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AERA Annual Meeting: "Power of Education Research for Innovation in Practice and Policy"
Opening Plenary Address
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Pennsylvania Convention Center, Terrace Level – Terrace I

"A Pipeline of Innovation:
Education Research from PK-12 to College"

Thank you, Barbara. I'm grateful for the opportunity to deliver this opening plenary address for the 2014 annual meeting of the American Educational Research Association.

I want to begin by thanking all of you for your efforts to evaluate and improve teaching and learning in our PK-12 schools and colleges across the country. Thomas Jefferson, who founded the University of Virginia two centuries ago, wrote frequently about the empowering effects of education. One particular phrase shows up again and again in his writings: "Knowledge is power."

As faculty, graduate and undergraduate students, and professionals working in research institutes, government agencies, and corporate and non-profit education organizations, you are generating new knowledge through your research and scholarship. The greater the rigor and quality of your science, the greater the power and impact of the knowledge you create, as the influence of your work extends into policy-making, classrooms, and communities.

Thomas Jefferson also believed that education can be an instrument of equity. In an age of monarchy, he wanted to replace what he called the "false aristocracy" of wealth and birth-privilege with "a natural aristocracy" based on "virtue and talent." You advance this mission today, as you work to close achievement gaps in education and to level the playing field for students everywhere.

Students across the country are the ultimate beneficiaries of your work, and the value of education research can be measured by its generative effect in their lives. Thank you for all you do.

The Innovation Pipeline

In education circles, we speak frequently about the "college pipeline," or the "education pipeline." We use these phrases to describe our broad national effort to foster student success at every level of

education, and to build an integrated system of effective PK-12 schools, community colleges, and four-year colleges and universities.

Today I want to discuss another type of pipeline, one that symbolizes the connection between research, the creation of powerful knowledge, and real-world impact. This is the "innovation pipeline" in education research. Think of the innovation pipeline as a mutually reinforcing system of research initiatives that address every aspect of teaching and learning at every level of our schools, from pre-K through college, yielding innovative programs and policies for teachers and students at every one of those levels.

In this innovation pipeline, education researchers are working now on a broad spectrum of issues, such as how to effectively measure teaching quality; how to interest students in STEM fields; how to close the achievement gap between wealthy students and those from low-income families; how to assess the effectiveness of online learning; among other complex issues.

We cannot choose just one or two of the many problems in education to tackle. We need solutions for all of them. So all of these problems need to be connected to the pipeline that carries innovation produced by rigorous research and development.

The innovation pipeline supports, and improves the likelihood of success, at every stage of the education pipeline. And ultimately, the education pipeline will succeed in its purpose of educating individuals and strengthening society only to the extent that the innovation pipeline remains productive. This is the topic I'll discuss further today.

A National Imperative
We should begin by acknowledging that assessment and evidence-based improvement of public education in America is no longer a niche concern for academics and policy-makers, if it ever was. In recent years, the effort to measure and improve education has moved to the forefront of major societal issues we are working to address in this country, along with our perpetual efforts to address poverty, unemployment, and so on. Education has an especially prominent role among these issues, because we also look to education for solutions to those other problems such as poverty and unemployment.

To be fair, we should also acknowledge the underline scale of the issue. American public education is a massive operation: Right now, more than 50 million students are enrolled in about 99,000 elementary and secondary schools in 13,600 public-school districts across the country. Public school systems employ about 3.3 million teachers full-time or full-time-equivalent. About 22 million students are enrolled in college, and about 16 million of them are enrolled in public 2-year or 4-year colleges.[1] When we consider strengthening the capacity of public education to foster student learning and development, it's important to recognize the enormous human scope of the issue we face.

Over the past two decades, many analysts have begun to proclaim that our public K-12 schools — and more recently, our public higher education system — are in crisis. At first it was provocative to say this. Then it became fashionable. Now it seems to be almost accepted as conventional wisdom.

The perceived crisis in education has drawn attention from every sector — government is working on it now, non-profits are working on it, the corporate sector is working on it. One positive result is that the Federal government has boosted its investment in education research and innovation over the last 10 to 15 years.

The U.S. Department of Education's Institute of Education Sciences specifically structured its grant-giving to encourage both the discovery of new ideas and the work that translates into tools that function at scale. As many of you know, IES has established 10 long-term programs related to research topics under its Education Research Grants Program. The topics relate to every facet of how schools promote student learning, including: cognition, education technology, policy, the social contexts of classrooms, and the promotion of an effective workforce of teachers and leaders.[2]

Support from IES, NSF, and even NIH is funding and fostering education research and development at every level. This is the first section in the innovation pipeline — the creation of ideas and early-stage solutions in the form of curricula, assessments, and technology tools that come from university-based R&D funded by these agencies.

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[1] Institute of Education Sciences, National Center for Education Statistics, Fast Facts: http://nces.ed.gov/fastfacts/display.asp?id=372

[2] US Department of Education, Institute of Education Sciences, Funding Opportunities: Education Research Grant Programs: http://ies.ed.gov/funding/ncer_progs.asp

As one result, we have a growing number of what we might call "start-ups" — programs that provide practical solutions, putting tools into teachers' hands and directly into the hands of students. But too many of these solutions are sitting on the shelf, because we do not have enough ways of moving these innovations out to larger applications while preserving their impact. This has created a gap in the innovation pipeline.

Universities are increasingly stepping in to help. For example, a cluster of universities, including the University of Virginia, have begun to facilitate the process of moving start-ups to scale, through partnerships with the private sector, business incubators, and the government. Historically, these sectors have been much more involved with tech-transfer in science-oriented fields, such as biotechnology. The challenge now is to make tech-transfer just as quick and seamless in education. Closing the gap in the education-innovation pipeline will require investment in entities that can contribute to a highly-functioning tech-transfer system.

The Demand for Accountability
The intensifying focus on education has resulted in rising demands for measurement and accountability. As a result, the demand for education R&D to generate knowledge with measurable impact is also rising. The conversation about accountability has dominated the discourse about K-12 education for more than two decades, and more recently higher education has become a target for scrutiny and potential reform.

My most recent research has focused on this issue of measuring productivity in higher education. A few years ago, I served as chair of the National Research Council Panel on Measuring Higher Education Productivity, and I co-authored the report[3] that our panel produced. I will share some of our findings, because they include lessons for educators at all levels, as well as potential areas of study for education researchers.

In recent years, progressive cuts in state and Federal support for public colleges and universities, combined with rising tuition, have brought the question of productivity measurement to the forefront. Measuring productivity makes sense in the context of manufacturing, but it's much harder to define and

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[3] National Research Council. "Improving Measurement of Productivity in Higher Education." Washington, DC: The National Academies Press, 2012: http://www.nap.edu/catalog.php?record_id=13417

quantify productivity when the output — rather than computers or cars — is the education of human beings.

In the NRC report, we tried to outline some responsible steps that universities can take to put productivity measures in place, while acknowledging the extent of the challenge. The panel quickly realized that a number of complexities characterize measurement of higher education production processes.

First, when attempting to measure productivity in education, we realize that not all of the qualities of good teaching and research are easily measured. Some aspects of the educational experience create value, but resist quantification by statistical measures.

Another factor is joint production: various units in colleges and universities generate a number of outputs such as educated and credentialed citizens, research findings, hospital services, and so on. And the labor and other inputs involved cannot always be neatly allocated to these outputs.

Another factor is the high variability in the quality and characteristics of the inputs, such as teachers and students, and the outputs, such as degrees. Yet another factor is the outputs (and inputs) of the production process that are completely non-market in nature.

As in other sectors of the economy, productivity measurement for higher education is a work-in-progress, in terms of its capacity to handle these complexities. Because no single metric can incorporate everything that's important, decision makers must appeal to a range of statistics or indicators when assessing policy options.

Much of the NRC panel's discussion centered on the issue of quality. All of you are familiar with the "Race to the Top" program designed to spur innovation in K-12 education. Our panel members had serious debates about whether quantitative measures of productivity in higher education — if not adjusted to consider quality — would trigger a "race to the bottom," as institutions rushed to improve productivity and competed with each other to get there, without adequate attention to academic quality.

Ultimately, we decided that we could <u>not</u> wait for a reliable output quality index to start measuring productivity. It is worth noting that the United States already has a well-developed quality-assurance system in the form of regional and subject accreditation. Furthermore, tight budgets within our universities have already put a high degree of pressure on quality. So the issue of quality is not being ignored, even if we cannot consistently measure it through productivity metrics.

In addition to implementing efficient business practices, our universities need to review existing academic programs from the perspectives of quality and cost-effectiveness, and when appropriate, adopt new instructional methods, such as cyber-learning and hybrid courses that blend instructional technology with traditional classroom teaching. Of course, this will require more education research to ensure that these new methods produce quality outcomes.

The demand for assessment in PK-12, and the demand for assessment, productivity, and return-on-investment in college education is ultimately a measurement of the impact of education. What is the impact of the knowledge that a student acquires in PK-12? What is the impact and ultimate value of a college degree? The answers to these questions begin with the work <u>you</u> do as education researchers. Rigorous <u>research</u> becomes the foundation for <u>teaching</u> that delivers impact for our students.

<u>A New Age of Innovation</u>

All of the conversation about "crisis" in public education, and all of the demands for accountability from PK through the college level, while seeming burdensome at times, have set the stage for a period of urgent innovation.

As politician Rahm Emmanuel once famously said, "You never want a serious crisis go to waste."[4] He said these words in November 2008, in the darkest days of the Great Recession. And he meant that a crisis creates a sense of urgency, and the urgency gives you the opportunity to do things you would not have been able to do before — to challenge old assumptions; to reassess conventional ways of doing things; to introduce new methods and ideas. And as a result of the rising demand for accountability that has accompanied the crisis, we have been given some measures — albeit crude measures, in some cases — that allow us to test the impact of novel approaches.

"In Crisis, Opportunity for Obama," Seib, G., Wall Street Journal, Nov. 21, 2008: http://online.wsj.com/news/articles/SB122721278056345271

So let me share a few examples of education research that is leading to innovative programs and practices. As president of UVa, I'm naturally most familiar with the education research being conducted in our own School of Education. In addition to being a leader in teacher education, UVa's Curry School of Education is producing some of the nation's best evidence-based innovation. Some of the programs focus on improving teachers; some focus on student learning and behavior; others focus on policy reform. Some focus on PK-12; while others focus on the college level. Together, they are connective pieces in the innovation pipeline.

Helping Children Read

Research conducted by UVa Professor of Reading Education Marcia Invernizzi [**in-vur-NIZ-ee**] resulted in the creation of Phonological Awareness Literacy Screening, known as PALS. This is an assessment tool for students' early literacy skills that provides customized learning experiences for students who are at risk of becoming poor readers.

Developed in 1997 with funding from the Virginia Department of Education, PALS consists of three instruments: PALS Pre-K for preschoolers; PALS-K for kindergartners; and PALS 1-3 for first, second, and third grade. In addition to these instruments, PALS Español K and PALS Español 1-3 are being developed in Spanish through another grant from the Institute of Education Sciences. PALS Español will help teachers distinguish between Spanish-speaking students who simply have delays in English language development and those who may have real reading difficulties.

As I mentioned earlier, great teaching tools do no good if the tech-transfer process breaks down and the tools fail to reach teachers. Working with colleagues, Professor Invernizzi founded a company, PALS Marketplace, to distribute PALS assessments and tools beyond Virginia. Today, PALS is used in schools in all 50 states in the U.S.

PALS was developed with state support and pilot funds, transferred into an R&D enterprise for testing and validation, and then moved to scale very quickly because of regulatory demands coming from states that had begun requiring early literacy assessments.

The researchers now hope to expand the PALS toolbox of assessments and teaching instruments to create seamless literacy screening and remediation at every level through eighth grade.

Preparing Students for High-Tech Jobs

In an example of collaborative innovation, faculty researchers from UVa's School of Education and our School of Engineering have partnered with local schools in Charlottesville to establish the first U.S. Laboratory School for Advanced Manufacturing.

Through the Lab School, Engineering and Education faculty and students work with school teachers to help students learn science using the latest 2D and 3D manufacturing technologies. This partnership provides students with advanced technical skills and training for high-tech jobs. And it helps our students and faculty in their professional training and research. The first Lab School opened at one of our local middle schools last fall, and the team will soon open additional Lab Schools at other middle and high schools in the area.

The Lab School collaboration grew from seed funding from NSF and the Commonwealth of Virginia. This is an example of how government, universities, and K-12 school systems can work together in ways that are mutually beneficial, and that meet a national need to prepare more students for high-tech jobs. The Lab School shows how we can use innovation to create a prototype. The challenge now is to test and replicate the prototype, and then work on bringing it to scale.

Building Better Teachers

About a decade ago, UVa Professor of Education Robert Pianta began to see the need for innovation in the assessment of early-childhood program quality. After a series of large longitudinal studies in early-childhood education, he established the Center for Advanced Study of Teaching & Learning, or CASTL.

Since the Center's inception in 2006, Professor Pianta, who now serves as dean of the Curry School, has worked with his team to develop multiple tools for the observation and assessment of teacher-student interactions; these tools are designed for scale-up and extension across grades and subject areas. The goal of CASTL is ambitious — to improve student learning at every level of education, in every subject, by building better teachers based on the scientific study of effective teaching.

As with the PALS program, the launch of CASTL coincided with increasing demands from state and federal regulatory infrastructure, including accountability measures built into the Head Start program.

As a result, a set of assessment tools created at CASTL — the Classroom Assessment Scoring System, or CLASS — has been written into state and national regulations, including use in every Head Start classroom in the United States and, increasingly, world-wide. Like the PALS program, CASTL is another example of innovation, supported by rigorous R&D, and then moved quickly to scale.

CASTL methods developed for K-12 students are now being used in CASTL-HE, a version of the program customized for higher education, under the direction of UVa Professor Karen Inkelas [**EEN-kuh-lus**]. In the past, much of the research on college teaching and learning has fallen into one of two categories. One category, concerned with faculty development, has aimed to develop innovations in pedagogy to improve teaching. The other category, concerned with institutional quality assurance, has focused on student learning outcomes. Although these two areas are clearly related, the respective areas of research have often remained in their silos. CASTL-HE brings the two categories together by connecting the study of instructional practice to student-learning outcomes.

Improving Student Behavior

Research has shown that school-based programs to promote good behavior can have a positive effect in curbing school violence, bullying, and other behavioral issues among students. Catherine Bradshaw, a Professor and Associate Dean in the Curry School, has collaborated with colleagues on federally supported trials of school-based prevention programs, including the widely-used Positive Behavioral Interventions and Supports, or PBIS.[5]

A PBIS program typically has three tiers. The first tier is a school-wide effort to teach all students about the behaviors that are expected of them. The other two tiers are directed toward students who have specific behavioral problems.

In a study[6] that was published in 2012, Bradshaw's research team looked at the effects of the basic school-wide approach. She and her colleagues followed 37 Maryland elementary schools that were randomly assigned to start, or not start, the PBIS program. Over four years, teachers filled out a checklist on classroom behavior for each of their students.

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[5] OSEP Technical Assistance Center on Effective Schoolwide Interventions, Positive Behavioral Interventions and Supports: http://www.pbis.org/

[6] "Study Gives School Behavior Program a Good Grade," Norton, A., Reuters: http://www.reuters.com/article/2012/10/16/us-behavior-program-idUSBRE89F17W20121016

The researchers found that, after four years, teachers at schools using the PBIS program reported less problem behavior, such as bullying. They also reported more positive behaviors among their students, such as sharing and cooperating. In other words, the study showed that behavioral interventions not only reduce bad behaviors, they can increase good behavior. The PBIS program is now used in more than 20,000 schools around the country, and we know it works because we have the evidence to back it up.

Preventing Youth Violence

Instances of school violence, including shootings in schools by students, have become a painfully common headline in recent years. Dewey Cornell, a UVa Professor of Education and clinical psychologist, is working with a team of faculty and students conducting research on effective methods and policies for combating youth violence and promoting school safety.

Their work produced the Virginia Student Threat Assessment Guidelines[7], a set of strategies for administrators to use in responding to a threat of student violence. The guidelines prepare school-based teams to evaluate student threats, and quickly resolve minor threats while taking appropriate action in response to more serious threats.

More than 1,000 Virginia schools and 2,700 schools in 14 states are now using the Virginia Threat Assessment Guidelines. Here again, we see the pipeline at work: rigorous R&D leading to innovation; innovation leading to early-stage impact; and early-stage results moving to scale.

Promoting Positive Youth Development

UVa's Curry School is also home to Youth-Nex — as in "youth-nexus" — a multi-disciplinary center in which faculty work together to promote healthy youth development. The program focuses on a wide variety of issues affecting youth development, including supportive relationships, health management, and civic engagement.

The 30-some faculty members who are involved in Youth-Nex focus on competencies in young people, rather than youth problems. In the process, they have found that teenagers are much less troubled,

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[7] Curry School of Education, Youth Violence Project: http://curry.virginia.edu/research/projects/threat-assessment

angst-ridden, and problem-prone than many people seem to believe. A Youth-Nex study on school climate in 423 middle schools in Virginia revealed that students feel overwhelmingly positive about their teachers and their schools: almost 80% said they liked their school.

Research revealed that teenagers who were given serious responsibilities — tutoring younger kids or helping out in a soup kitchen, for example — had higher test scores and fewer behavioral problems than those with no such responsibilities. Dropout and pregnancy rates among such teens also dropped by at least half.

The research shows that most teenagers really <u>want</u> to be good and to do good; they just need a little motivation and guidance. Now we can use that evidence to build programs that support healthy youth development.

Youth-Nex has played a critical tech-transfer role, translating new findings from the science of adolescent development into the next stage of application and R&D. And the program moves R&D to scale by getting research results out into the mainstream of public awareness and by training the next generation of researchers in this field.

Opening Access to Higher Education

With tuition costs rising faster than the rate of inflation in colleges and universities across the country, keeping college affordable has become another top educational issue, especially for families in the lower-income brackets.

Unfortunately, we know that students from disadvantaged backgrounds often face barriers to college enrollment. The Federal government's "Middle Class Task Force" examined questions related to the struggles of middle- and low-income families, and issued a report titled "Barriers to Higher Education."[8] Here are some of the key findings:

- Family income is a major determinant of college enrollment. While 78% of high school graduates from high-income families enrolled in college, only 63% and 55% enrolled from middle- and low-income families, respectively.

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[8] "White House Task Force on Middle Class Families Staff Report: Barriers to Higher Education." http://www.whitehouse.gov/assets/documents/MCTF_staff_report_barriers_to_college_FINAL.pdf

- In addition to <u>income</u> barriers, <u>information</u> barriers keep many students from less-affluent backgrounds out of college. This is because they lack the so-called "road maps" that could help them find their way to college. For example, low- and middle-income students frequently eliminate colleges from consideration based solely on sticker-price cost, even before researching financial-aid packages.

Later in this meeting, AERA President Barbara Schneider will speak about the so-called "college mismatch problem"— the issue of low-income and minority students who choose to enroll in colleges that are less selective than the ones for which they qualify based on their grades and test scores.

Research by UVa faculty members Sarah Turner and Ben Castleman is helping us understand how to effectively connect with lower-income students to break down information barriers. One line of Professor Turner's research examines the reasons that high-achieving, low-income teens choose not to enroll in the nation's top colleges, and Professor Castleman's research has focused on the ways we can support prospective first-generation college students throughout the application process. Together, their research has provided a dual approach to helping talented students enroll.

A study[9] by Professor Turner and Stanford Professor Caroline Hoxby examined the effects of providing low-income, high-achieving high school seniors with information including college application guidance, information about the costs of college, and a fee waiver for college applications. The authors reported that this intervention increased the percentage of students who applied to a selective institution (from 55% to 67%); increased the number who were admitted to a selective institution (from 30% to 39%); and increased the number who enrolled in a selective institution (from 29% to 34%), relative to a comparison group.

Professor Castleman, recognizing that information barriers can keep some low-income students from following through on their plans to enroll in college, conducted a study[10] of low-cost interventions. A

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[9] "Hoxby, C., & Turner, S. (2013). "Expanding college opportunities for high-achieving, low income students." Stanford, CA: Stanford Institute for Economic Policy Research. http://ies.ed.gov/ncee/wwc/SingleStudyReview.aspx?sid=20005

[10] "Stemming the Tide of Summer Melt: An Experimental Study of the Effects of Post-High School Summer Intervention on Low-Income Students' College Enrollment" (2012), Journal of Research on Educational

sample of high school students received text messages during the summer after graduation to remind them of major tasks that need to be completed for enrollment, and to offer peer mentoring. The results showed that this summer counseling led to substantial improvements in both the rate and quality of college enrollment. Once again, this is the R&D-to-innovation-to-scale pipeline at work.

Partially based on this faculty research, we are developing a new admission outreach strategy at UVa. As part of the strategy, we plan to identify high-achieving students who are qualified for admission to UVa and send them personalized messages that explain the realities of college cost, need-based financial aid, and net price. We will continue to provide practical information and individualized guidance throughout the application and financial aid process. As another facet of the strategy, we are strengthening our partnerships with high schools in low-income areas and with local and regional college-access organizations that work closely with at-risk students. We are also providing opportunities for students to visit UVa for free, and arranging for these students to meet with peer and faculty mentors.

Considering the financial and personal benefits of college education for individuals, and considering the greater good that college-educated citizens contribute to society, we have an obligation to ensure that a college education remains available and affordable for people from <u>all</u> socioeconomic backgrounds. This will help us create the "aristocracy of talent" that Thomas Jefferson envisioned. Education researchers are helping us build that new aristocracy.

<u>Closing – Completing the Pipeline</u>

The innovative programs that I've talked about today were developed from research at UVa, but innovation-producing research is happening in many other schools and research institutes across the country.

At UVa, we are still not completely successful at fostering the transfer of innovative solutions so they can have a broad impact at scale. We do a better job of tech-transfer in biotechnology and engineering, mostly because we have been doing it for much longer in those fields. In education, we are in the process of <u>inventing</u> the institutional supports that will enable the transfer of solutions. And we have come to realize that this requires intense focus and a specialized set of supports. Until we fully succeed in this effort, we are partially responsible for gaps in the innovation pipeline.

Effectiveness, Castelman, B., et. al.,:
http://www.tandfonline.com/doi/abs/10.1080/19345747.2011.618214?journalCode=uree20&

If all of us are committed to developing innovative programs and policies for education, we need to marshal <u>all</u> of our forces and deploy <u>all</u> methodologies that are available to us — qualitative as well as quantitative research; the best randomized controlled trials as well as the best ethnographies, case studies, and so on.

The challenges in education are many, and of many different kinds, therefore many different kinds of research are required. To limit ourselves to one method would be a fundamentally reductionist approach.
Every form of rigorous research is constructive; every bit of evidence helps; every incremental improvement at every level of education is a step in the right direction.

This is the constant, iterative process of innovation — the pipeline of innovation that you are building.

Thank you for your commitment to this important work.