



IRVINE NETWORK ON
INTERVENTIONS IN DEVELOPMENT

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PROPOSAL TEXT POST DOCTORAL FELLOWSHIPS

SCHOOL OF EDUCATION, UNIVERSITY OF CALIFORNIA, IRVINE

YEARS 2013-2015 AND 2016-2017

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SIGNIFICANCE

Our application seeks support for four, two-year postdoctoral fellowships, with recruitment and fellowship activities spanning a total period of five years. The postdoctoral training program we propose combines two vital elements: i) *substantive* training, guided by a four-project, interdisciplinary research network focused on understanding the what works, for whom it works, and under what circumstances it works nature of education interventions; and ii) *methods* training, taking advantage of the latest quasi-experimental and distributional statistical techniques.

The heart of the research opportunities provided to fellows is a five-year NICHD-funded program project (P01) that was awarded recently to the University of California, Irvine. The program project's principal goal is to understand why human capital intervention programs and policies, directed at children in the preschool, middle childhood and adolescent stages of development, have the effects, non-effects and, in some cases, perverse effects that they do. Taken together, the group's collective and coordinated efforts will constitute a research network that we call the Irvine Network on Interventions in Development. Fellows will be intimately involved in many facets of the Network's activities. Greg Duncan serves as PI of the program project grant and is the proposed PI for this postdoctoral fellowship grant.

Postdoctoral fellows will work on analyses of the specific policy interventions that are spread across the four projects. These include: i) early childhood programs such as Head Start and Early Head Start (Project I – George Farkas, PI; Deborah Vandell and Greg Duncan, co-PIs); ii) state standards for health education curricula involving alcohol, tobacco and other drugs (Project II – Christopher Carpenter, PI); and iii) Head Start, school voucher programs and state policies regarding high-stakes exams for grade promotion and/or graduation (Project III – Marianne Bitler, PI). A fourth project (IV – Greg Duncan, PI) complements the first three by addressing the “so what?” question of the possible longer-run consequences of augmenting skills or improving behavior at various points in childhood and adolescence. Up-and-coming junior faculty at UC Irvine with expertise in sociology (Andrew Penner, Thurston Domina), criminology (Sara Wakefield), epidemiology (Tim Bruckner), motivational psychology (AnneMarie Conley) and developmental psychopathology (Candice Odgers) will also devote time to these subprojects and to cross-project synthetic activities.

Substantive Significance

Policy research on children's learning and behavior is heavily balkanized by discipline. Economists bring strong experimental and quasi-experimental methods to their policy research, and recognize in their conception of causation that policies may have heterogeneous treatment impacts. But economic theories make few concrete predictions regarding either the nature of that heterogeneity or the processes by which the black-box policy impacts they estimate come about. Sociologists bring a sophisticated conception of the many contexts (e.g., schools, neighborhoods) in which children develop, but rarely employ experimental or quasi-experimental methods to investigate the effects of interventions within these contexts. Developmental psychologists have strong conceptual models of how policy interventions and other environmental conditions may differentially affect children within and across developmental stages – birth to school entry, middle childhood, adolescence and early adulthood. However, while psychologists have developed some of the most rigorous and consequential educational interventions (e.g., Perry Preschool, Abecedarian), some of which incorporate random-assignment evaluation designs, much of their empirical research, like that of sociologists, relies on nonexperimental data and relatively weak causal empirical methods. Further, they rarely use statistical techniques such as quantile regression that are capable of estimating varying program effects across the distribution of outcomes for population subgroups.

Our common conceptual approach assumes that children and youth profit from education-related interventions to varying degrees, for two fundamental reasons. First is what we call *stage/policy fit*. Children in different developmental stages vary in their responses to policies because of differences in the fit between policy-induced changes in children's immediate environments and the accomplishment of stage-salient developmental tasks (Sroufe, 1979; Waters & Sroufe, 1983). For example, the potential for high payoffs to

education interventions mounted early in childhood is supported by evidence regarding the critical importance of early childhood for brain development (Knudsen, Heckman, Cameron, & Shonkoff, 2006) and is formalized in economic models of human capital development (Cunha, Heckman, Lochner, & Masterov, 2006).

A second example is the seminal work of Eccles et al. (1993), who argue that the primary/middle-school model of education structure is inferior to an integrated K-8 structure because middle schools are ill-matched to the emerging developmental demands of children as they transition to adolescence. Transitioning children are in special need of close relationships with adults outside their homes, and yet the transition to middle school involves moving from a single teacher to multiple teachers; heightened concern about status relative to peers is exacerbated by middle-school tracking; needs for more complex academic tasks are often met by more rote teaching styles; and needs for self-determination, participation in rule making and emotional support are met by increased regimentation and rigid disciplinary policies. Eccles et al. argue that, as a consequence of these ill-fitting features of middle school, many students disengage from their schoolwork and focus on peers and other non-school priorities.

But there is also substantial variation in treatment impacts across children *within* a given stage (Imbens & Angrist, 1994). We call this *child/policy fit*. Early childhood interventions such as Head Start and Early Head Start are geared toward providing learning experiences to children whose family environments are unlikely to provide enough of them. Thus, they “fit” better, and likely generate larger impacts, for children from economically disadvantaged than advantaged circumstances – a hypothesis that we test in Project I. Also tested in Project I is the interesting “fit” hypothesis that high-quality child care has particularly positive impacts and low-quality care has particularly negative impacts on children with difficult temperaments (Pluess & Belsky, 2009). Middle- and high-school programs aimed at preventing the onset of or reducing smoking, drinking and drug use are typically geared toward normative rather than problematic development (Project II). Thus they likely “fit” better for students who have not yet experimented with these substances. In the case of students who have already begun such experimentation, these programs may even generate unintended negative impacts (Dishion, McCord, & Poulin, 1999). Sometimes “fit” issues arise from the nature of the intervention. High-school exit exams (Project III) focus attention on the differential impacts on youth with achievement skills near or far from the pass/no pass thresholds, a topic that can be investigated productively with quantile regression techniques.

A fundamental premise of our program project is that effective policies must fit with individual children’s achievement of stage-specific developmental tasks. To formulate hypotheses from this child/developmental stage/policy-fit perspective, we draw upon the expertise of developmental psychologists (postdoc fellowship proposal co-PI Vandell), psychologists (Conley and Odgers) and criminologists (Wakefield) whose collective expertise on human development spans the life course. Each of the four P01 subprojects benefits from the expertise of economists, sociologists and developmental psychologists, which, when coupled with the network-wide activities, will enable postdoctoral fellows to experience an exciting, deeply interdisciplinary training experience focused on education-related interventions.

Significance of Strong Methods Training

Training for effective policy-related research in the education field also involves using and, when needed, developing strong empirical methods. Where possible, our policy-analytic methods take advantage of random-assignment experiments (Projects I and III). In the case of Projects II and IV we employ the natural experimental and fixed-effects methodologies of applied economics and epidemiology. The economists (postdoc fellowship proposal co-PIs Bitler and Carpenter, PI Duncan), epidemiologists (Bruckner), and sociologists (co-PI Farkas, plus Domina and Penner) in our Network have considerable experience with quasi-experimental methods.

Some of our policy research questions concern the *distribution* of policy impacts across higher and lower functioning children and youth. Since some aspects of current methods for understanding distributional impact are problematic, one of our projects (III, postdoc proposal co-PI Bitler) will develop and extend new methods, apply them to the analysis of several preschool- and school-based policy interventions, distribute accessible software on the Network’s website, and promote the use of these methods at professional meetings.

Although strong in addressing issues of omitted variable bias in causal models of policy impacts, economists' policy studies often fail to attend to measurement issues. The measurement of achievement, anti-social and health-risk behaviors often raises scaling and reliability issues. To address these problems, we are able to draw upon the considerable psychometric expertise of the developmental psychologists (co-PI Vandell, Conley and Odgers) and sociologists (co-PI Farkas) in the network, as well as psychometric methodologist Margaret Burchinal, an adjunct faculty member at UC Irvine and statistician at UNC-Chapel Hill who is involved with Farkas's Project I.

In sum, what is uniquely significant in our proposed postdoctoral training program is that we *combine* state-of-the-art methods with a theory-based approach, led by Vandell and Duncan, to understand the heterogeneous nature of intervention program impacts. Our overall program project involves economists, developmental psychologists, sociologists and epidemiologists. All of these individuals have committed to a series of interdisciplinary seminars, "lessons learned" conceptual papers, and other activities designed to forge a richer understanding of the nature of education intervention effects on children of all ages. Each postdoctoral fellow will be involved in the activities of a specific project as well as the Network-wide activities.

Project Descriptions

All of our individual projects are united by the same general themes – in particular stage/policy and child/policy fit as a source of treatment heterogeneity. Ongoing seminars and a series of working papers will build toward a cross-project synthetic understanding of these themes. Postdoctoral fellows will work on one of the four individual projects, plus the cross-project activities.

Project 1: Heterogeneous Impacts of Early Childhood Interventions; George Farkas, PI and Deborah Vandell and Greg Duncan, co-PIs

In its examination of the heterogeneous effects of early intervention programs, the first project is primarily a Goal 1 secondary analysis, but since its treatments include scaled-up programs, it also addresses Goal 4 elements of understanding program effectiveness. Innovative research skills this project will provide to postdoctoral fellows include the application of cutting-edge statistical techniques to the analysis of four random assignment and one regression discontinuity evaluation of early childhood intervention programs. In addition to analysis of RCT and regression discontinuity data, this project involves propensity score matching and using instrumental variables methods to estimate the child impacts of program characteristics that were not randomly assigned.

Research has demonstrated that much of the academic achievement gap observed in economically disadvantaged children is already present when formal schooling begins at age 5. This fact has focused the attention of policy-makers and researchers on educational and enrichment programs for children from birth to age 5, particularly on Head Start and pre-kindergarten programs offered to children and families with economic and other disadvantages. Postdoctoral fellows will help to discover differences in intervention efficacy for children from different backgrounds and/or with different characteristics. Such knowledge is necessary to meet the goal of creating programs to ensure that most children enter kindergarten ready to learn.

Project I employs the program project's child-environment fit perspective to derive and test hypotheses regarding which combinations of child, family, and child care program characteristics lead to larger child care treatment effects on cognitive and socio-emotional school readiness outcomes for children. It first tests a *compensatory hypothesis* in which high-quality child care most strongly benefits at-risk children. This is an experimental test using data from four evaluations that employ an experimental manipulation of high-quality child care – the Infant Health and Development Program (IHDP), Early Head Start (EHS), the National Head Start Impact Study (NHSIS), and the Preschool Curriculum Evaluation Research Study (PCER). Tests are also performed using a regression-discontinuity design applied to the Oklahoma Universal Pre-K program.

A second set of experimental tests examines competing predictions from *compensatory* (least skilled children profit the most) and *skill begets skill* hypotheses (the most skilled children profit the most) using data from the IHDP, NHSIS, Oklahoma Pre-K, and PCER studies. Third, we use data from EHS, NHSIS, and PCER

to test the *protective* hypothesis that certain personal and family factors protect at-risk children from the negative effects of low-quality care. We use these same data to test the *cumulative disadvantage* hypothesis that poor-quality programs are most detrimental for children with a high number of risk factors. Finally, we test the *differential susceptibility* hypothesis that children with difficult temperaments are at once hurt the most by low-quality care but helped the most by high-quality care. In addition, we will undertake analyses of two of the experimental databases – the NHSIS and PCER – to determine which characteristics account for differential effects experienced by population subgroups.

Tests of the various hypotheses regarding child-policy fit involve estimating interactions between baseline characteristics and the treatment dummy in each study. Since all of the data sets that we use randomly assigned children to treatment and control groups, our analyses should provide unbiased estimates of variation in treatment effects. The analysis of the impacts of program characteristics employs instrumental variables procedures using the random assignment feature of both the HSIS and PCER studies to exploit program (random assignment to treatment or control) and site (i.e., classroom, center, or agency) variation in process quality. (For a discussion of this methodology, see Ludwig & Kling, 2007 and Bloom, Zhu, & Unlu, 2010.) Specifically, we can use interactions between treatment group assignments (T) and site (S) as instrumental variables to isolate experimentally-induced variations in process variables such as child care classroom quality. For a single classroom quality indicator (W), and using Controls (which include treatment dummies) to denote baseline covariates, we have:

$$(1) \quad W = T*S \gamma_1 + S \gamma_2 + \text{Controls } \beta_1 + \varepsilon_1$$

$$(2) \quad \text{Later Skills} = W \lambda_1 + S \lambda_2 + \text{Controls } \beta_2 + \varepsilon_2.$$

This two equation system is identified because the treatment by site interactions appear in equation (1) but not (2). That is, the variation in W that is used to estimate W's effect on Later Skills comes from within-site treatment-control differences. This ensures that the prediction of Later Skills with W in (2) is identified from exogenous (i.e., random assignment) variation. Additional interactions between, for example, classroom quality (W) and the child's at-risk status are estimated by adding interaction terms between W and the at-risk indicator to equation (2), and using interactions between the treatment by site interactions and the at-risk indicators as instruments.

Project II: Impacts of State School Health Curricula; Christopher Carpenter, PI

In its look at the impacts of state school health curricula, the second project also mixes Goal 1 secondary analysis with Goal 4 analyses of program effectiveness. Methodologically, by exploiting variation across states and over time in the adoption of health curricula, it will provide postdoctoral fellows with training in the approaches (in particular difference-in-difference models) adopted in economics and policy evaluation to deal with potential omitted variables.

This second project employs a developmental perspective to understand the conditions under which state health education curriculum requirements regarding alcohol, tobacco, and other drugs (ATOD) have protective or harmful effects on youth substance use. A key developmental task of adolescence is to establish a stable identity. This period is characterized by experimentation and social role-taking during the transition from childhood to adulthood. As indicated by troublingly high rates of youth participation in risky behaviors such as alcohol consumption, smoking, and use of marijuana and other illicit drugs (Johnston, O'Malley, Bachman, & Schulenberg, 2011), substance use appears to be central to the identity-building enterprise for too many U.S. youth.

This project will first create and maintain an ongoing, comprehensive database of state requirements regarding ATOD education as well as a variety of other policies pertaining to health education and academic content adopted over the 1990s and 2000s. (These data will be posted on the Network's website after they have been compiled and documented.) Developmental theory suggests that the effects of policies will likely vary with the biological age and personal characteristics (e.g., gender, self-control) of students; characteristics of the students' school and peer groups (e.g., prevalence of substance use, peer use); and characteristics of the programs themselves (e.g., duration, approach). This project will test these theories with the first comprehensive quasi-experimental analysis of state requirements for ATOD education in health curricula by exploiting

substantial variation across states in the timing and implementation of these policies. For youth outcomes, data are drawn from the 1991-2009 Youth Risk Behavior Survey, the 1976-2009 Monitoring the Future study and the National Longitudinal Survey of Youth 1997. Outcome data include teacher reports of actual health education instruction and youth self-reports of substance use from several representative datasets. This research will enable postdoctoral fellows to help advance our understanding of the appropriateness of statewide ATOD curriculum interventions in youth substance use.

To examine the effect of the various public policies on outcomes we will estimate difference-in-difference (DD) models that identify the effects of the ATOD curriculum requirements using variation across states in the timing of adoption and in the grades of youths targeted by the various policies. The basic DD models are of the form:

$$(1) Y_{ist} = \beta_0 + \beta_1 X_{ist} + \beta_2 (\text{State ATOD Curriculum Requirements})_{st} + \beta_3 Z_{st} + \beta_4 S_s + \beta_5 T_t + \epsilon_{ist}$$

where Y_{ist} are the various outcomes pertaining to actual instruction and delivery of health education content reported by teacher or principal i in state s in year t . X_{ist} is a vector of individual level demographic characteristics that varies across the datasets depending on who is being surveyed but generally includes the respondent's age, race, ethnicity, and education. Z_{st} is a vector of time-varying state characteristics and related policies that may have independently affected youth risk outcomes, including: the state unemployment rate, fraction black, fraction of households below the federal poverty line, excise taxes on cigarettes and alcohol, age-targeted drunk driving laws, and graduated driver licensing policies with an intermediate phase. S and T are, respectively, state and time fixed-effects.

Project III: Distributional Impacts of School Policies; Marianne Bitler, PI

In its look at the distributional impacts of a number of educational interventions, the third project also mixes Goal 1 secondary analysis with Goal 4 analyses of program effectiveness. Methodologically, it develops and applies statistical techniques related to the distributional analysis of quantitative data to educational policy research.

The twin goals of excellence and equity should lead policy-makers to be interested in both the *average* effects of educational policies and their *distributional* consequences. But although developmental science suggests that many interventions should have heterogeneous effects, most educational evaluation research focuses on the estimation of mean treatment effects either for the population at large or for particular subgroups of interest. We build on recent innovations in quantile regression, quantile treatment effect (QTE) estimation, and other explicitly distributional approaches (e.g., Abadie, Angrist, & Imbens, 2002; Angrist, Chernozhukov, & Fernandez-Val, 2006; Athey & Imbens, 2006; Chernozhukov, Fernandez-Val, & Melly, 2009; Firpo, 2007). These methods are applied in Bitler, Gelbach, and Hoynes (2006) and tests based on them are developed in Bitler, Gelbach and Hoynes (2011).

Developmental theory suggests that good and bad matches between student circumstances and intervention program design will produce heterogeneous program impacts, and that understanding the nature of this heterogeneity is essential for optimizing program design. The Farkas/Vandell/Duncan and Carpenter projects propose tests of child/policy fit hypotheses with interaction models allowing for differential program impacts across population subgroups that are defined by baseline characteristics. Project III develops and implements complementary approaches to testing child/policy fit hypotheses: quantile treatment effect estimation and other distributional estimators as well as tests of what subgroup mean impacts models might miss. It applies these techniques to data from the evaluation of programs and policies targeted at four different education settings, ranging from pre-kindergarten to high school. One draws data from the National Head Start Impact Study. A second uses data from the School Choice Scholarships Foundation's offering of three-year scholarships worth \$1,400 per year to a randomly selected group of low-income children in grades K-4. Third, data are drawn from several school districts to evaluate the distributional impacts of the California State Board of Education's requirement that all public school students take Algebra I by 8th grade, which will provide postdoctoral fellows with the opportunity to help evaluate the distributional consequences of this curricular change on achievement and motivation using rich, longitudinal student-level data from three high-poverty, ethnically-diverse Southern California school districts. Fourth, district data are used to evaluate California's high school exit exam

(CAHSEE), which was mandated by the state legislature in 1999.

As the results of our analyses emerge, we will devote considerable effort to promoting the use of distributional methods among education policy researchers. We plan to present this work extensively at venues such as the annual meetings of SREE, AERA, ASA, AEA, PAA, and APPAM. We also plan to write up at least one and likely several methodological papers to illustrate these methods. One will lay out the application of distributional methods and the tests about subgroups for educationally-oriented audiences. Another will illustrate the application of these methods in a non-randomized setting. We will also make available Stata code and post tutorials on the Network's website for each of the estimators we plan to use. Postdoctoral fellows will be encouraged to be involved in these outreach activities.

Project IV: Adult Correlates of Middle-Childhood Skills and Behaviors; Greg Duncan, PI

This Goal 1 exploratory study investigates links between various skills and capacities in middle childhood (age 7-10) and adolescence (age 13-16) and both positive (completed schooling, earnings, good health) and negative (criminality) outcomes in adulthood (age 25-50) in Anglo and Nordic countries. As such, it provides a "so what?" linkage between the kinds of short-run cognitive and behavioral outcomes employed in Project I-III studies to consequential adult outcomes.

It is hypothesized that early school success and the absence of anti-social behavior help to launch children on positive school trajectories that lead ultimately to more successful labor market careers and better adult health and avoiding costly involvement with the criminal justice system. In the case of adult health, we hypothesize that early skills and the absence of anti-social behavior improve health by reducing teen health risk behaviors. More generally we hypothesize mostly within-domain (e.g., early anti-social behavior and adult criminality) linkages and expect that child/adult associations will be weaker in Nordic than in Anglo-American countries.

The investigation is a comparative one, involving population-based data from six datasets drawn from four countries: the Swedish Study of Individual Development and Adaptation, the Finnish Jyväskylä Longitudinal Study of Personality and Social Development, the British Cohort Study (1970 birth cohort) and the British National Child Development Survey (1958 birth cohort), and the U.S. Baltimore Beginning School Study and the U.S. National Longitudinal Survey of Youth, Child Sample (NLSY). All of these datasets share four crucial properties: i) representative samples of children drawn from national or large community populations; ii) measurement of achievement and behavioral skills at ages 7-10 and 13-16; iii) measurement of completed schooling, adult earnings, work hours, crime and health in adulthood (between the ages of 25 and 50); and iv) prior family (e.g., parental education, family structure) and often child (e.g., IQ, early temperament, birth weight) controls to help ensure that the estimated effects of middle-childhood skills are not simply the product of unmeasured family circumstances and correlated individual characteristics. All of our proposed analyses involve longitudinal methods. The criminality analyses will involve structural equation modeling. One of our datasets (the NLSY) includes siblings, which enables us to eliminate biases from persistent unmeasured family condition by estimating family fixed effects models. We expect that postdoctoral fellows who choose to work on Project IV will devote the most time to these NLSY-based analyses.

FELLOWSHIP PLAN

General Principles

Conducting consequential education policy research requires a diverse set of skills –conceptual, methodological and practical. On the conceptual side, researchers need to understand the rudiments of child and adolescent development; social context and organizations; and hard-headed policy analysis. On the methods side, researchers need to understand the logic of causal analysis and be able to apply it to policy research problems using the latest techniques. On the practical side, they need to be able to work and connect with various kinds of policy audiences.

Few newly-minted Ph.D.s possess all of these skills, and the gravitational forces of the disciplines lead many to never gain all of them. At the same time, their more specialized skills can serve as a strong foundation for acquiring the broader set of needed skills. A postdoctoral fellowship provides a two-year window of opportunity to broaden and deepen the education research skills of the fellows. For any given fellow, the training program needs to be carefully tailored to building on existing strengths toward the acquisition of the broader set of skills.

Our fellowship plan is intended to fill each fellow’s two-year window of opportunity with an optimal mix of training activities. Most important are: i) close mentoring from three senior transdisciplinary education scholars (Duncan, Farkas and Vandell); ii) the research projects described above; iii) courses and workshops to fill conceptual or methodological gaps; iv) a seminar series and the close interactions that fellows will have with seminar speakers; and v) cross-project Network activities devoted to a unified understanding of child/policy and stage/policy in education-related interventions. Our two methods-focused PIs (Bitler and Carpenter) will be able to draw from their own postdoctoral fellowship experiences to help shape the structure (e.g., orientation, focus on individual fellows vs. the cohort pair of fellows) of fellow activities.

Research Training Activities

We propose to recruit two cohorts of postdoctoral fellows, each residing at UC Irvine for two years. Given the timing of the possible award and the amount of time needed to recruit and resettle fellows, we have designed the fellowship periods to coincide with the July 1-June 30 project years. The chart below shows an approximate plan for the timing of the recruitment and tenure of fellows. If possible, we will slightly adjust this plan so that the first two fellows have some overlap with the second two fellows, so as to facilitate their acculturation to the project.

Timing of Postdoctoral Fellowships

	July 2012- June 2013	July 2013- June 2014	July 2014- June 2015	July 2015- June 2016	July 2016- June 2017
Recruitment	X		X		
Fellow 1		X	X		
Fellow 2		X	X		
Fellow 3				X	X
Fellow 4				X	X

Each fellow will be assigned to Duncan, Farkas or Vandell as their primary faculty mentor. The mentor will be selected based on the fellow’s research interests and training needs. The fellow and faculty mentor will meet weekly in the first year of the fellowship and every other week in the second year. The mentor will match fellows with research projects, advise on needed coursework, advise on the fellow’s independent research agenda and facilitate connections with other researchers on campus and around the world. To facilitate frequent, informal interactions, fellows will have offices close to the program faculty.

Conceptual and Methodological Training

Recruited postdoctoral fellows will arrive with a strong set of disciplinary skills and, in all likelihood, less strong understanding of the conceptual and methodological approaches taken in education research conducted in other disciplines. Upon arrival, each fellow’s senior mentor (Duncan, Vandell or Farkas) will assess training needs that might be filled by a variety of courses offered at the University of California, Irvine, many of which

are taught by faculty associated with the postdoctoral training or the larger program project. Almost everyone will profit from at least one course or workshop in rigorous methods not covered by their graduate training but vital for understanding and contributing to the increasingly interdisciplinary field of education policy research. And almost all fellows will lack foundational exposure to the key concepts in either developmental psychology, economics or sociology that are vital for a cross-disciplinary understanding of education policy issues. To fill these gaps we anticipate that the typical postdoctoral fellow will take two or possibly three courses.

Here we list candidate conceptual and methodological courses. In the case of the latter, we assume that the fellows will arrive with reasonably strong quantitative skills taught in their home disciplines.

Conceptual Courses

Economic Foundations of Education and Social Policy. Taught by Greg Duncan, this course provides a beginning to intermediate-level understanding of the microeconomics of consumer demand, market and general equilibrium, human capital investment and cost-benefit analysis. It is filled with examples of education and other social policies and is intended to introduce an economist's way of thinking about policy questions to noneconomists.

Theories of Human Development. Deborah Vandell teaches this course, which provides a discussion-based introduction to concepts central to the study of human development. Drawing from developmental psychology, it examines topics including, but not limited to, mediation and moderation, ecological systems theory, attachment theory, stage-environment fit, and behavioral genetics.

Social Capital and Student Achievement. This course, taught by George Farkas and Thurston Domina, investigates the concept of social capital and how it has been used in educational research over the past 20 years. The focus is on social relationships in families, schools, and neighborhoods, and how these relationships are positively and/or negatively related to student achievement.

Educational Policy and Politics. Thurston Domina and George Farkas teach this as a workshop for educational researchers who want to understand and influence American educational policy. They survey the landscape of contemporary U.S. educational policy and politics, covering specific policies such as the federal Elementary and Secondary Education Act as well as broader policy movements such as choice, accountability, standards, and teacher quality.

Methods Courses

Applied Regression Analysis. Taught by Greg Duncan, this course integrates statistical methods employed by education researchers in sociology, economics and developmental psychology. It emphasizes causal reasoning in its coverage of traditional regression approaches, path analysis, regression discontinuity, fixed effects, multi-level models and event-history models. Given the scope of topics, the course's goal is less proficiency (although there are weekly lab assignments) than being able to understand the strengths and weaknesses of the methods employed in empirical work on education across the disciplines.

Empirical Methods in Applied Microeconomics. Taught by Marianne Bitler, this course focuses on the empirical methods used in modern applied microeconomics. It teaches students topics and methods that can be applied to produce original research in applied fields using cross-sectional and panel data: complex sample surveys and data collection, missing data and multiple imputation, weighting, standard error issues, bootstrapping, panel data methods, difference in differences (linear and non-linear), instrumental variables, regression discontinuity, quantile regression, matching and propensity score approaches.

Applied Econometrics and Research Methods. Taught by Christopher Carpenter, this course helps students become more knowledgeable consumers and producers of empirical research, particularly with respect to identifying causal effects using quasi-experimental approaches. This course reviews a variety of econometric techniques and research designs used by applied economists, especially in the areas of health, labor, and public economics. Topics covered include: selection on unobservables designs, difference estimators, fixed-effects, instrumental variables, regression discontinuity, selection on observables designs, regression adjustment, and propensity scores. Particular attention is paid to several practical issues that arise when analyzing economic data (e.g., clustering).

Structural Equation Modeling II: Longitudinal and Advanced Topics. Taught by Candice Odgers, this course covers a wide range of longitudinal, multi-level and mixture modeling techniques within a Structural Equation Modeling (SEM) framework. This course reviews the assumptions underlying SEM and trainees will be provided with lab-based instruction to ensure the transfer of skills and knowledge into their research programs. A companion course has also been developed for faculty and postdoctoral researchers and builds on the fundamentals of SEM established in the introductory course of this sequence (SEM I).

Seminars

The P01 program project sponsors a biweekly seminar that mixes presentations from outside speakers selected for their breadth and expertise on topics that overlap heavily with our projects with presentation of project plans and results from Network members. All postdoctoral fellows and Network members are expected to attend all of these meetings.

We will invite outside speakers to present seminars in each year of the P01 program project. We budget in the current proposal for three additional speakers who, in addition to presenting a seminar, will spend an extra evening and half-day talking with the postdoctoral fellows about research and career interests. We have found that these kinds of personal connections can be very beneficial for the development and employment prospects of early-career scholars.

Many of our outside speakers will be drawn from the group of scholars who have agreed to serve on the program project's Advisory Committee. These include Howard Bloom (MDRC), Daniel Bolt (University of Wisconsin-Madison), Doug Clements (SUNY- Buffalo), Robert Crosnoe (UT Austin), Ken Dodge (Duke), Jacquelynne Eccles (Michigan), Dale Farran (Vanderbilt), Daniel Keating (Michigan), Susanna Loeb (Stanford), Jens Ludwig (University of Chicago), Wayne Osgood (Penn State), Sean Reardon (Stanford), and Jeffrey Smith (Michigan).

Plan for Recruitment and Selection of Fellows

The interdisciplinary nature of our training will lead us to cast a wide recruiting net. We could imagine promising candidates emerging from Ph.D. programs in education, psychology, sociology, public policy and economics, although the high ratio of assistant professor starting salaries to stipend in economics leads us to doubt that we will be successful in recruiting economists. Consistent with the RFA, prospective fellows will be in the final stages of completing their dissertations and advised that graduation will be required prior to their beginning the training program. Only citizens and permanent residents of the US will be eligible for the program. We will make a special effort to recruit under-represented minorities, drawing on the extensive resources and training provided by UC Irvine as well as working with external organizations whose mission is to increase minority participation in research. For example, as recent President of the Society for Research on Child Development, Duncan worked closely with SRCD's committees on Racial and Ethnic Issues and with its Student and Early Career Council and can tap into their networks of minority scholars. Deborah Vandell and George Farkas have similar service-based connections into relevant AERA and American Sociological Association committees and interest groups.

Given the timing of the fellowships, recruitment efforts will be concentrated in years 1 and 3 of our training grant period, although in the event that a fellowship period is cut short by a job offer or other reasons, there may be some recruitment activity in other years as well. We will begin by placing announcements in discipline-specific job bank listings as well as strategic advertisement in the newsletters, journals and conference programs of academic societies such as American Educational Research Association, Society for Research on Child Development, American Psychological Association, American Sociological Association, Association for Public Policy Analysis and Management, Population Association of America, Society for Research on Educational Effectiveness, and American Economic Association. We will also send announcement letters to top departments in relevant fields.

Collectively, the PI and co-PIs have developed far-ranging networks of education-related researchers in all of the disciplines we will target. We will alert members of these networks to the fellowship opportunities via email. Moreover, since the five key personnel collectively attend all of the major professional meetings of key academic societies, we will use those opportunities to circulate notices of the fellowship opportunities and meet

with prospective candidates. Two such trips are budgeted for years 1 and 3; we anticipate all other trips to the professional association meetings will be paid for in other ways.

We will ask prospective fellows to submit a statement about their goals for the training program plus CVs, letters of reference, a research paper and transcripts. After phone (or, in cases where meetings at professional societies are possible, personal) interviews with the most promising dozen or so candidates, we will invite three finalists to Irvine to spend a full day meeting with the PI and co-PIs, presenting a research seminar, and getting to know the campus and surrounding area. Training program PI and co-PIs will then meet to decide on a final ranking of the candidates.

Stipends, Travel and Costs

Each fellow will be paid \$51,471 in the first year of the fellowship and \$52,500 in the second year to allow for UC Irvine-mandated stipend increases in the second year. The fellows will receive benefits provided by UC Irvine to postdoctoral fellows. Fringe benefits costs above the \$12,000 IES cap will be covered by the program faculty's other (non-IES, non-federal) research funds. As specified in the RFA, we budget for expenses to recruit fellows; PI and fellow travel to annual IES meetings; fellow travel to research conferences; seminar series expenses; and administrative support for the training program (5% effort from a Department of Education staff member). The budget justification provides details on these items.

PERSONNEL

Key personnel for the postdoctoral training program consist of three senior mentors (Duncan, Farkas and Vandell) who collectively span the major foundational disciplines for education research and have compiled distinguished records of research and mentoring, and two methods and policy-focused mentors (Bitler and Carpenter) who have already made major contributions to a variety of applied policy research topics. All five are key personnel on the NICHD program project grant at UC Irvine.

PI Greg DUNCAN (Ph.D., Economics, University of Michigan, 1974) is Distinguished Professor in the Department of Education. He will devote 12% of his time to the postdoctoral administrative, general mentoring and project-specific training activities in each year of the project. Prior to his 2008 arrival in Irvine, Duncan was the Edwin Tarry Professor in Northwestern University's Education School. Duncan has a long history of mentoring graduate students and post-Ph.D. scholars. As shown in Appendix A, many of his Ph.D. students have taken positions in highly-ranked research universities. At Northwestern he served as co-director of the IES-funded Multi-disciplinary Program in the Education Sciences predoctoral training program as well as director of the Joint Center for Poverty Research, where he mentored several early career visiting scholars.

Duncan's CV includes 239 articles and chapters and 14 books, with much of his recent research devoted to understanding the contextual determinants of child achievement and attainment. His work with random assignment experiments includes the Milwaukee New Hope work support program and the Moving to Opportunity residential mobility experiment. His recent articles have employed sibling fixed effects, instrumental variables to estimate the effects of family income on child achievement, meta-analyses of data from all early childhood education programs and longitudinal analyses of prenatal conditions linked to adult labor market attainment. He has served on proposal review panels for IES, NICHD and several foundations.

Duncan has considerable experience with the kind of interdisciplinary research network that is funded by the NICHD program project. He was a president of the Population Association of America (2008) and the Society for Research in Child Development (2009-11). He was elected to the National Academy of Education in 2009 and the National Academy of Sciences in 2010.

Co-PI George FARKAS (Ph.D., Sociology, Cornell, 1973) is Professor of Education and Sociology. He will devote 7% of his time to the postdoctoral general mentoring and project-specific training activities in each year of the project. He is an expert on quantitative methodology, with a particular focus on experimental and quasi-experimental program evaluation, fixed and random coefficient models, and structural equation modeling. From 2005 to 2007 he directed the Statistics Core of the Population Research Institute at Penn State. From 1978 to 1985, working with Abt Associates and Manpower Demonstration Research Corporation, he evaluated the

congressionally mandated *Youth Incentive Entitlement Pilot Projects*. He has also been active in program design and implementation. *Reading One-to-One*, the tutoring program he began in 1990, was an important influence on President Clinton's *America Reads* initiative. A Fellow of the American Educational Research Association, he was the 2009-10 President of the Sociological Research Association. He is the lead PI (co-PIs are Burchinal, Duncan and Vandell) on an IES-funded grant to measure the extent to which preschool program impacts vary by prior child language and attention skills.

Co-PI Deborah Lowe VANDELL (Ph.D., Psychology, Boston University, 1977) is Chair and Professor of Education, and holds a joint appointment in the Department of Psychology and Social Behavior. She will devote 7% of her time to the postdoctoral general mentoring and project-specific training activities in each year of the project. Prior to these appointments, she was the Sears Bascom Professor of Education at the University of Wisconsin-Madison. Vandell's research has focused on the effects of developmental contexts (early child care, schools, after-school programs, families, neighborhoods) on children's social, behavioral and academic functioning. She is a Fellow of the American Psychological Association, the American Psychological Society, and the American Educational Research Association. As one of the principal investigators with the NICHD Study of Early Child Care and Youth Development, Vandell conducted an intensive study of the development of 1,300 children from birth through age 15. In other research, Vandell has focused on out-of-school contexts in middle childhood and adolescence. Early in her career, Vandell developed an intervention program designed to foster social interactions among hearing and deaf preschoolers.

Co-PI Marianne BITLER (Ph.D., Economics, MIT, 1998) is Associate Professor of Economics and Faculty Research Associate, National Bureau of Economic Research. She will devote 5% of her time to the project-specific postdoctoral training activities in each year of the project. She brings to the P01's education research agenda her expertise on the effects of cash assistance and food assistance programs on families and children, as well as on the effects of various social policies on fertility-related behaviors. Bitler is a specialized co-editor at *Economic Inquiry* for the topic of health economics. Bitler has diverse experience in methods. She has worked on weighting and imputation of missing data in several large survey data sets. Based in part on that expertise, Bitler recently was asked to serve on a National Academy of Science Panel on Using the ACS to Estimate Children in Poverty for School Breakfast and Lunch Programs. Her recent work in the *American Economic Review* examines the extent to which mean impacts can explain variation in the outcomes of policies, pointing to the need to consider outcomes at various points in a full distribution. Other work develops a statistical test for rank preservation in experimental data or explores the extent to which variation across the distribution is captured by mean comparisons. In addition to these approaches, Bitler has used many other applied econometric techniques including instrumental variables, propensity score matching, quantile regression, and regression discontinuity approaches. Bitler had postdoctoral fellowships at the RAND Corporation, funded by NICHD and NIA. She will draw on her experience as a postdoc and otherwise in helping to train and mentor postdoctoral scholars.

Co-PI Christopher "Kitt" CARPENTER (Ph.D., Economics, University of California, Berkeley, 2002) is Associate Professor of Economics/Public Policy at the Paul Merage School of Business, Research Associate at the National Bureau of Economic Research, and Co-Editor at the *Journal of Policy Analysis and Management*. He will devote 5% of his time to the project-specific postdoctoral training activities in each year of the project. Prior to arriving at UC Irvine, Carpenter spent two years in postdoctoral training at the University of Michigan as part of the Robert Wood Johnson Scholars in Health Policy Research Program. Carpenter has served on multiple Ph.D. and master's thesis committees in economics, demography, business, and social ecology while at UC Irvine as well as on his school's junior faculty mentoring committee dedicated to advising early career scholars. Carpenter is an expert in policy evaluation research, and his 35 published articles and book chapters use many of the quasi-experimental methods described in the NICHD program project. Carpenter was PI on an NIAAA-funded R01 award that evaluated the effects of the minimum drinking age using regression discontinuity methods, and is PI on an American Cancer Society Research Scholar grant evaluating state insurance mandates using triple differences methods. He has served on 12 NIH review panels for various social science and population studies committees and is currently a standing member and chair of NIAAA's health services review panel.

Other UC Irvine faculty with funded time on the P01 program project include *AnneMarie Conley* (Ph.D., Psychology & Education, University of Michigan, 2007), Assistant Professor of Education who researches how students are motivated to learn; *Thurston Domina* (Ph.D., Sociology, City University of New York, 2006), Assistant Professor of Education and Sociology who studies the relationship between educational policy and social inequality; *Candice Odgers* (Ph.D., Psychology, University of Virginia, 2005), Assistant Professor of Psychology who is trained as a developmental and quantitative psychologist, but has also received training in psychiatric genetics and criminology; *Andrew Penner* (Ph.D., Sociology, University of California, Berkeley, 2008), Assistant Professor of Sociology and an expert on gender differences in mathematics achievement who has received awards for his distributional research on this topic; and *Sara Wakefield* (Ph.D., Sociology, University of Minnesota, 2007), Assistant Professor of Criminology, Law and Society and Sociology and an expert on the effects of incarceration on inequality outcomes, especially as they relate to children and the family.

RESOURCES

Founded in 1965, the University of California, Irvine, is one of the youngest of the nation's major research universities. Historically, UC Irvine social sciences were distinguished by a pioneering commitment to high-end modeling in mathematical and behavioral science and by a commitment to interdisciplinary research.

The specific institutional home for the P01 program project is the UC Irvine Department of Education, which was initially established in 1971 as the Office of Teacher Education. Beginning in 2004-05, the University has committed significant resources to strengthen and expand the size and scope of the Department of Education. The number of ladder-rank research faculty has increased from nine filled FTE in 2005 to 21 filled FTE in 2010. Newly added faculty include a Distinguished Professor (Duncan), a Department Chair (Vandell), two additional full professors (including Farkas), two associate professors and eleven assistant professors, all from top-tier programs at institutions like Northwestern, Michigan, Wisconsin, Yale, Penn State, Stanford, Vanderbilt, UCLA, and Princeton. Seventy students were enrolled in the Department's Ph.D. program as of September, 2011. The Department is housed in its own building on the UC Irvine main campus. Assignable square footage is 33,392 and includes seminar and meeting rooms for training activities and temporary office space for visiting co-Investigators and consultants.

UC Irvine offers excellent resources to support the work described in this proposal, and an already established collaboration across diverse departments and disciplines. The Department of Education, the home department for the proposed work, will provide secure individual offices and dedicated secure storage for research records for the postdoctoral fellows. The Department also offers ample conference room and meeting space for regular meetings of the mentors and postdoctoral scholars and for seminars. The Department's conference rooms accommodate groups ranging in size from 8 to 25 people, with additional seating available on the perimeter of the largest room. Meeting and seminar rooms can be arranged for formal presentations, roundtable sessions, and small group work, and are equipped for audio and video presentations and for teleconferencing.

The university's support for collaborative endeavors includes the provision of a state-of-the-art Linux-based computing system that facilitates ready access, secure file storage and backup and abundant computational power. These computing services are provided by the newly developed UC Irvine Social Sciences Computing Cluster, currently provisioned with five 2.4Ghz AMD Opteron 248 dual core RHEL machines used for batch processing. The main server (stats.gse.uci.edu) has 8GB of main memory. The other four systems have 4GB each. The main server houses four 1TB disk drives shared in partitions to each system. The shared disk provides common storage for all user home directories and applications software. A portion of the drives is reserved for nightly backups of all work except secured research. Security provisions in the system are strong. In 2009 the National Longitudinal Study of Adolescent Health staff certified the system for the use of Adolescent Health confidential data files. More information may be found at http://www.gse.uci.edu/research/research_statistics.php.

The Department of Education provides each investigator with a powerful PC and printer, and statistical software packages are available through university-negotiated agreements with vendors. The Department's

Technical Services Group provides support for all Department faculty and research staff computers. The Group offers Apple G4 file and web servers running OS-X 10.4 server systems for both Apple and Windows operating systems, each supporting approximately 1TB of data space and providing for collaborative sharing of files and programs for research.

Electronic and paper-based library resources to support research are available through the university's Jack Langson Library and the Science Library. The Jack Langson Library holds general collections in the humanities, fine and performing arts, social sciences, social ecology, and management, as well as special collections and government documents. It also features a state-of-the-art Multimedia Resources Center, a technology classroom for hands-on research instruction and a Student Communications Room for Internet and e-mail access. The Science Library centralizes the science and technology collections for physical and biological sciences, medicine, computer science, and engineering, and features an Interactive Learning Center and computer laboratory.

Department of Education faculty have been highly successful in competing for grants from federal (NSF, NIH, IES, DOED, DHHS), state (CDE) and local (Orange County) agencies. In 2010, the total volume of funded projects per faculty member was comparable to top-tier Schools of Education, according to *U.S. News and World Report* rankings. The Department's research support services include an eight-person Business Services Office with two full-time contract and grant analysts, and a dedicated Director of Research. On the larger UC Irvine campus, the Office of Research Administration (ORA) is the office of record for extramural proposals and awards supporting research, education and public service activities of UC Irvine faculty, staff and students. Post-award administration is provided primarily by Contracts & Grants Accounting under the direction of the campus Controller. The Contracts & Grants unit is responsible for financial reporting and the administration of extramural funding.