set social standards for one another or create institutions that serve an entire neighborhood, affluent neighbors are likely to be an advantage.
>
> When neighbors compete with one another for scarce resource[s], such as social standing, high school grades, or teenage jobs, affluent neighbors are likely to be a disadvantage. (p. 176)

The first effect is seen in increased high school completion rates of children from poor households who attend schools in affluent areas; though it is not seen in grades or chances of attending college. The second effect is seen in terms of a relative deprivation

model that assumes that children will compare their economic position and academic success to those of their affluent neighbors. Because children from low-income households do worse in school, they are likely to form a more favorable opinion of their abilities if they attend a school in a less affluent area (p. 116). This latter effect is described by Shirk, Bennett, and Aber (1999), whose case studies of children from poor households in affluent areas illustrate the stress associated with commuting between two socio-economic worlds. The phenomenon of relative deprivation is worthy of further study as they also report that the suburban poor constitute the fastest growing demographic of poverty (pp. 249-250).

In Part 1 of our study, our university-community research collaborative has explored the needs and characteristics of the suburban poor in Solana Beach. While a separate jurisdiction, Solana Beach is a bedroom community in the greater San Diego area. In the following sections we will describe the methods we used in Part 1 of our study and our findings.

Methods

When our community-university research collaborative began meeting in August 1999, we collectively designed a research methodology that would draw on the existing data to which the different members had access. This methodology included analysis of existing documentary and statistical data, participant observation, interviews and ethnographic observation and description of housing and living conditions in Solana Beach. The representatives of the local school district, local Head Start, and the Boys and Girls Club each explored their agencies' existing data on their service populations. The representatives shared this data with the collaborative in qualitative and quantitative forms that removed identifiers of individuals and families. For example, the collaborative worked with the addresses, but not the names, of families residing in Solana Beach whose low-income levels qualified them for Head Start and for scholarships and special programs at the Boys and Girls Club. Similarly, the collaborative worked with the addresses only of children whose low academic performance resulted in invitations to attend a special summer program in basic skills offered as an intervention by the local school. Other data that lacked identifiers when pooled for the collaborative, but that was collected by the participants under guidance of the collaborative, included a breakdown of the ethnic composition of local schools and the percentages of children receiving subsidized lunches and descriptive data on the characteristics of families receiving financial assistance from the Boys and Girls Club. In addition, the Head Start representative and the local school representative cooperated in producing composite cases of families served by both agencies. Though based on actual cases, in the interest of protecting privacy, specific identifiers such as the ages and sex of the children have been changed.

Another form of data collection consisted of interviews and ethnographic observations. The local school representative worked with bilingual volunteers who spoke Spanish and English; they conducted phone interviews with families whose children had been invited to attend the school's summer program in basic skills, but had not attended.

The Boys and Girls Club representative interviewed representatives of local law enforcement about gang activity and youth at risk in Solana Beach. The local Head Start representative asked a staff member whose job included home visits with local Head Start families to produce general descriptions of the living conditions in two areas targeted by the research collaborative. University researchers added their observations of housing exteriors to these data.

Findings

Our findings are presented in three sections. The first describes who the poor are in Solana Beach. This section draws on the institutional data of agencies represented by our community-university research collaborative. The following section describes where the poor live in Solana Beach. This section draws on institutional data, but also on interviews and ethnographic observations. The final section describes how the poor live in Solana Beach. This section draws on case studies of families served by our collaborating institutions.

Who are the poor in Solana Beach

Based on median household income, Solana Beach is an affluent area. However, as noted above, ten percent of the population and 12.7% of the children live in households earning less than $24, 000 per year. Most of these households are Spanish-speaking or Spanish dominant and of Mexican heritage. Others are single parent households and other non-English speaking homes. Most of the adults in these households have not completed high school, many have not completed grade school.

There is a Head Start pre-school center in a Spanish-language Catholic mission in the Eden Gardens area of Solana Beach. The center currently serves 76 children, of whom 39 reside in Solana Beach. Reflective of the service population, teachers at Head Start are Spanish dominant or bilingual in Spanish and English.

There are five elementary schools in the Solana Beach School District. Two have one percent or less of their students receiving subsidized lunches. The Latino (Hispanic) population of both these schools is less than three percent. At one school located at a substantial distance from downtown Solana Beach, and to which children from Eden Gardens are bussed, seven percent of the children receive subsidized lunches and 12% are Latino.

The two schools that are closest to downtown have much higher percentages of both children receiving subsidized lunches and of students who are Latino. The school that serves grades K-3, Solana Vista, has a population of which 25% receive subsidized lunches (88 free, 13 reduced fee) and 26% are Latino. At the school that serves predominantly grades 4-6, Skyline, 18% receive subsidized lunches (73 free, 15 reduced fee) and 24% are Latino.

Skyline is located across the street from the Boys and Girls Club. Children from Solana Vista are dropped by school bus at Skyline after school. The children who participate at the club are most often from these schools.

The Boys and Girls Club in Solana Beach is the Lomas Santa Fe Branch of the Boys and Girls Clubs of San Dieguito, the largest provider of after-school activities for children in Solana Beach. During 1998-1999, 21 children received scholarships for Club fees based on financial need as established by federal guidelines. In 1999-2000, 27 children from Skyline School who attended the Homework Club received scholarships as well.

In fall 1999, the club located its teen programming off site. The year before, the club had been serving 38 youths ages 12-18 who were targeted for outreach to youths at risk based on the recommendation of the local sheriff's department. Part of the risk in Solana Beach is gang activity. Police have been called to the club to deal with fights in the parking lot between the local gang and one from a neighboring jurisdiction. It was parental concern about teen violence and drugs that caused the club to move the teen program off site. Funding to the club for teens at risk has been dramatically reduced this year.

Twelve teens from Solana Beach participated in an off-site high school class run at the Club during 1998-1999. These students were referred to the class from the AVID program at Torrey Pines high school. AVID is a program offering guidance in study skills and scholastic culture to children whose academic performance is not consistent with their potential. For ninety percent of those attending the class, English was a second language. The twelve from Solana Beach reside in two areas of town identified by the research collaborative as pockets of poverty.

Where the poor live in Solana Beach

Based on the addresses of the client populations of Head Start and the Boys and Girls Club scholarships and teen class, our community-university research collaborative has identified two pockets of poverty in Solana Beach. These areas were identified by plotting the addresses of clients on a map of the town and are consistent with less detailed mapping of Hispanic residents and income levels based on the 1990 census and available from the San Diego Association of Governments (SANDAG). (See Appendix 2.)

In addition to Head Start and the Boys and Girls Club clients from low-income households, the addresses of children who attended a special summer basic skills program at Skyline school are plotted on the map. Children were invited to attend in response to PSAA 99's requirement that school districts develop intervention programs for those children who were in the lowest quartile of their grade based on the SAT 9 test. Skyline invited children in the lowest 40% from all schools in the district. Of the total of 180 participants in the program, 122 were from Solana Beach. Of these, 92 were coded

for Spanish as first language. Sixty-four of the Solana Beach participants received free lunches. Eighty-four were from the two pockets of poverty.

The two pockets of poverty in Solana Beach are two very different areas. Eden Gardens is a small area bordered by Stevens Avenue on the West, Villa de la Valle on the South, Interstate 5 on the East and Genevieve Street (and the Catholic mission) on the North. The Eden Gardens area grew up with Solana Beach which was founded in 1906 at the same time that the Santa Fe Railroad began building a nearby retirement community for railroad executives. The labor camp for those building both Rancho Santa Fe and Solana Beach became Eden Gardens. For all of its history, the four square block area has been populated predominantly by Mexicans and their descendents. Waves of immigration have kept the area Spanish-speaking. The families of many of the residents have been in the area for generations, handing houses down. Older detached homes are mixed with apartments and new condominiums, evidence of the "gentrification" of this highly valuable property. (See Appendix 3.)

While some low-income residents live in small older wooden houses, some of which are almost hidden between street-front properties, many of the lower income residents live in three newer apartment buildings known as the Valley Avenue Apartments, the Genevieve Street Apartments, and the Stevens Street Apartments. The Valley Avenue Apartments back up to La Colonia Park. They have a simple exterior and are painted blue. The 2 and 3 bedroom apartments in this complex rent for $1,000-$1,200 per month. Due to the high rents many families are forced to live together in one apartment. Entire families will share a bedroom and use the kitchen and living room as a common area.

The Genevieve Street Apartments are located across the street from the Spanish-language Catholic Mission. These apartments are located in a tan cement building that was once the community's school for Mexican children. While the eight apartments have two floors, the high rents require that two families share each apartment.

Similar to the others, the Stevens Street Apartments are boxy and simple structures. One-bedroom apartments in this complex rent for $700-$800 per month. Here also families share the apartments in order to afford the rents.

The Route 1 Corridor is quite different from Eden Gardens. This is strung along between Highway 101 and South Sierra Street. As in Eden Gardens, low income residents live close by affluent neighbors, but in dramatically different conditions. (See Attachment 3).

The Avalon Apartments on Highway 101 are located across the street from very expensive beachfront properties. The apartments appear not to have been renovated since they were built in the 1950s. The apartments are studios built around a central paved courtyard. Entire families rent the studios. Because the doors face the paved courtyard, it serves as a communal space.

The South Sierra Apartments are located in an older, two-story wooden building. There are apartments on both floors. There are few windows in the building, which appears to have been built before the 1940s. Corridors leading to each apartment are dark. As with other complexes, high rents require that two families share these apartments.

The other low-income housing in the Route 1 Corridor is located in a trailer park. Close to the South Sierra Apartments, the park consists of about 12 old trailers from the 1960s and 1970s. The trailers are not mobile homes, but caravans or early RVs. Many are broken down and appear to be in very bad condition. Each trailer has a little bit of land around it. Some residents use the land to store items, some use it for trash. Some try to make it presentable with plants. The average rent for these trailers is $800 per month. Because of the extremely small living space, single families live in a trailer.

How poor families live in Solana Beach

The following two cases are composite "typical family" cases jointly constructed from client files by the Head Start representative and the local school representative of the community-university collaborative. While based on actual families in Solana Beach, identifiers have been removed and family characteristics are drawn from multiple similar cases.

Family A is a two-parent family with three children ages 6 through 11. Both parents have a high school education and the mother is taking college classes to become a teacher's aide. Both parents have taken ESL classes to improve their English. The father works as a maintenance person for approximately $10 per hour and works early hours so he can be home for his children when they return from school. Mother works within walking distance of the home, but works later hours in order to send her children off to school in the morning. The family rents a small house in the Eden Gardens area and does not share the house with other families. The family also owns a car. All the children in the family attend Solana Santa Fe school, a school where English only has been taught since the school opened. Both parents are active in the lives of their children, helping the children with homework, for example, or helping them with organized soccer. The entire family is seen on family outings frequently during the week.

Family B is a two-parent family with five children who range in age from 2 to 14 years of age. Both parents have approximately a 6th grade level education. One or both parents work in the fields and make approximately $6.00 per hour. They work 10 hours a day, from 6:30 A.M. to 4:00 or 5:00 P.M. The family has no car, so the parents must use the bus. The family shares a house with two other families in order to afford the high rent. Through the 1997-1998 school year, Family B's Spanish speaking children began their formal public education in Spanish speaking classes held at the K-3 school, Solana Vista Elementary. As the children increased their English proficiency, they were gradually introduced to a more and more English speaking environment. Since the

1998-1999 school year, and the implementation of Proposition 227, these children have been in English only classes. It is difficult for either parent to help with homework because they do not speak English. The children often experience trouble in school. .

As the children in families like Families A and B grow up, some come to the Boys and Girls Club, where they are offered scholarships. The families of scholarship recipients must all have incomes below federal poverty levels. To get a picture of the types of Solana Beach families who use this service to participate at the club, here are some examples.

Family 1 is a Hispanic household with three children ages 6 to 16. The family lives in Solana Beach on an income of less than $14,000 per year. The children were in the Head Start program. Although the older children in the family attended the Club for many years, they did not return once the Club was forced to raise its fees.

Family 2 is also a Hispanic household living in Solana Beach. The two youths in this two-parent household of four are long term participants at the Club. The family of four's income is less than $20,000 per year.

Families 3 and 4 are single parent households, one Hispanic and one Caucasian. The one child in Family 3 has attended the Club for several years. Family 3's income is less than $16,000 per year. Family 4, which an income of less than $24,000, has two children, graduates of Head Start, who participated in the Club regularly until the fees changed.

While the club offers a form of after school child care and a safe and enjoyable environment with multiple art, sports, and educational activities, many families that could qualify for scholarships do not participate. When asked why, a common response is that the scholarship covers only general membership, not the desirable programs like organized youth sports, e.g., basketball, swimming, or the many field trips and outings. As one father put it, "It is better not to have them come" than to come and see what they cannot afford.

Discussion

The descriptions of the lives and living conditions of poor children in Solana Beach are characterized by conditions of de facto segregation, in spite of the fact that poor children and children from more affluent households live side-by-side in Solana Beach. The long history of the self-replicating Spanish-speaking community marked not only by Spanish language, but also by lower income and lower educational levels reflects a form of poverty that seems intransigent, despite the affluent area. This scenario is consistent with the condition that Jencks and Meyer (1990) describe as leading to a relative deprivation model based on different standards and competition for resources along socio-economic, and, in this case, ethno-linguistic lines.

The evidence from Solana Beach also supports the consensus that poor children do poorly in school, particularly as they get older. The process of mapping poverty and invitations to the summer basic skills program at the school demonstrated that the children in the lowest 40% of their grades most often came from the two pockets of poverty in Solana Beach. In addition, while the K-3 school that has the highest numbers of children who are listed as Hispanic and who received reduced fee or free lunches did relatively well on the SAT 9 tests in 1999 (based only on children in grades 2-3), Skyline, which serves similar numbers of Hispanic children from low income houses, and whose students are predominantly from grades 4-6, had the least improvement of scores between 1998-1999. It is also telling that children from Head Start families in Solana Beach are among those who later in life receive scholarships from the Boys and Girls Club and among those who drop out of the area's highly ranked high school.

Our study of the characteristics and needs of children from low-income households in affluent Solana Beach supports the National Research Council's (1990) finding that poor children in affluent areas share the needs of their economic peers who live in less affluent areas. Our collaborative's work suggests that agencies working with poor families in affluent areas should coordinate their services and, as does Head Start, work not only with the children, but with the whole family in providing support. Along with the need for articulation of services across time and across age groups, we have also been confronted with the need for clear communication of the availability of services and the norms of the agencies, i.e. the schools, that provide those services. In addition to the need for communication, a recurrent theme among the families our agencies serve is the need for transportation in order to take advantage of community services.

Part 2: Measuring Outcomes of Informal Education Programs

The measurement of cognitive and social outcomes of informal community-based education programs is a relatively new and, by nature, difficult issue. The difficulties arise due to the informal nature of the programs, which often includes voluntary attendance and a mix of academically oriented and recreational activities. In the case of the Fifth Dimension in Solana Beach, which, as noted above, has eschewed quantitative measures, complex qualitative methods have been designed to "study simultaneously development on several interacting levels or 'genetic domains' (1985) over time" (Cole 1995b, p. 5). These methods include the ongoing collection and archiving of field notes based on the participant observation of students and researchers, videotaping, interviews, and the collection of numerous records of individual children's self-paced progress through the program's activities.

The use of numerous records and representations along with systematic instructor notes about a child's progress is similar to using a portfolio approach to assessment. The longitudinal, case-based methods we have used in the past (and continue to use in addition to our pilot use of quantitative measures) are also consistent with Siegler and Crowley's (1991) microgenetic method. They define the method as having three

properties: "(a) Observations span the entire period from the beginning of the change to the time at which it reaches a relatively stable state. (b) The density of observations is high relative to the rate of change in the phenomenon. (c) Observed behavior is subjected to intensive trial-by-trial analysis with the goal of inferring the processes that give rise to both quantitative and qualitative aspects of change" (p. 606). Siegler and Crowley argue that, though labor intensive, longitudinal qualitative methods yield more complex qualitative and quantitative findings than traditional assessment methods, findings that more adequately reflect the complexity of variable cognition and cognitive growth (p. 618). Additionally, and consistent with the philosophy of the Fifth Dimension, they describe the common finding of microgenetic studies that innovations, i.e., learning/development, occur following successes as well as failures.

Siegler and Crowley provide examples in which systematic observations of learning interactions are used to measure quantitatively the development of skill and accuracy in operations and qualitatively to describe changes in strategies. Our work with the Fifth Dimension has used undergraduate field notes and videotapes to make similar measurements. Because the undergraduates play a complex role that incorporates the role of instructor along with that of co-learner, we have supplemented the observational data with a system of logging progress in each child's individual folder. In addition, we have sought to take into account the presence and participation of undergraduates, other children, and computers in a child's learning interactions and process of development. This is a larger grained version of the "ensemble" approach described by Grannot (1998) and suggested by Rogoff's work with "communities of learners," both of which are qualitative approaches that yield large volumes of qualitative, case-based data.

While our methods of assessment in the Fifth Dimension in Solana Beach have consistently been qualitative, there are cases in which quantitative measurement of Fifth Dimension outcomes has been conducted (See for example: Blanton, Moorman, and Warner 1996; Mayer, Duran, Quilici, Moreno, Woodbridge, Sanchez, and Lavezzo 1996; Shustack, Strauss, and Worden 1997, 1996.). These studies, however, have been conducted in institutional contexts that are far less informal than the Fifth Dimension in Solana Beach. The programs that respond to quantitative measurement are characterized by controlled, rather than voluntary attendance, and by more controlled physical contexts that allow for pencil and paper tests. In comparison, the Fifth Dimension in Solana Beach, has operated for thirteen years in a Boys and Girls Club that adheres to an open-door policy which allows children to come and go from the program and to choose between several ongoing activities at the Club at will. This institutional context, as well as the theoretical basis of the original Fifth Dimension (Cole 1996), has made the quantitative measure of cognitive and social outcomes of the program a significant challenge. Our university-community research collaborative addressed this challenge in Part 2 of our study, the methods and findings of which are described in following section. In presenting our findings, we consider it essential to include descriptive material on the changes that our programs have undergone in response to changing contexts.

Methods

As our community-university research collaborative began working with measurement in July 1999, the school representative facilitated meetings with school personnel that resulted in the placement of university researchers as participant observers in the school's summer basic skills program. The researcher's field notes were shared with the principal of the school and with our research collaborative. Based on those notes, as well as an analysis of the basic skills computer software that the school pilot tested during the summer program, our collaborative began a review of software. At the same time, the members of the collaborative brought together for joint consideration measurement tools from their different institutions. Based on our review of these tools and our desire to maintain the integrity of the Fifth Dimension approach, the collaborative chose to incorporate new educational software into the Fifth Dimension program structure, which itself was modified in quarterly iterations as described below. In addition, we chose to continue using the longitudinal qualitative methods described above.

In choosing software for our experiment with quantitative measures, the community-university research collaborative sought to include software that would allow work with basic mathematical and literacy skills as well as keyboarding. At the same time, we sought software that would provide means for measurement of changes in those skills in ways that were similar to the software used in the school's basic skills intervention programs. Given the informal nature of the Fifth Dimension, we were also interested that the games be playful as well as substantive. In our selection of software titles, we were assisted by the UC Links Literacy Consortium in the form of recommendations and support materials.

The games we selected were Slam Dunk Typing, Word Munchers Deluxe, Grammar Games, Missing Links, Puzzle Tanks, and Troggle Trouble Math. Slam Dunk Typing was selected because it had been successfully used at UC Riverside's Cibrary program both as an introduction to keyboarding and as a gateway into that UC Links program's activities. Word Muncher's Deluxe was chosen based on its successful use in a summer program at UC Links' La Clase Mágica program in Solana Beach. The late addition of Number Munchers was based on our success in using Word Munchers Deluxe as well as our earlier success in using older versions of the software. Missing Links was added based on earlier research at LCHC/UCSD as well as its record producing function and its potential for adding selected passages to the game. Puzzle Tanks was added based on its successful use in the Fifth Dimensions at Appalachian State University in North Carolina as well as the UC Links program at UCLA. Grammar Games was added because it had a record producing function and had been used in a research study at the Fifth Dimension associated with CSU San Marcos (Waldorf 1997). Troggle Trouble Math was added for the same reasons, it had a record producing function and had been used in research at Appalachian State University.

These games were also distributed in terms of age-level and academic area. Word Munchers Deluxe provided practice for younger learners with several basic language

skills. Grammar Games also addressed several skills and was geared to older learners. Missing Links provided practice with decoding words, sentences and paragraphs. Similarly, Number Munchers provided younger learners with basic numerical skills, while Troggle Math was appropriate for both younger and older learners. Puzzle Tanks provided practice with ratios and problem solving. We added Slam Dunk Typing in response to the Skyline principal's suggestion that the children could benefit from practice with keyboarding.

Because Troggle Trouble Math was the game with which we had the most success, as will be described below, it is useful to describe this game in more detail. The game is a quest for keys that allow one to progress to higher and higher levels. In order to earn the energy needed to keep up the search for keys, one must solve word problems. The game thus provides practice with literacy as well as math skills. In addition, in the course of one's search, one encounters destructive troggles. One defends oneself from troggles by raising a shield and producing an equation to correspond to a given answer and mathematical function, e.g. "10" and "+".

As noted above, in the process of incorporating the new computer games, we made iterative modifications to the Fifth Dimension program structure. The reader will recall that the games of the Fifth Dimension are organized by a structure reminiscent of a game board and referred to as "the maze." The maze helps children navigate their progress through the Fifth Dimension games. Each game is assigned to one of twelve rooms in the maze and a list of games is posted for everyone to view. The children keep track of their progress in the maze by using a passport. If a child achieves a good or expert level in a game, she records her progress on a page in the passport. In order to get a passport and game folder, the children fill out a passport application, which is kept in the folder along with the passport.

The maze is governed by a set of guidelines listed in the Fifth Dimension Constitution, which is also included in each child's game folder along with a copy of the maze. In addition to a copy of the constitution and the maze, the game folders contain a travel log sheet that serves as a recording tool the undergraduates and staff to keep a record of what games the child has played on what days along with his levels and scores. To guide the special way in which games are approached in the Fifth Dimension, each game in the maze has a task card that not only provides instructions on how to play the game, but also extends the challenges in the game to include literacy activities and reflection on strategies used. Appendix 4 contains copies of these tools as they appeared during fall quarter.

As the academic year progressed, the tools described above were modified in response to the decreasing control of the program structure as will be explained below. Attempts were made to make recording quantitative data easier and to emphasize the maze games as well as those games designated for quantitative measurement. The children filled out a passport renewal sheet and were issued new passports when there were modifications to the maze. The constitution was modified each quarter to reflect the focus of the Fifth

Dimension at that time and the list of games was modified as new games were added to the maze throughout the year. A spreadsheet was kept on file for each child that played in the Fifth Dimension. This spreadsheet was kept at the LCHC lab and was used only for tracking the children's progress with the newly added games used for quantitative measurement. The spreadsheet format was updated to reflect changes in the travel log.

In winter quarter, the new games designated for quantitative measurement were removed from the maze rooms and put in a separate category so that they could serve as a gateway to the maze. Reflective of Boys and Girls Club culture that often rewarded children with pizza parties, the passport was modified to include a pizza chart that simplified the recording process. Twelve slices on the pizza now represented the twelve rooms in the maze. A separate log sheet just for the gateway games was introduced. This log sheet was very detailed and specific to fulfill the requirements for quantitative measures. (See Appendix 5.) The existing travel log was used along with the passport to record play in all remaining games in the Fifth Dimension. Special instruction sheets were also passed out to the undergraduates and included in the task cards for gateway games to ease the recording process. In order to control the children's movement in the maze, a consequence chart was introduced. This chart listed a specific sequence the children were to follow when moving from game to game instead of letting the children choose their own path.

In spring quarter, as focus shifted toward maze completion, the passport was entirely replaced by a pizza progress chart. This chart with twelve slices had all of the appropriate space for recording 6 good and 6 expert level games. The original travel log was used once again for recording all games including the Gateway Games. The consequence chart was removed and children were allowed to move from game to game as they chose.

Findings

Just as our methods have been complex, our findings are complex. In order to guide the reader through the findings, we include a chart that lays out the contexts in which measurement of cognitive and social outcomes in our informal education programs took place. These include the institutional context (Boys and Girls Club and university) and the programmatic context (Fifth Dimension and Homework Club). (See Table 1.)

Changes in our local programs

At the beginning of academic 1999-2000, we were in the process of building on our existing informal education programs to include additional and somewhat more formally presented science content to be delivered in after-school, community based science and technology clubs. Due to the changed educational and social context described above as well as changes at the level of the university and community institutions that house our programs, the programs have changed in both anticipated and unanticipated ways. For example, the school's need to respond to the changed educational and political context

resulted in the discontinuation of one of our after-school educational programs that had been running at the school. In lieu of that program, the school, the Boys and Girls Club and LCHC/UCSD cooperatively designed and implemented a Homework Club that has been running at the Boys and Girls Club. The Homework Club, which is coordinated with the Fifth Dimension, is part of the school's response to the legislation requiring that children in the lowest quartile of their grade on the SAT 9 receive intervention programming.

Our afterschool and Informal Science and Technology Program efforts were directed at three differing age cohorts during the 1999-2000 academic year: elementary, middle and high school aged children. As often as possible each of these activities was linked to ensure continuity and in the hopes of developing a more robust system of informal science programs.

For the K-6 cohort, dominant efforts in math, science and technology revolved around expanding Fifth Dimension activities. In particular, several new programs were evaluated and instituted in the Fifth Dimension: the Incredible Machine, Gizmos and Gadgets, and new Magic Schoolbus adventures (dinosaurs and rain forest). Additionally, on several occasions, students from the middle and high school programs participated in Fifth Dimension science activities. In particular, the upper grade students would offer lessons on recently mastered material to the younger students. Two such lessons were the teaching of making Gak (a non-toxic chemical experiment to make silly putty) and Adventures with Dry Ice (examining the properties of CO2).

For the Middle School cohort, the UCSD Science and Technology Club was newly redeveloped and operated during the fall, winter and spring quarters 1999-2000. Undergraduate university students from Physics 180: Teaching and Learning Physics used this site as one of the primary opportunities for conducting their required fieldwork and research. The site operated either one or two days per week as part of the Boys and Girls Club Teen Center. A detailed accounting of the activities is available at: http://lchc.ucsd.edu/ssac/. However, these include the broad categories of physics, chemistry, electronics, computers, technology and problem solving. Particular activities at this club included: digital video production, Lego (tm) robotics, manufacture of high voltage strobe lights, computer repair, and teaching younger children about these activities.

The science and technology component of the high school TEACH (teen educators advancing in community and health) program operated one day per week at the Teen Center. Activities were similar to those presented in the Science and Technology Club; however, the projects were longer lasting. Under the supervision of UCSD physics majors, the projects were closely tied to study of the underpinning scientific theories. In particular, students built high voltage strobe lights and analog crystal radios.

In terms of the Fifth Dimension itself, as noted above, we began changing the content and the approach in summer 1999 in response to the school's emphasis on basic skills

and the needs of our target children. There were other changes at the Boys and Girls Club and at the university that influenced quarterly changes to the Fifth Dimension in Solana Beach. Early on in the school year, the Boys and Girls Club significantly raised their membership fees. This increase in the cost changed the demographics of the Club. The structure of Club programming and scheduling was changed as well. Also early in the school year, the Club organized the children into age/grade appropriate activity groups, called pods. Keeping children in one activity for a specific amount of time fostered the implementation of the Fifth Dimension programmatic structure. Throughout the fall quarter this dual structuring process (at the Club and in the Fifth Dimension program) facilitated participation and the predictability of individuals' attendance in the Fifth Dimension. We knew when each age group would visit the Fifth Dimension and could prepare accordingly. However, after the winter break, the Club removed the pod structure, allowing children to control their own attendance and participation in the Club activities. In place of the pods, the Club instituted roll call at the beginning of each day. With free choice, children moved freely in and out of the Fifth Dimension. When the pods were in place, time was set aside for our measurement games. However without the pods, reliability of children's participation during this time period decreased. Without the controlled environment of the pod system, our ability to measure game play decreased.

Throughout the school year, there was a turnover of UCSD participation at the beginning of each quarter. The varying levels of experience and knowledge of each professor affected the undergraduates. Each quarter brought new undergraduates to the club, which required ongoing orientation and training at the Fifth Dimension site.

In addition, there was a constant turnover in the Boys and Girls Club staff throughout the year. Specifically in the Fifth Dimension, there were three different site coordinators over the period of 9 months. The new staff did not always sympathize with UCSD's goals of measurement, as they were unfamiliar with the history and purpose of the program.

In December, the Club's homework room merged with the homework club that previously had been running at Skyline Elementary School. The children's teachers at school referred them to the program. In the beginning, the Skyline group was kept separate from the rest of the Club children and routines. Only after they spent at least one hour in the homework room were they allowed to participate in Club activities. In an attempt to integrate the Skyline group with the rest of the children at the club, the children were invited to attend the Club's roll call and were later allowed to leave the homework room as soon as their assignments were complete. Although the Skyline group of children gained freedom to participate in other Club activities, many of them did not visit the Fifth Dimension frequently. This began to change during spring quarter, as individual children began to attend the Fifth Dimension regularly.

Within the structure of Fifth Dimension, there was a constant evolution of the measurement tools and procedure of the program, as described above. In the beginning

of the year, the focus was on quantitative measurement, derived from the selected educational games that had been newly introduced. Once the control inherent in the pod system was removed, the ease of collecting data in the Fifth Dimension was lost. In order to deal with this change, we directed our attention towards the educational games and how they were recorded. The games previously assigned to the first three rooms in the maze became a separate, preliminary part of the maze. They were given the name 'Gateway Games,' as they provided the children access/entry to the rest of the maze. The children were required to play the educational games before playing any other maze games. The consequence chart described above was also used to control the children's movement in the Fifth Dimension (See Appendix 5.)

By the beginning of spring quarter, we realized that the children were focusing their attention on the Gateway Games, instead of the maze. We felt that it might be possible to collect adequate quantitative data from designated playtime at the beginning and end of each quarter, instead of every day. We combined a requirement that children begin each quarter by playing the Gateway Games with end-of-quarter triathlons from which we attempted to draw post quarter scores on the Gateway Games. These efforts were complicated by the unreliability of attendance and the difficulty in consistently recording the scores. In the Fifth Dimension itself, the children were challenged to focus solely on completing the maze. Measurement tools were changed accordingly so that all participants (children and undergraduates alike) would redirect their attention to the maze. (See Appendix 6 for measurement tools used in spring. Please refer to appendices 4, 5 and 6 to examine how the measurement tools evolved throughout the year.)

Attendance

Evidence concerning attendance at the Fifth Dimension can be gathered from either quantitative data or qualitative data. The quantitative data are derived from the site coordinator's attendance sheets as well as the children's Fifth Dimension folders, in which the dates they played the maze games are indicated. The qualitative data source, the undergraduates' field notes, also yields quantitative evidence about attendance figures in the form of tallies of how many different days an undergraduate mentioned each child.

As a result of the dynamics of Club life, the attendance data from the different sources do not coincide. However, when considered in conjunction, the quantitative and qualitative data provide a clear picture of patterns of attendance.

Quantitative Data on Attendance

In fall quarter, entries in the children's folders indicated that 76 children attended the Fifth Dimension, while in winter and spring there were only 43 and 21 children respectively. Of these children, there were 44 who attended the program regularly. This

number was derived from a list of children who had three or more entries throughout more than one quarter. The grade distribution over the three quarters changed, as is illustrated in the following table. (See Table 2.)

Grade	Fall Quarter	Winter Quarter	Spring Quarter
K	12	10	3
1	8	10	5
2	8	6	4
3	5	5	3
4	14	5	3
5	16	4	1
6	13	3	2
Total	76	43	21

Table 2a. Quantitative Attendance Data

Qualitative Data on Attendance

By examining the undergraduate field notes, we found different results for the children's attendance. In comparison to submitting two sets of field notes in the winter and spring quarters, during the fall quarter, undergraduates were required to submit only one set of field notes per week. We found that a decrease in the frequency of notes was accompanied by a decrease in the quality of the accounts of undergraduate interactions with the children. The following chart illustrates the number of children who appeared in field notes for each quarter.

Grade	Fall Quarter	Winter Quarter	Spring Quarter
K	5	12	12
1	5	9	9
2	6	8	8
3	4	4	4
4	6	13	13
5	9	15	13
6	5	10	10
Total	40	71	69

Table 2b. Qualitative Attendance Data

It is apparent that both quantitative and qualitative data collection play an important part in keeping track of the children's attendance. Throughout the school year, the undergraduates are responsible for recording the children's scores in their folders, as well as documenting these interactions in their field notes. In the fall quarter, the undergraduates were successful at recording the children's scores in folders, as is apparent in the first chart—76 children were accounted for. By contrast, recording of

children's performance in the undergraduate field notes for fall quarter was less reliable, as is apparent in the second chart. Only 40 children of the 71 children whose attendance is recorded in their folders and on the attendance lists are mentioned in the field notes.

In the winter and spring quarters, a return to two sets of field notes per undergraduate per week corresponds to higher attendance numbers derived from the qualitative data. The attendance figures derived from quantitative measures diminish in correspondence to diminished emphasis on recording game scores in folders. The disparity between the quantitatively and qualitatively derived numbers is further explained by the addition of the Homework Club and other activities within the Boys and Girls Club to the undergraduates' areas of interaction. The undergraduates' documented interactions with children outside of Fifth Dimension coincide with the decrease in activity recorded on the children's Fifth Dimension score sheets.

Children's Individual Outcomes

Table 3 lists a summary of the data for 10 children with respect to attendance, engagement in the program and evidence of cognitive and social change. In looking for a representative sample of children, these 10 case studies were chosen because they offered diversity of age, grade, gender, first language, and socioeconomic status. These cases were selected using both quantitative and qualitative assessment and particularly researcher observations. Depending on the amount of data in each data category, the children were given a score of high, medium, or low. A score of high represents a large amount of evidence available for that data category while a score of medium represents a moderate amount of evidence and a low score a minimal amount of evidence. Note that a low score in attendance based on quantitative measures refers specifically to attendance in the Fifth Dimension. The three children who had low attendance in the Fifth Dimension had a high level of attendance in the Homework Club. A score of low in the fields of social and cognitive change does not mean that the child has a low level of social or cognitive ability; rather it means that for those children there was minimal evidence for change in these measures. (See Table 3.)

As Table 3 shows, each topic was measured quantitatively and qualitatively with the exception of social development for which we rely only on data from field notes. The entries for Attendance were derived in the same manner as the data presented in Table 2. Engagement in the Program was assessed by looking at the number of times each child participated in Fifth Dimension activities as well as evaluating the comments made by the undergraduates about the nature of the child's engagement. By both measures, engagement in the program was high. In a similar manner, evidence of cognitive change came from examination of each child's first and last scores recorded on their educational computer program game sheets as well as commentary from the undergraduates about cognitive ability. Here again we see evidence of cognitive change that is slightly greater in the case of the quantitative measure. The only measure developed to assess social change is through use of undergraduate commentary. We coded the undergraduate's field notes for social change when they reported styles of interaction with other children,

undergraduates, and adult staff. Change was considered positive if the interaction style moved from isolation and/or disruption to collaboration and productive interactions in both play and learning situations. The overall evidence with respect to social change shows marked positive change.

The data in Table 3 also show that in order to develop a clear picture of a child's progress, collection of quantitative and qualitative data is required. Especially in the case of the three children for whom attendance in the Fifth Dimension was low, commentary from the undergraduates who worked with them in other areas of the club was essential in gathering evidence of social and cognitive change.

We are still in the process of gathering quantitative evidence on the children in our programs from the school. We believe that this data along with that which we have collected will provide an accurate and relevant assessment of the outcomes of our informal programs.

Outcomes Measured by Game

Data from the children's game folders has yielded interesting results as well. One aspect is the popularity of each of the Gateway Games, i.e. those games that were implemented specifically in order to study measurement. As the environment of the Fifth Dimension changed throughout the school year, so did the trends of game play, changing the way in which quantitative data was recorded. For example, the popularity of each of the Gateway Games fluctuated throughout the school year. In the beginning, when the program structure was controlled and focused on Gateway Game play, these games were highly popular and they were played frequently by many of the children. In winter quarter, as control of the structure was removed and time set aside for quantitative measurement decreased, the frequency with which the children played these games decreased. In spring quarter, when focus moved towards completion of the maze, the frequency of Gateway Game play decreased significantly.

Despite the decrease in the frequency of Gateway Game play, it was still possible to see which games were more popular than others. Troggle Math continued to be the most popular game during all three quarters. In fact, Troggle Math emerged as one of the most popular games in the whole Fifth Dimension. Slam Dunk Typing and Grammar Games were popular as well. Word Munchers started out as a very popular game, but later in the year children tended to play other games more. Puzzle Tanks and Missing Links were the least popular games, getting little play throughout the year. One game, Number Munchers, was added in spring quarter and proved to be quite popular as well.

In addition to being popular, Troggle Math was also the easiest game for which to record scores as there were only a few fields to monitor; grade level, score and time-on-task. In addition, this game has a record feature in which a player could go back and retrieve her score even after the game was over. Other games, such as Slam-Dunk Typing and Word

Muchers were more difficult to record as there were many different fields and therefore many variables involved in recording scores for these games. In addition to grade level, it was necessary to choose a specific task in each of these games, e.g. grammar, phonics, categories.

Although Troggle Math was popular and relatively easy to record, it also lent itself to manipulation by the children. In observing the strategies the children used in order to succeed in this game, it became apparent that many children figured out how to push certain keys in order to skip difficult math problems and still collect points. Therefore, a high score in this game did not always accurately reflect how much math the child had done. This resistance to challenge is similar to a finding from our participant observation during the school's summer basic skills program. There, children who were not successful in the games and could therefore not keep up with the high level of competition that arose among children, started a new game of their own in which they competed to get the lowest score possible.

In our experiment with the use of games for measurement in the Fifth Dimension, evidence of improvement varied from game to game and quarter to quarter. Scores seemed to increase throughout fall quarter for several games. However, this increase was not as apparent in the winter or spring quarters, times when the frequency with which children played these games decreased. Spring data, in particular, were not sufficient to suggest any trends. The various types of trends seen for each of the games are summarized in Table 4. (See Table 4.) The evidence presented in Table 4 suggests that commercial software games are limited as tools for measurement of cognitive change. This is particularly true in an informal program with voluntary participation and multiple individuals sharing responsibility for recording scores. Our most robust and surprising finding was the enduring popularity of Troggle Trouble math across the three quarters and their changing contexts and across ages and genders. This, in addition to the game's record producing function suggests that Troggle Trouble Math is worthy of further consideration as a model for "playful" measurement in informal learning settings. The children's development of resistance strategies, i.e., subverting the program(mers') intent, should act as a caveat, however, This resistance, also observed in the school's use of basic skills software, suggests that measurement using computers requires a controlled stetting in which human-computer interaction is monitored.

The two other most popular games, in and out of the Fifth Dimension maze, were Number Munchers and Word Munchers Deluxe. Scores are difficult to record in both games. However, the games provide enjoyable practice with basic skills the improvement of which could be measured separately with pencil and paper measures. Slam Dunk Typing proved both popular and impossible to score and record. It did encourage children to practice keyboarding. Puzzle Tanks and Grammar Games were of interest to individual children, but were often difficult for individual learners. On the other hand, both of these games provoked animated discussion and joint problem solving between learners of different levels. This was also true of Missing Links, which

was used jointly by English emergent children who enjoyed using oral practice to find missing letters as they decoded reading passages.

	POPULARITY	ABILITY TO RECORD SCORES	OUTCOMES BASED ON SCORES
Troggle Math	High in all three quarters	>High-game contains record function >Caveat: Children able to skip math problems and still obtain points	>Scores increase in Fall quarter, stay about the same in Winter (Not enough data for Spring)
Word Muchers	High in fall and winter, lower in spring	>Medium-specific task rarely recorded compromising com-parability of scores	>Higher score achieved in less time
Slam-Dunk Typing	Medium in Fall and Winter, increases in Spring	>Low-Difficult to record multiple categories-only time on task recorded consistently	>Hard to tell with recording so difficult
Grammar Games	Medium in all three quarters	>Medium-specific task rarely recorded >Game often ended before score could be recorded	>Slight increase in scores seen-more apparent in Fall
Puzzle Tanks	Low in all three quarters	>Medium-specific categories rarely recorded >No point score available-only increased level of ability	>Difficult to tell without score in the form of points >Level of ability does seem to increase over time
Missing Links	Low in all three quarters	>Low-Difficult to record multiple categories-only time on task recorded consistently	>Hard to tell with recording so difficult

Table 4. Analysis of Gateway Games as Measurement Tools

Discussion

Our experiment with quantitative measurement in the informal education, after school Fifth Dimension program suggests that quantitative measures of cognitive and social

outcomes do not work particularly well in this setting. This is due, in part, to the informal nature of the program, particularly the voluntary quality of participation which limits our ability to administer pre-post tests and establish control groups. It is also due to the difficulty of controlling the context in a community-based, collaboratively run informal education program. Our experience this year has clearly illustrated that as the institutional context became less structured the programmatic structure became less controlled and collection of both qualitative and quantitative data became less reliable.

On the other hand, we were able (though at a high labor cost not funded by this grant) to collect both quantitative and qualitative data sufficient to construct portraits of individual children's development and the development of the collaboratively run program itself. These data have illustrated that understanding of the complex nature of development in our program is increased by adding even marginally reliable quantitative measures to our qualitative, longitudinal and case-based methods of assessment.

The complicated interplay of quantitative and qualitative data, which we reported above with respect to attendance and outcomes for individual children at the Fifth Dimenision, reflects a quite general property of informal educational programs and their evaluation. A basic finding of this work is that *neither the qualitative or quantitative data, taken singly, provides a plausible description of children's development.* The openness of the systems virtually precludes total consistency of data collection. The difficulties of collecting systematic quantitative data increase as the structure of the activities *outside* the Fifth Dimension, at the institutional level of context, is loosened. At the same time, and for the same reasons, the structure of the Fifth Dimension is loosened so that it is more difficult to maintain the core values of the activity. However, when the different sources of data are considered jointly, a theoretically interesting and empirically interesting description of developmental change at the levels of microgenetic, ontogenetic, and cultural-historical change emerges. We are in the midst of a detailed analysis of these relationships.

Perhaps the most interesting outcome of our experiment with measurement has been the development of closer relations between the university and the school. As noted above, LCHC/UCSD has been working directly with Skyline Elementary school, first running an after school program at the school (1996-1999) and then participating in the co-development of the Homework Club (with the Boys and Girls Club.) In the course of this research, we have been given access to certain measures used by the school in assessing cognitive outcomes (e.g., old versions of grade-normed one-minute reading tests and exposure to the CCC basic skills computer program). In the process, LCHC/UCSD has begun to share our quantitative and particularly our qualitative data with the school. We have jointly discovered that by sharing the data gathered through our different methods, we are each better able to use our expertise in case-based interventions for the children we jointly serve.

The school is expert at quantitative measurement of cognitive outcomes and formal instruction. LCHC/UCSD is expert in qualitative measurement that complicates in a

productive fashion the school's quantitative findings. LCHC/UCSD is also expert in operating informal, self-paced educational programs that use collaborative learning and focus on success, rather than failure. By working together, we are finding improved methods of intervention that are meaningful in school, but cannot be delivered by the school alone. Our challenge is to package this complex and labor intensive approach to measuring outcomes in a way that will speak to funding agents as well as children and collaborating agencies.

Implications of the Study as a Whole

Our research collaborative is intensely interested in the results of both parts of this research study. Our shared goal is to provide meaningful community service, teaching, and learning opportunities in our community-university programs. The results of our shared research will go a long way toward helping us to achieve that goal.

Our study of poverty amid affluence suggests that poor children in places like Solana Beach need the same services as children in poor neighborhoods. The assumption that the more affluent community's culture will somehow rub off on poor residents does not take into account the boundaries between socio-economic and ethno-linguistic groups. It is not reasonable to assume that affluent neighbors are willing to extend a hand to lift up the less fortunate in their midst. Agencies like the Boys and Girls Club, Head Start, the public schools and the universities can and must act as cultural brokers, helping poor families to access the resources of their affluent communities. These agencies must anticipate the need to "translate" or communicate across national languages but also cultural and class norms. This process will be enhanced if the agencies involved in this work coordinate their efforts to provide ongoing, articulated support.

Another very practical need is for transportation. Access to services that do exist is denied to many because they lack transportation. Ideally, service agencies should be coordinated with a shared transportation service. The most important implication remains, however, making the needs of the poor in affluent areas visible so that public and non-profit agencies do not neglect this population.

Along with adequate housing, food, medical care, information about services and transportation to service delivery points, education remains a primary need of poor residents in affluent communities. Because these residents do not share the educational culture of their affluent neighbors, they can benefit from intervention for the whole family. This has long been the Head Start model. It is beyond the capabilities of the public schools to provide the targeted help that diverse learners require in order to take advantage of the educational opportunities that their neighborhoods provide. It is here that the schools can benefit from collaboration with service agencies and the university in providing informal auxiliary education.

Our study has shown that measuring the outcomes of such informal education is complex and difficult to quantify. Quantitative findings are not adequate to explain the

development of diverse learners in informal settings. A mix a qualitative and quantitative methods is necessary in order to build a clearer assessment of needs and successes. Our study suggests that this mix of approaches is most productively handled collaboratively by those who are expert in quantitative measurement and formal instruction and those who are expert in qualitative measurement and informal education. Our challenge remains translating the complex findings of such a collaborative approach to funding agents.

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PROJECT TEAM

UCSD Participants:

Michael Cole, Ph.D. Professor of Communication and Psychology, Director of the Laboratory of Comparative Human Cognition, where Cole and other researchers developed the Fifth Dimension, a model community-university program for informal, after school learning.

Noah Finkelstein, Ph.D. Lecturer, Department of Physics and National Science Foundation Post-doctoral Fellow at the Laboratory of Comparative Human Cognition, where he is conduction research on teaching and learning of physics.

Honorine Nocon, C. Phil., Communication and Research Associate at the Laboratory of Comparative Human Cognition, where she supports and studies the development of diverse communities of practice.

Katie Van Thillo, Research Assistant

Allison Weston, Research Assistant

Community Participants:

Lori Hayes, Director, St. Leo's Head Start (at St. Leo's Mission and the San Dieguito Boys and Girls Club).

Sarah Thomsen, Program Director, Boys and Girls Clubs of San Dieguito, Lomas Santa Fe Branch (1999-2000)

K-12 Participant:

Linda Colby, Special Needs Teacher, Solana Beach School District, engaged in developing programs for students at risk at Skyline Elementary School and Solana Santa Fe Elementary School.

	FALL QUARTER	WINTER QUARTER	SPRING QUARTER
INSTITUTION	>Boys and Girls Club raises membership fees significantly >Children are assigned to age/grade appropriate activity groups (aka pods) part of a new programming schedule >Change in Fifth Dimension site coordinator >Optional homework room becomes Homework Club for kids referred from Skyline Elementary School >Change of homework room staff >New UCSD course professor >New UCSD undergraduates attend Boys and Girls Club	>No change in Club membership fees >End of age/grade activity groups-children given free choice among Club activities-general roll call instituted >Change in Fifth Dimension site coordinator >Homework Club kids allowed to walk over from Skyline Elementary without adult supervision. >Homework Club kids attend roll call >Change in homework room staff >Resource aid sent over from Skyline Elementary to help in homework room >New UCSD professor >New UCSD undergraduates attend Boys and Girls Club >Change in Boys and Girls Club program director	>No change in club membership fees >Club institutes free time at the beginning of each day, prior to roll call >Homework Club participation guidelines change to allow kids to join Club activities as soon as homework is complete >Homework Club kids' names integrated into master Club roll call list >Homework room staff leaves during last week of school year >New UCSD professor >New UCSD undergraduates attend Boys and Girls Club
PROGRAM	>Fifth Dimension game maze redesigned >Educational games selected for quantitative assessment are assigned to rooms 1,2, and 3 >Children's folders include constitution, passport application/passport, and travel log >Activity periods begin with 15 minutes for play of games in rooms 1-3 and for logging scores >Change in Fifth Dimension site coordinator >New UCSD undergraduates work with children	>Consequence chart added to structure of game maze >Educational games separated from maze- become "Gateway Games" >Children's folders include constitution, passport renewal form, new passport, travel log, and Gateway Game recording sheet >Each day starts with one 15 minute Gateway Game play session >Change in Fifth Dimension site coordinator >New UCSD undergraduates work with children	>Consequence chart removed from game maze >Site coordinator independently adds 15 new games to Fifth Dimension-not added to maze game list >Children's folders include new constitution, pizza progress chart, and travel log >New emphasis is put on maze completion >15 minute Gateway Game time ends-children required to play one game in each Gateway area before playing maze games >New UCSD undergraduates work with children
MEASUREMENT	>Controlled programming schedule (pods) controls children's presence in Fifth Dimension and increases predictabillity >Activty period begins with 15 minutes specifically for games in rooms 1-3 and for logging kids' scores >Children's folders include travel logs for game score records >Each educational game has a task card that includes instructions for undergraduates to record kids' scores >Children's game score records are transferred to data spreadsheet that tracks play across the quarter	>Open schedule allows for child to choose activities-this decreases control/predictablility of child presence in Fifth Dimension >Each day starts with one 15 minute Gateway Game play session-less emphasis on these games once this session ends >Children's folders include a Gateway Game recording sheet travel log updated to include field for type of help the child receives (from an adult or kid partner) >Undergraduates are given special guide sheet to aid game score recording process >Data spreadsheet is updated to reflect changes in travel log and idiosyncracies of Gateway Games	>Additional freedom in activity schedule further reduces control and predictability of child participation in the Fifth Dimension >Requirement for Gateway Game play reduced to once per quarter in each of the three subject areas in order to draw focus to the maze games >Children's folders include travel log for recording scores for all games-field for type of help received is removed. Folders also include individual pizza progress charts for completion of the the maze >Data spreadsheet recording process modified as required entries are reduced

Table 1- Changes across the 1999-2000 school year

TYPE OF EVIDENCE	QUANTITATIVE MEASUREMENT	QUALITATIVE MEASUREMENT
Attendance	***Based on log sheet in children's travel folders*** 4/10 high evidence of attendance 3/10 medium evidence of attendance 3/10 low evidence of attendance * ***High attendance in Homework Club***	***Based on frequency of child's name in undergraduate fieldnotes*** 3/10 high evidence of attendance 5/10 medium evidence of attendance 2/10 low evidence of attendance
Engagement in Program	***Based on accomplishment on pizza progress chart and travel log and participation in tournaments.*** 2/10 high evidence of engagement 6/10 medium evidence of engagement 2/10 low evidence of engagement	***Based on commentary in undergraduate fieldnotes*** 7/10 high evidence of engagement 2/10 medium evidence of engagement 1/10 low evidence of engagement
Cognitive Change	***Based on examination of first and last scores in various games as recorded in children's folder*** 7/10 high evidence of improvement 1/10 medium evidence of improvement 2/10 low evidence of improvement	***Based on commentary in undergraduate fieldnotes*** 4/10 high evidence of improvement 2/10 medium evidence of improvement 4/10 low evidence of improvement
Social Change	***No measurement used***	***Based on commentary in undergraduate fieldnotes*** 5/10 high evidence of improvement 4/10 medium evidence of improvement 1/10 low evidence of improvement

Table 3- Comparison of Quantitative and Qualitative Data for 10 Case Studies