



SALZBURG
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SESSION REPORT

Untapped Talent: Can Better Testing and Data Accelerate Creativity in Learning and Societies?

OPPORTUNITY
FOR
TESTING

- 1) Gives indication of preparedness
- 2) Able to provide support
- 3) Collect data

EDUCATION FOR TOMORROW'S WORLD

This Salzburg Global Seminar session was held in collaboration with the following organizations:

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The RSA

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Session 558

Salzburg, December 12 to 17, 2015

Untapped Talent: Can Better Testing and Data Accelerate Creativity in Learning and Societies?

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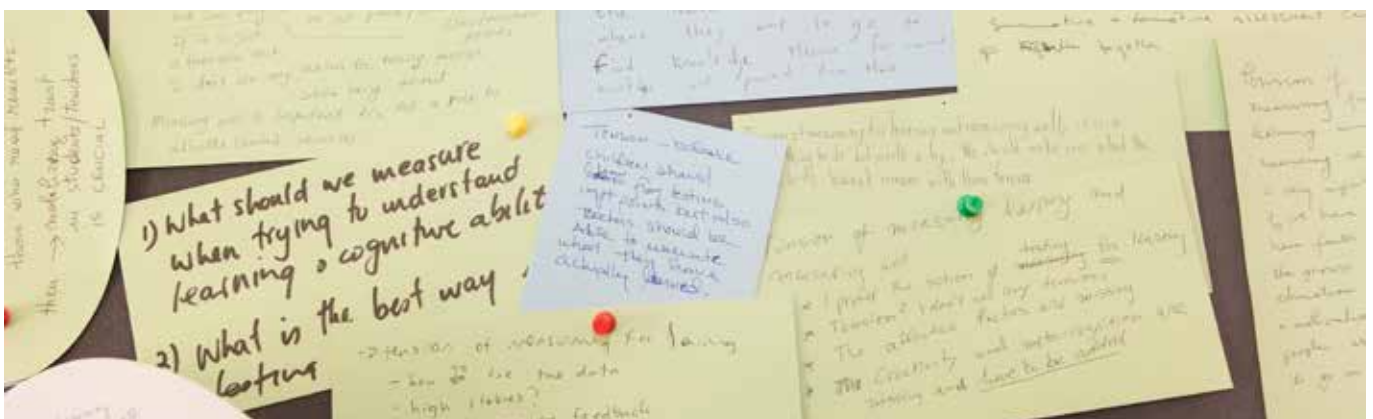
Introduction

New technologies are taking us faster towards a post-industrial world in which the service sector will dominate the manufacturing sector, even in emerging and developing economies. Across the globe, young people, in particular, urgently need skills and support networks to realize their potential and forge individualized pathways for learning and work. Their success in navigating their education and their subsequent participation in the workforce are critical to both their own futures and their countries' future.

As we look ahead, two important issues arise. First, current teaching systems and metrics are being called into question. Do our current systems and metrics identify students' skills and abilities? Second, special attention needs to be paid to overlooked talent, especially among marginalized groups. Are we exploring how best to identify and nurture this otherwise wasted potential?

With the advent of "big data" and increased computational power, now is the time to think in less static and more dynamic ways about the skills and abilities we want our current students and future workforce to have and how to assess, evaluate and harness these skills to transform labor and employment and include those who are at risk of marginalization. To identify talent and foster success across our societies, assessment science and practice, along with predictive analytics, will need to become drivers for change.

Recognizing the importance of this emerging opportunity, Salzburg Global Seminar, in collaboration with **ETS** (Education Testing Service), the **Inter-American Development Bank** and the US-based **National Science Foundation**, and in association with the UK's **RSA** (Royal Society for the encouragement of Arts, Manufactures and Commerce), convened the session *Untapped Talent: Can Better Testing and Data Accelerate Creativity in Learning and Societies?* (December 12 to 17, 2015).





1. Michael Nettles

2. Soledad Bos and Catherine Millett

3. Clare Shine

4. Paul Jansen

Education and labor issues have featured as topics for discussion in Salzburg Global’s program portfolio since the 1950s. As a global assessment company, ETS works with educators, policymakers and business leaders worldwide on a range of educational and assessment issues affecting learners from as early as pre-school, to learners who are about to enter the workforce. Throughout this work, ETS strives to provide innovative and meaningful measurement solutions that improve teaching and learning, expand educational opportunities (giving special attention to the plight of disadvantaged and under-served populations worldwide), and inform policy. The December 2015 session in Salzburg was the continuation of a long, ongoing partnership between Salzburg Global Seminar and ETS; previous related sessions together have covered issues of childhood development and education, marginalized students, and education and social mobility gaps.

Alongside ETS, partners on the session included the US-based National Science Foundation (NSF) and the Inter-American Development Bank (IDB), the latter of which brought a delegation from Argentina, Chile, Mexico, Uruguay and the US to share the innovations in Latin America and the Caribbean, as well as learn from other regions. The session was also held in association with the UK’s Royal Society of Arts (RSA).

The five-day program focused on the current gap between standardized assessments and the need to educate and measure for “21st century skills” of creativity, critical thinking, communication and collaboration, from early childhood through formal education and beyond.

The gathered cohort of 41 Salzburg Global Fellows, including experts in education, policy, learning science, and neuroscience; education activists and advocates; and representatives from private enterprises and international organizations, from across 18 different education systems, explored the power of data of all sorts – data exhaust and predictive analytics as well as educational testing – to reveal new pathways for people to develop these skills, and access work in a transforming labor market, with particular attention paid to marginalized groups at risk of exclusion across generations.

Through a variety of panel-led plenary discussions and in-depth group work, the session addressed the growing demand for interdisciplinary practice and education, which depends on a mix of divergent and convergent thinking at the heart of creativity, culminating in a collaborative *Salzburg Statement on Realizing Human Potential through Better Use of Assessment and Data in Education*.

“Humans are gifted with so many talents and our societies in the future demand that we unlock and acknowledge all those talents that are available. The current ways of testing are simply not capturing the full picture. The innovative use of data and development of new testing systems should support mapping and unlocking all human talents available!”

Paul Jansen,
Program Director,
Salzburg Global Seminar



The Potential for Data in Untapping Talent

SPEAKERS:

Clare Shine

Vice President & Chief Program Officer, Salzburg Global Seminar

Michael Nettles

Senior Vice President, ETS, USA

Catherine Millett

Senior Research Scientist, ETS, USA

Nora Newcombe

Professor of Psychology, Temple University, USA

Soledad Bos

Education Senior Specialist, Inter-American Development Bank, USA

Can better testing and data accelerate creativity in learning and societies? “Yes it can!” was the resounding answer from session chair, Michael Nettles, at the opening of the Salzburg Global Seminar program *Untapped Talent: Can Better Testing and Data Accelerate Creativity in Learning and Societies?*

As the Senior Vice President of ETS – best known for its design, administration, and scoring of assessments like the GRE® and TOEFL® – it is unsurprising that **Michael Nettles** is an advocate for better testing, but it was his excitement about the potential for big data that he wished to share with participants in Salzburg.

Big data is opening up numerous, well-paying job opportunities in the US across diverse sectors, from commerce to medicine to education – but these openings are unlikely to be filled.

“The fact is, we do not yet have the capabilities, or even the know-how, required to achieve our vision for all these data,” lamented Nettles. “We have barely begun training the people to do the work. In the United States, there are more than half a million unfilled jobs in the IT sector... By 2020 there will be 1.4 million computer specialist job openings, but our [US] universities are unlikely to produce enough qualified graduates to fill even 30 percent of them,” he added.

Why is this? And how can better assessments and data usage fill this talent gap?

One way in which data can help, argued Nettles, is by feeding algorithms that can “replace race, class-, and culture-based criteria with demographically blind data-based criteria that remove subjective human evaluators.” This would help the tech sector become more diverse and end the perception that you have to be white, male, and well-connected to get ahead in the industry.

“Every keystroke on a computer can be captured, cataloged, analyzed, and used. Whether it should be captured, cataloged, analyzed, and used is a different, but equally urgent, question. ”



Michael Nettles
Senior Vice President, ETS, USA



Clare Shine, Nora Newcombe,
Soledad Bos and Catherine Millett

New forms of assessment, such as games, can help identify valuable STEM (Science, Technology, Engineering and Math) skills in those who typically struggle in current tests. By generating “fine-grained data” – such as “document edits, gaming collaborations, responses on intelligent tutoring systems, even eye and body movements recorded by body sensors” – which is then immediately available for review, “the learning process itself can become the best source of evidence of learning, replacing the test,” remarked Nettles.

This could have potentially huge advantages for those students who currently underperform in traditional testing environments, enabling their so-far “untapped talent” to be fully realized. There would also, of course, be much larger implications for test designers, administrators, and teachers. Who would collect this data? As Nettles’ colleague **Catherine Millett** pointed out in her opening remarks, teachers may have limited knowledge, capacity or interest in collecting such data – especially if it gets in the way of simply teaching. “How do we identify the ‘right’ big data?” she asked.

“Every keystroke on a computer can be captured, cataloged, analyzed, and used. Whether it should be captured, cataloged, analyzed, and used is a different, but equally urgent, question,” added Nettles. Further consideration also needs to be taken of the cost of employing such technology solutions; socioeconomic gaps could be widened rather than narrowed. “Entrusting so much of our education, careers and personal lives to algorithms and analytics also runs the risk of replacing our humanness with a blind faith in data processes,” warned Nettles.

Nora Newcombe, a psychology professor at Temple University in Philadelphia, PA, USA, whose work is funded by NSF, encouraged participants to consider the “science of learning” and to avoid making assumptions about how innate creativity actually is and how simply it can be assessed.

“Talent”

While in Salzburg, some session participants took umbrage with the term “talent” and expressed critical views against the notions of innate talent and biologically-determined intelligence. As one Fellow declared: “We do not argue that there is something innate in terms of IQ and the SAT [the standardized test used for US college admissions],” with another reiterating: “Intelligence is not innate.” The Myths of Creativity by David Burkus, referenced during the session, suggests that human creativity develops primarily in interaction with a particular environment. Contemporary neuroscience and learning sciences, having confirmed the remarkable plasticity of human brain, seem to suggest that the question is not so much about identifying particular innate human

talents, but building those talents on the incredible potential each unique individual represents. Here the issue is not so much about the individual differences than the resources individuals from different socio-economic backgrounds have to develop their talents, skills and competencies. In the world of limited resources, allocation of these resources is a serious issue and a lot remains to be done.

For the purposes of this report, the term “talent” continues to be used to express the underleveraged and underexplored skills and abilities we seek to better identify and nurture.



“What is creativity?”

“Creativity is not a trait in a person that can be assessed or tapped. Creativity is an occurrence that can happen when children or adults are prepared with knowledge and in a setting in which they are allowed to explore the parameters of a problem in a way that it has not been previously explored. Some will blossom in that situation more than others, but that does not mean that they have a trait of creativity.”

Nora Newcombe, Psychology Professor,
Temple University, USA

“The definition I use is a world-used definition, which is ‘imaginative activity fashioned to produce outcomes that are judged by observers to be original and of value.’ ...In terms of my work, RSA’s work, it’s very much focused on closing the creativity gap. We see those gaps in three ways. First, the gaps between learners who have the opportunities and capacities to develop their creativity, and those learners who don’t. Secondly, the gap between the creative potential of teachers and whether the school systems support or stifle that creativity. Finally, the gap between some systems and institutions – schools in our case – that nurture or squash the creativity of learners and teachers.”

Joe Hallgarten, Director of Education, Royal
Society of Arts (RSA), UK

“Creativity is thinking outside of the box. From my economics mindset, creativity is not part of what we do everyday, so when I think outside of my little model, I am being creative.”

Soledad Bas, Education Senior Specialist, Inter-
American Development Bank, USA

“I really like [E. Paul] Torrance’s way of assessing creativity, which is fluency, flexibility, originality and elaboration. I really believe in the potential of enhancing creativity in schools and in students – K-12 and higher education. So I don’t think it’s only an innate talent that either one is born with or not, I really believe in being able to enhance or to accelerate creativity, but we need to work on it.”

Zemira Mevarech, President, David Yellin
Academic College of Education, Israel



You can read more from the session
in our daily newsletters available to
download as PDFs online:

www.salzburgglobal.org/go/558



Nora Newcombe



Joe Hallgarten



Soledad Bas



Zemira Mevarech

“Structural education reforms, combined with a push by educational stakeholders for more transparency and evidence-based policies, have motivated governments across Latin America to invest resources in the development of monitoring and evaluation systems. However, there continues to be wide variation in the quantity and quality of data across countries in the region.”



Gregory Elacqua,
Principal Economist, Education
Division, Inter-American
Development Bank, USA

Global Innovations on Testing and Data

With participants – hereby known as Salzburg Global Fellows – attending from across the globe, examining how different countries are tackling the related issues of assessments, data gathering, and nurturing creativity and “talent” was a natural start to the first full day of the *Untapped Talent* session.

Through a series of panels, presentations and interviews, best practices from the various parts of the world in innovation in education, transformation of systems, and cross-sector collaborations were shared. Time was also taken to consider and learn from innovations that were not successful. Discussions in Salzburg illustrated that significant differences exist among countries and regions in their capacity to exploit the potential offered by the recent advances in data collection and analysis, assessment and testing, and learning and neuroscience. Not all countries are in a position to use effectively the newly-opened opportunities for the development of their educational systems and societies, and even those that do have robust, well-funded education sectors still face roadblocks to adopting these new methods of assessment and evaluation.

Latin America

MODERATOR:

Gregory Elacqua

*Principal Economist, Education Division,
Inter-American Development Bank, USA*

SPEAKERS:

Hernán Hochschild Ovalle

Executive Director, Elige Educar, Chile

Soledad Bos

*Education Senior Specialist,
Inter-American Development Bank, USA*

Fellows started in Latin America, a region that has enjoyed significant economic growth in the past 25 years, coupled with rising education spending and standards. Significant improvements are being made, but this is happening at different rates in different countries. Some countries have well-established public school systems with regular testing and comparable results, while others are only just starting to do this and remain to be convinced of the benefits of regular assessments and data collection.

However, even in countries that do conduct regular testing and data collection, such as Chile and Mexico, their best students’ results lag behind even the poorest students in China, according to PISA data. The lowest

performing schools are making the greatest improvements, but the highest performing schools are stagnant, leaving the region's school leavers and graduates unprepared to enter the global economy.

Encouraging regular and comparable assessment, and the collection of basic data such as numbers of schools, teachers and pupils, are just two approaches the Inter-American Development Bank (IDB) has taken to try to improve the region's education outcomes. If policymakers do not even know how many students they have living in a given area, how can they distribute adequate resources? If schools test one age group one year but a different group the next, how can they make comparisons and track progress year-on-year? More countries are starting to adopt practices that address these concerns.

Another key area in need of reform in the region is teaching. Low admittance standards to teacher training courses coupled with low esteem of the profession, often make it hard to attract the best students to teaching. The region is facing a stark contradiction: everyone wants to improve education but no one wants to be teachers. Increasing pay is not enough. Working conditions, mindsets and attitudes towards the profession must also be improved. Generating evidence of good teaching practice and learning outcomes is needed to support such changes.

IADB-supported Latin American delegation: Harvey Sánchez Restrepo, Andrés Peri, Soledad Bos, Mauricio Farías Arenas, Hernán Hoschild Ovalle and Gregory Elacqua



“I think one interesting area for innovation in getting students to enter into science and technology fields is to understand how to widen pathways for students to enter those fields from outside fields...Many universities [in the USA] require students to take, say, two semesters of science, two semesters of math by the time they graduate, but they don’t specify when, and so you might be able to take a math class in college and that might foster your interest in the field, but not sufficient enough to create pathway... Graduation requirements might be better suited as early college requirements.”



David Miller,
Psychology PhD student & NSF
Graduate Research Fellow,
Northwestern University, USA

North America and Europe

MODERATOR:

Susan Levine

Professor, University of Chicago, USA

SPEAKERS:

Zemira Mevarech

President, David Yellin Academic College of Education, Israel

Abby Loebenberg

Honors Faculty Fellow, Arizona State University, USA

David Miller

*Psychology Ph.D. student & NSF Graduate Research Fellow,
Northwestern University, USA*

In a panel on North America, the issue of “math anxiety” – a trait shared by many teachers, students and parents alike – was raised. Of all US college students, those studying to be elementary school teachers profess to have the highest level of “math anxiety,” questioning their math skills or simply declaring that they “are not a math person.” If teachers lack confidence in their math skills, they run the risk of passing on this math anxiety to their students. This may be compounded if students also sense math anxiety from their parents.

Two solutions to tackle math anxiety and to untap students’ potentially unexplored talents in STEM (science, technology, engineering and math) areas were proposed by panelists speaking on North America and Europe: one – enable more STEM-learning at college level, and two – introduce more meta-cognitive and meta-creative thinking into the learning process at all levels of education.



Zemira Mevarech (right) and Heejin Park

The US education system, especially at high school and college level, is already broader and less specialized than the curriculum offered in much of Europe, where students often specialize in a field or specific subjects from the age of 14. Many US colleges, through the use of distribution requirements, mandate that students of all majors complete math and science courses. The timing of when these courses are taken may be important as the earlier these course requirements are taken, the greater the opportunity the student has to discover their talent in this field and thus switch majors. Much of the debate surrounding participating in STEM study focuses on majoring in the field, but those leaving the STEM fields should not be seen as a failure – they can bring valuable knowledge and skills to other fields, such as education, policy, and law.

Instilling meta-cognitive and metacreative skills in all students can help with their problem reasoning and enhance their critical thinking and creativity, encouraging such questions as: What is the problem about? How is the problem similar to other problems I've already solved? What strategies might work to solve the problem? Does this solution make sense? Could it have been done another way? Am I stuck? Why? It is such new pedagogy that will accelerate creativity and learning, not testing, argued one Fellow.

In the UK, as session observer **Kaye Wiggans** of the publication *TES* reported, the UK government is conversely introducing “a series of reforms in England that will increase the use of linear, high-stakes academic testing and compel almost all pupils to focus on academic subjects” rather than more creative or vocational subjects.

Unlike its southern neighbors, the US already collects a lot of assessment data from its students, but the use of this can be controversial. Some colleges use the “blunt instrument” (as one Fellow called it) of SAT scores and GPAs to calculate students' eligibility for college funding, for example. As **Maghan Keita** of Villanova University argued: “Data has no meaning without context and it is the context that gives it validity and then allows us to think about how it can be applied.” However, this data often does not highlight the more “creatively disruptive” students, whereas their essays, teachers' recommendation letters and in-person interviews would likely offer greater insight. If we persist on using quantifiable data, how can we assess and quantify creativity?

“Data has no meaning without context and it is the context that gives it validity and then allows us to think about how it can be applied.”



Maghan Keita,
Director, Institute for Global
Interdisciplinary Studies,
Villanova University, USA



Susan Levine



Abby Loebenberg

Africa and Asia

MODERATOR:

James Anyan

Ph.D. candidate, University of Helsinki, Finland

SPEAKERS:

Mary Goretti Nakabugo *Country Manager, Twaweza East Africa, Uganda*

Sandeep Pandey

Social Activist, Independent, India

Yasmine Ibrahim

*Senior Officer Recruitment and Fellowships, The American University
Cairo, Egypt*

“Education systems in Africa are largely examination-oriented, focusing more on testing memorization and less on assessing creativity. Can better testing and data in these contexts accelerate learning? Yes! If the examinations and tests are improved to focus on assessing and rewarding creativity, teachers and children will also engage more in creative activities. What gets measured and rewarded, gets done.”



Mary Goretti Nakabugo,
Country Manager, Twaweza East
Africa, Uganda

The question of measuring creativity is also asked in Africa, where, as **Mary Goretti Nakabugo** explained, much of the education system was inherited from former colonial powers and has been aimed at training clerical staff with little focus on creativity. Although access to education across the continent has improved, the quality of the education offered is poor in many countries. Approximately 250 million children worldwide cannot read, write or count even after four years of primary education – the majority of these children are in Sub-Saharan Africa. Creative or critical thinking is not encouraged, with “teaching to the test” prevalent. Children are taught only to reproduce that on which they are to be tested – but this could provide a window of opportunity: if children were to be tested on creativity, they would be encouraged to be more creative. However, much like other regions Nakabugo lamented, there is still little understanding at this stage of exactly how to assess such creativity.

Assessment is considered important because without testing, it is not known how well the system is functioning, schools and governments cannot be held to account, people are not empowered, and ultimately education will not be improved, lamented one Fellow. A shift should be made from focusing on formal schooling to supporting learning as a considerably broader goal.

In India, there is “The Right of Children to Free and Compulsory Education Act, 2009” in place; however, education is in fact neither free nor compulsory: 50% percent of children leave education before completing eighth grade and 25% do not even enter school. Of the 10% of school graduates who go on to higher education, the majority remained unemployed and unemployable after graduation because of the low quality and limited relevance of higher education studies.

The Indian assessment system is tarnished by the poor regard the country has for the examination system. Although tests and exams are widely and regularly taken by those able to attend school, the examination system is

widely perceived by the public as bureaucratic and not entirely meaningful, and as such, tests and exams are also widely and regularly cheated on. Students, parents, teachers, and even politicians are involved in large-scale cheating practices, not only discrediting the exam system, but also undermining the whole education system, and ultimately the future of the society as a whole. Cheating is so prevalent, lamented one Fellow, that “the next generation of teachers won’t even be qualified enough to help the next generation of students cheat!”

One effort to move away from cheating and build greater trust in assessment results has been to trial a system of a “non-competitive one-to-one interactive evaluation process.” Students meet with their professor for a one-on-one discussion on their understanding of a given subject. Depending on their understanding, this appointment takes between 15 to 60 minutes. This might seem time consuming but it cuts down on the professor’s time spent in setting and marking exams – and is impossible to cheat (though it is still open to corruption).

The need for greater trust was one of the motivations for the innovation of community-led schools in post-revolution Egypt. Poor education, high unemployment, and political interference have all led to a low level of trust in the public education system in the country. Community-led schools are accredited by the Ministry of Education but the curriculum is set by local parents, teachers and community leaders, leading to a sense of ownership – and greater trust. The curriculum also covers more than literacy and numeracy, with greater focus on “life skills,” allowing for greater creativity, meeting the communities’ needs for skills as well as supporting the growth of social capital.



“I think in education learning is more important and sometimes the examinations, which are based on the idea of a competition, do not reflect the true learning. So, I think we should just do-away with the competition-based examinations and have an evaluation process which is non-competitive, interactive, one-to-one, so that you can actually test the learning, and I have been doing this in India and the results are quite encouraging, the students like it and they also said there is more learning.”



Sandeep Pandey,
Social Activist, India

Yasmine Ibrahim and
James Anyan

“The first [opportunity with online testing] is the possibility of setting a test for the whole country (Uruguay) and being able to reach every school and every kid. So we estimated the amount of paper that would imply that and that would be tons of paper – many trees are saved because we’re doing this... The second thing is to have results in real time so we can inform teachers on the next lesson they have to do given what happened in the test. Those things in the past implied four months of work, now we’re doing real time results...”



Andrés Peri

The Digital Option

That we now have at our finger tips more data about students than we ever had before is indisputable, but how can we actually realize the power of this data to benefit the education system as a whole and the individual student? This was the key question facing Fellows on the third day of *Untapped Talent*.

Realizing the Power of Data

MODERATOR:

Catherine Millett

Senior Research Scientist, Educational Testing Services, USA

SPEAKERS:

Lindsey Richland

Associate Professor, University of Chicago, USA

Andrés Peri

Director Department of Research, Evaluation and Statistics, National Administration of Public Education, Uruguay

Advances in computer technology and data processing and analysis allow a radical departure from the traditional methods of paper and pencil testing. Computerized methods of testing allow recording and detailed analysis of the thinking and response processes, including attention distribution, task ordering, and even eye movements. Advances in neuroscience and learning sciences also enable the identification and assessment of a broader range of skills and the replacement of outdated constructs (such as IQ testing), which overshadow popular perceptions of human potential to a significant extent.

While new technologies and scientific advances offer an entirely new horizon for testing and improvement of education, discussions in Salzburg suggest that we are still in the early stages of using these new opportunities for building more prosperous and just societies. Technological and scientific development offer significant opportunities, but in many places these opportunities are either not being harnessed or worse – are squandered. In an attempt to reduce the cost of testing, cheap, computer-adaptive multiple-choice proxy tests are often being used. The tasks in such tests may be only indirectly related to the constructs they are meant to measure, leading to a wide-scale use of suboptimal tests. It is, for example, argued that multiple choice math tests often rely on elimination rather than mathematical reasoning.

Several of the Fellows from across the world expressed criticism towards high-stakes summative testing, where the test results carry significant consequences for the students, as well as the teachers, schools, and entire

education systems. The results of such tests often determine access to the best universities – as well as the funding to pay for attendance at such schools. Performing well on such tests is imperative for parents who may invest significant resources into additional tutoring, as well as schools and teachers whose performance is being assessed according to the students’ results on such tests.

Training students to pass tests that fail to measure students’ learning and command of the subject matter, and instead rely on proxy measures leads to significant waste of resources – in terms of funds spent on sub-optimal testing as well as in terms of lost human potential not being developed as a direct result of such testing.

Although repeated and high-stakes testing is controversial, cognitive data shows that testing can also be used for learning; students who study and answer test questions are more likely to retain information than those who only study. Testing in and of itself is a learning process, and particularly when provided with feedback to students, can be a powerful opportunity to support learning.

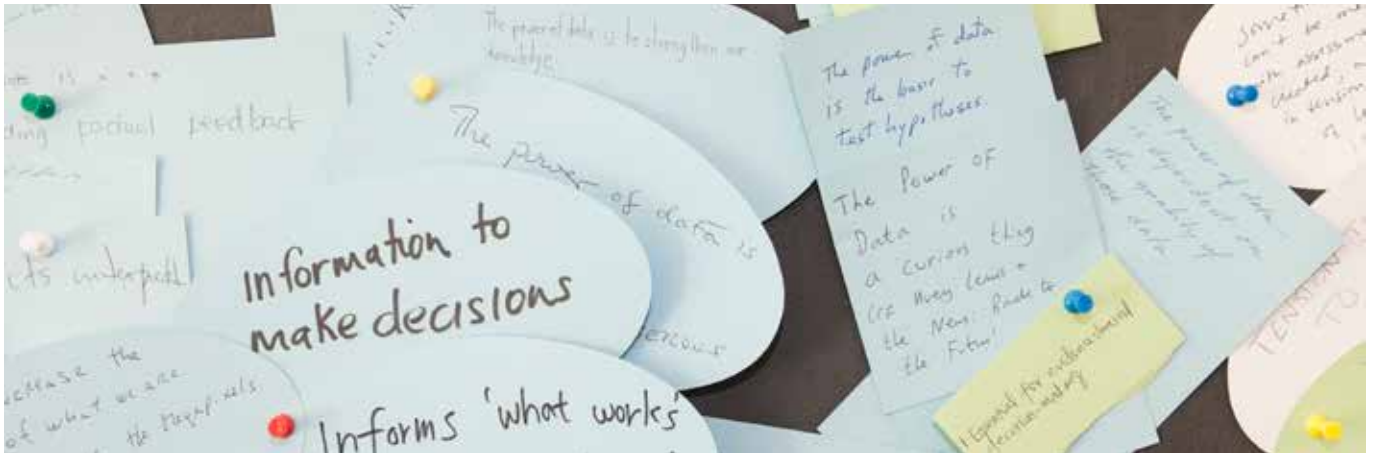
We need to not only measure and assess for learning, but also we need to measure and assess well. Using testing which tracks students’ progress during the test, as well providing a score at the end, can help educators understand their students’ cognitive processes and reasoning – not just see what the student got right or wrong. As **Andrés Peri**, the director of the Research and Evaluation Department at the National Administration of Public Education of Uruguay iterated: “An important part is not the assessment, but what happens after.” Education that relies on well-designed tests enables the

...[But] think about doing something for a whole country using computers and the internet: there’s always at least a glitch in part of the process. The key issue is that the effort of doing the testing is less than what you get from it... for example the connection can slow down, they can collapse... Some of the problems are that you need an infrastructure in order to do things on the technological side that have to be in place so that the technology pays off in what you want to do. ”

Andrés Peri,
Director, Research and
Evaluation Department,
National Administration of Public
Education (ANEP), Uruguay



Lindsey Richland (right)
with Hisham El-Zayat and
Naziema Jappie



“There are many advantages to testing because you know where you are and where you’re going with that particular subgroup of children, but I think there are also a lot of problems interpreting just what the data mean... and that it’s important to be able to understand exactly what sort of questions you’re asking and whether you’re tapping what you think you’re tapping.”



April Benasich,
Professor of Developmental
Cognitive Neuroscience,
Rutgers University, USA

teacher in a computer-supported and information-rich classroom to guide the educational process by asking questions that enable the student to better tackle the task at hand. While the promise of Artificial Intelligence is great, it still does not allow the intelligent leading of human learning by computers. Accordingly, IT-supported classrooms still require well thought-through human pedagogies, just as the current state of computer-based testing requires human scoring of tests for higher cognitive skills.

Data is being collected in different contexts for a variety of purposes and combining data from different sources easily leads to exponential growth of data. How to identify the right kind of data to answer any particular question becomes an additional and important concern, as **April Benasich**, the Elizabeth S. Solomon professor of developmental cognitive neuroscience at Rutgers University, New Brunswick, NJ, USA, contemplates: “There are also a lot of problems interpreting just what the data means... It’s important to be able to understand exactly what sort of questions you’re asking and whether you’re tapping what you think you’re tapping.”

However, when each keystroke or the slightest body movement, even an eye movement, can be captured, recorded, analyzed and stored indefinitely, a whole range of new questions emerge – from individual privacy to patterns of exclusion being reinforced or new ones being created. Identifying the right data to be analyzed for creating fairer societies becomes an increasingly urgent concern. As session chair, **Michael Nettles**, said in his opening remarks: “Entrusting so much of our education, careers and personal lives to algorithms and analytics also runs the risk of replacing our humanness with a blind faith in data processes.” We need be clear about the purpose of the data and precise in its collection; an ocean of data on its own is not necessarily helpful.

Many Fellows in Salzburg agreed that there appears to be a “tension between mobilizing [data driven solutions] for learning and the assessment.” **Susan Levine**, Professor and Rebecca Anne Boylan Chair in Education and Society at University of Chicago, USA, listed three challenges related to using data in support of teaching and learning:

- Teachers and school leaders are by and large not sufficiently prepared to translate learning data into pedagogical decisions;
- Schools are not well equipped to provide the kind of information needed for pedagogical decision-making to teachers (and students, and parents) nor is it provided in timely manner to teachers, parents and students;
- There is a lack of systemic approaches to adopt data-supported decision-making in which teachers, school leaders, and researchers are involved from the beginning.

Nora Newcombe, professor of Psychology and the principal investigator of the Spatial Intelligence and Learning Center at Temple University, Philadelphia, USA, argued that from the point of view of developmental psychology, face-to-face human interaction is essential for a child’s development. We also often hear stories of children being inspired by teachers in their choice of a field. We have not yet, however, seen somebody being inspired by a computer to enter fields other than computer science. Meanwhile, Benasich also argued that research has shown the importance of printed books as opposed to reading the text on screen for cognitive development. Writing also supports human development in a manner that typing does not.

However, we cannot forget that testing measures performance rather than learning, and performance may not always reflect learning. For example, the pressure of performing or requesting demographic information at the beginning of the test can lead to increased anxiety and activating negative frames of thought related to stereotypes, which in turn reduces exam performance.

Learning is better retained when links can be made between different subjects and strategies – this also encourages greater creativity. If tests can be designed to make connections across curricula, the anxiety associated with tests could be countered, improving performance and increasing learning outcomes.

Regardless of the data produced through testing, it is not about its type or size, but rather how the data are used. Different data are useful to different stakeholders; what is useful to a teacher to help their students learn better is not the same information as that which is needed by policymakers or that which can be easily understood by the public.

“It’s a very difficult matter how to test a young child – a one, two, three year-old child... This is a very hard global question: how do we test young children? We would like to know where they are, we would like to know if the prevention program I’m giving them is useful for them, but we can’t ask them. So we will need to have an adult to ask him how his child is moving on. But I think we need to develop a tool that a child can give us feedback as well. So this is quite a problem that we do not have any tools, that I know, that can bring from the children some information about where they are.”



Ayelet Giladi, General and Academic Manager of Early Childhood Programs, NCIW Research Institute for Innovation in Education, Hebrew University of Jerusalem, Israel

“Big Data takes the assessment to the next level: students, families, teachers and policymakers can see and track performance and development of the education system to analyze assessments results at the country, district, school, classroom, and student level. This could help us to compare patterns, co-develop solutions, and share what works among members of the community. Furthermore, Big Data enables interoperability of different sources of information and makes a data set convertible into a ready-integrated information system for consistent knowledge that may feedback to the whole system in all its different levels. ”



Harvey Sánchez Restrepo, Executive Director, National Institute of Educational Evaluation, Ecuador



Maddalena Colombo and Terry Mazany

The “Uberization” of Education Data and Assessment

MODERATOR:

Amy Luitjens

Director of Admissions, Humphrey School of Public Affairs, University of Minnesota, USA

SPEAKERS:

Terry Mazany

President & CEO, The Chicago Community Trust; Chairman, National Assessment Governing Board, USA

Harvey Sánchez Restrepo

Executive Director, National Institute of Educational Evaluation of Ecuador, Ecuador

RESPONDENT:

Maddalena Colombo

Associate Professor, Università Cattolica del Sacro Cuore, Italy

“Accept disruptive technologies!” was a key piece of advice given during the presentation of case studies on how formal assessment can be linked to Big Data to understand what works on various levels: individual, community, employers and society in general. Uber did it to the taxi industry. AirBnB is

doing it to the hotel business. What sort of “disruptive” technology could have a similar impact on education?

The use of big data and linking it to formal assessments is already causing shake ups in countries such as Ecuador, where its initial rankings of schools based on assessment results alone did little besides upset students, parents, teachers and policymakers alike. Linking that data to multiple other data sets, however, has proven hugely insightful.

Harvey Sánchez Restrepo, executive director of the National Institute of Educational Evaluation of Ecuador, explained how by applying bigger data sets, such as socioeconomic, demographic, type of school, etc., the National Institute of Educational Evaluation was able to start building a much fuller picture of why some students thrived while others struggled, despite attending the same sort of school, or coming from the same socioeconomic background. Considering variables as detailed as gender balance, pupil and parent satisfaction levels, school life, pupils’ distance to and from school, attendance, etc., offers a much fuller picture as to why some schools perform better than others – and offers insights into how to improve those that are struggling.

In some countries, such as the UK, inspections are carried out in all schools to try to make similar assessments, but in countries of more limited resources and more remote communities, this data is even more valuable: “We can’t visit all the schools! That’s what we need data for,” remarked one Fellow.

Terry Mazany, chairman of the US National Assessment Governing Board, presented a case study from the US of another tech solution that is promising to be “disruptive”: LRNG. As Mazany explained to the participants gathered in Salzburg, through LRNG’s predesigned and interchangeable “playlists”, students can “get lost” in a topic of their choice and interest, by accessing online and in-community resources, receiving in-person mentorship, attending “real life” events, and ultimately achieving a “digital badge” – a qualification that Collective Shift (the organization behind LRNG) hopes will eventually be recognized by universities and employers.

Education needs this “disruptive innovation” because, as Mazany said, “the world isn’t going to wait for our schools to improve in 10 year blocks,” and students need 21st century skills now to guarantee their success in the future.

“Big Data has the potential to provide a large scale foundation for many lines of further inquiry, the use of which could result in even more powerful, and actionable data. However, in order to prevent Big Data from simply being an aggregation of high volumes of information, it’s essential to engage stakeholders at all levels in a broad context to ask what else we hope to gain from the data, how we can explore it further and more substantively, and then how can we collaborate to create effective action.”



Amy Luitjens,
Head of Admissions, Humphrey
School of Public Affairs,
University of Minnesota, USA

Measuring Talent in 2050

Looking at the various sectors, the priorities within the sectors, and the role they play in measuring talent for the year 2050, the fourth day of *Untapped Talent* examined how the private, education and government sectors look at talent assessment and testing skills. Participants also considered how they envision the testing systems needed in 2050, as well as the (desired) role of each sector in designing and implementing these systems, especially looking at how this would connect with the work and realities on the ground.

Private Sector

MODERATOR:

Varaidzo Mureriwa *Managing Director, The P-STEM Foundation, South Africa*

SPEAKERS:

Gregory Elacqua *Principal Economist, Education Division, Inter-American Development Bank, USA*

Heinrich Dirk *Project Manager, Via Afrika, Media24Books, South Africa*

“If you look at STEM in itself, its very essence is creativity. Someone had to be creative to come up with that new technology. Someone had to understand a mathematical concept and be able to translate that into modern world reality.”



Varaidzo Mureriwa,
Managing Director, The P-STEM
Foundation, South Africa

One of the key areas of underdeveloped talent highlighted repeatedly in Salzburg was that of STEM skills. As **Michael Nettles** noted in his opening remarks, by 2020 the US IT sector will have 1.4 million well-paid computer specialist openings – but US universities are unlikely to produce graduates to fill even 30 per cent of them. Access to high-skilled jobs is, as a rule, controlled by the formal education system, which is often impacted by disparities in access based on socio-economic status, race and gender. Recent advances in data collection, testing and data analysis hold the potential of opening access to high-skilled jobs according to an individual’s ability to perform particular job responsibilities rather than the applicant’s formal educational background, and with this to a more inclusive and equitable society.

While many contemporary rewarding jobs require a solid STEM education, not just in the IT sector, the countries that need to fill these jobs with highly qualified graduates the most, for the purposes of their economic development as well as social justice, often experience major difficulties offering high quality education. For example, South Africa has extremely high youth unemployment, while 66% STEM education based jobs remain unfilled for more than six months. On math and science South Africa ranks 143rd among 144 countries participating in the PISA assessment. The level of STEM education is particularly low in rural regions and townships, where 72% of South African learners live. National dialogue all too often follows



the “blame and shame” format, with various stakeholders focusing on the responsibilities of other parties, instead of building alliances for a radical change. **Varaidzo Mureriwa**, the managing director of the P-STEM Foundation, South Africa, argued: “We should move away from the ‘blaming and shaming’ to identifying our collective responsibility for improving STEM education in South Africa.”

One private company sharing in that responsibility is Media 24 with its Via Afrika Digital Education Project, with which it plans to revolutionize South Africa’s 21st century classrooms. Following the proverb “a butterfly is not a more efficient caterpillar,” **Heinrich Dirk**, project manager at Via Afrika, argues that South Africa does not need a more efficient, but a radically transformed educational system. One example how this can be done is being offered by the Tabor Maths app from Via Afrika. Students learn through ebooks, individualized math programs, and quiz-driven mobile and tablet apps, using 21st century tools such as tablets instead of traditional text books. Such tech-based initiatives are disruptive and innovative by nature – but they are not the panacea to all education needs. Technology needs to be combined with two other important elements: content knowledge and pedagogy. Using only technology and content knowledge is not enough and feels disconnected. Introducing pedagogical solutions to these two other elements can enable better observation of and response to changes in learners’ needs.

Engagement is a key factor: how can we retain children’s attention when the outside world is so stimulating? Technology alone will not solve this problem – we need to maintain students’ motivation regardless of the

Heinrich Dirk

modes of teaching employed. Allocation of resources and learners' access to human instruction remains important regardless of technological advances. However, as Dirk noted: "Unfortunately the choice is often not between a teacher and a computer, but a computer and nothing at all." This opens another kind of segregated world where some students have access to printed books and human interaction, while others read from the screen with the communication being reduced to that of the level of machines, even if very smart machines. This, worryingly, is likely to reproduce a similarly stratified and unequal society.

Education Sector

MODERATOR:

Zemira Mevarech *President, David Yellin Academic College of Education, Israel*

SPEAKERS:

Hugh Burkhardt *Professor, University of Nottingham, UK*

Naziema Jappie *Director, Centre for Educational Testing for Access and Placement, South Africa*

Within the education sector panel, discussions focused specifically on questions around the role of the education sector in leading the way for innovations in designing assessment and testing systems to be inclusive in regard to marginalized groups (marginalized in the widest sense, including income, class, ethnicity and gender).

Naziema Jappie, the director for the Centre for Educational Testing and Placement at the University of Cape Town in South Africa shared an example of such assessment and testing with the case of the South African National Benchmark Test (NBTs). As well as assessing students' performance, to better understand the readiness of students upon exiting school, the NBTs helps

Hugh Burkhardt





assess the competencies of students who wish to pursue higher education, showing that well-developed tests can also help universities to identify students' development needs and provide them with the support they need to succeed in higher education. The tests also assesses the relationship between higher education entry level requirements and school-exit outcomes, and assists with curriculum development. With supplemental assistance and a view that there is a responsibility to help students not doing well in school, success rates are increasing.

Jappie also raised the important role that students have to play in helping to drive reform within the education sector. In South Africa, barriers to an effective educational system were met with demands by students to reform curricula in schools. The apartheid system was entrenched in the South African education system, creating separate development opportunities for different nationalities and races. After 1994, students played an important role in the reform of higher education, continuing to be a strong voice in the education system and playing an active role in pressuring the system to change, most recently seen with the "Rhodes Must Fall" movement to remove the statue of colonialist Cecil B. Rhodes from the University of Cape Town.

When it comes to developing tests, "poor strategic design," **Hugh Burkhardt**, professor at the University of Nottingham in the UK, argues, "is the main source of low impact of improvement initiatives." The cost of well-designed tests, where the tasks are closely aligned with the constructs to be assessed, appear considerably more expensive than the proxy tests. In the final choice of testing instruments, all too often the cost appears decisive even in face of a threat of losing most of the important information useful for guiding students' learning. Summative, high-stakes tests remain a significant mobilizing power of public attention and capacity of resource mobilization. Unfortunately such tests easily fail meeting the imperative of what Burkhardt proposed as the "Hippocratic Oath of Assessment": Do No Harm!

Naziema Jappie

“Poor strategic design is the main source of low impact of improvement initiatives.”

Hugh Burkhardt,
Professor, University of
Nottingham, UK

Government and Policy Designers

MODERATOR:

Jiyun Kim

Deputy Director, Ministry of Education, Republic of Korea

SPEAKERS:

Koji Miyamoto

Project Lead, Education and Social Progress Centre for Educational Research and Innovation, OECD, France

Mauricio Farías Arenas

Head of Inspecting Division, Superintendence of Education, Chile

While we can develop many innovative ways of working and have the scientific proof of what works and what does not, it is eventually the government which designs and signs the policies regarding education testing and assessment into laws. As such, the third panel in this collection considered: Do policymakers even care about people’s talent? What do we mean by the word “talent”? And how can we convince policymakers to care about “talent” and its “untapping”?

Talent can be defined as “the power or ability of mind or body viewed as something divinely entrusted to a person for use and improvement.” Although some participants at the session took umbrage with the word “talent” (it suggests innate ability, rather than a malleable and improvable skill), the talents that much of the session focused on were so-called “21st century skills.” which the Organization for Economic Co-operation and Development (OECD) posits can be broadly placed in five categories: interpersonal engagement, relationship enrichment, task completion, intellectual engagement, and emotional regulation.

Data shows that students with both higher cognitive and social and emotional skills are more likely to complete college, earn a higher income, and have lower instances of depression, with the social and emotional competencies proving even more important in this relationship than cognitive skills.

So if the evidence shows these skills are important for tomorrow’s (and today’s!) workforce, do policymakers care about this? Rhetorically at least, it would appear: yes. The Australian Education Act 2013, for example, includes wording such as “confident, creative individuals,” and “active and informed citizens,” and the accompanying curriculum framework includes more than just literacy and numeracy; for example both critical and creative thinking and ethical and intercultural understanding feature. The UK’s Department for Education’s recent reforms propose a “broad and balanced curriculum” that will “help young people develop the confidence, motivation and resilience they will need to succeed as adults in modern Britain.”

“Our evidence may be very clear, but if it does not resonate with the politicians’ priorities, getting policies adopted by the legislator would be very difficult indeed. ”



Evidence and rhetoric, however, may prove to not be enough. (Indeed, the UK’s reforms remain controversial owing to their proposed increase in high-stakes testing and focus on academic subjects over those more creative and vocational.) As one Fellow remarked, public policy is too often not based on data, but on fiction or anecdotes, with another Fellow adding: “Politicians don’t care about evidence-based policy – they care about policy-based evidence!” But researchers need to play their part, too, by supporting politicians and delivering sound evidence with another Fellow asking his peers: “Do we produce the right evidence?” Policy development requires high-level aggregate data and evidence-gathering takes time – but as discussed in Salzburg, it can have impact.

One region where significant progress has been recently made in developing evidence-based education policies is Latin America and the Caribbean, as Maria Soledad Bos, an education senior specialist in the Education Division at the Inter-American Development Bank noted: “Learning about what works in a specific context, rigorous impact evaluations using data, using assessment to evaluate programs and policies are a new trend in the region.”

It is imperative to get the evidence to the politicians and through them, into the policy-making process. It is thus essential to know how, when and where to enter evidence into the policy-making process. One should be aware of the political dimension of policy making. Connections need to be established between the evidence and politicians’ priorities and from this, a convincing story should emerge. “Our evidence may be very clear, but if it does not resonate with the politicians’ priorities, getting policies adopted by the legislator would be very difficult indeed,” a Fellow remarked.

One also needs a lot of patience. In Chile, they have been gathering assessment data since 1998; the first stage of education reform passed in 2014. If you start collecting evidence, be prepared to wait years before policy is implemented; in particular, warned one Fellow: “Be prepared for bureaucracy.”

Jiyun Kim, Koji Miyamoto and
Maurício Farías Arenas

Closing the Gap – Untap the Talent

The key question facing Fellows in Salzburg was “Can better testing and data accelerate creativity in learning and societies?” After five days of intense discussion, the consensus appeared to be: yes. But a larger question loomed: If yes, then how so? How can tests be better designed? And how can the data they produce be better harnessed to accelerate creativity in learning and ultimately build more inclusive societies?

At the conclusion of the Salzburg session, the Fellows jointly issued the *Salzburg Statement on Realizing Human Potential through Better Use of Assessment & Data in Education* which sought to directly answer those questions. [See following pages.]

According to the Statement: “Assessments and data often struggle to capture the essence and value of cultural differences critical to each community and country’s identity. When based on narrow concepts of achievement and performance, they rely too heavily on simplistic tasks, disempower learners and teachers, and contribute little to improving pedagogy and professional development.”

In their Statement, the Fellows expressed the belief that: “Data can empower teachers, students and learners” and called for “more diverse indicators of creativity, as well as knowledge skills of local concern.” The detailed Statement, which calls on “all key stakeholders in the integrated education system – policymakers, educators, assessment providers and information technologists” to act, offers recommendations covering elements of policy investment and the most effective areas to provide complementary funding, methods to make better use of research in education and assessment fields, and how to better communicate the information gathered so that it can be better understood and be more beneficial to those receiving it.

The Statement promises a commitment by the Fellows to work together to “accelerate education transformation for tomorrow’s world” within their own countries, to share and collaborate across sectors and to be ambassadors for the statement.



The Salzburg Statement on Realizing Human Potential through Better Use of Assessment and Data in Education

A CALL TO ACTION

Rising investment in education around the world increases expectations that national systems will prepare more learners for higher levels of education, employment and careers, and that assessments will generate better data on system performance, benefits of public investment, and ways to achieve success in educating each learner.

However, despite much excellent practice, assessments too often reinforce assumptions and expectations about learners' capabilities rather than seeking to identify their full potential. Assessments and data often struggle to capture the essence and value of cultural differences critical to each community and country's identity. When based on narrow concepts of achievement and performance, they rely too heavily on simplistic tasks, disempower learners and teachers, and contribute little to improving pedagogy and professional development. Most current approaches reinforce education systems where gaps are widening and goals are narrowing.

We, the participants at Salzburg Global's session on *Untapped Talent: Can better testing and data accelerate creativity in learning and societies?* (December 12 to 17, 2015), urge all key stakeholders in the integrated education system to join together to help to address the following challenge:

How can we accelerate demand for improved assessment and use of data to progress toward more equitable and personalized education systems that value a wide range of goals and benefit all learners and society?

Goals and Principles for Action

Assessments and tests are used to inform and shape educational policy at local, national, and global levels. To support the success of diverse populations, their goal should be to represent a broad spectrum of behaviors and potential, promote interest in learning, and contribute to improving learner outcomes and the effectiveness of education systems.

Due to resource constraints and competing priorities, today's assessments usually capture only a partial picture of human potential. They sample a limited range of academic performance under conventional standardized conditions.

New approaches are essential to measure the breadth of human capabilities and potential, and to communicate this more effectively to the public. We need to focus on the variety of skills and knowledge that lead to success in contemporary educational and occupational environments, and on improving the outcomes of learners and their education systems. This may require an expansion of current measures in order to meet learning and workforce needs for the 21st century.

Advances in transparent high-quality assessment and data can help build the evidence base for broader measurement of human potential.

Data can empower teachers, students and learners

We need more diverse indicators of creativity as well as knowledge and skills of local concern. This means that educational assessments and big data need to produce sufficient information to:

- Challenge assumptions and expectations;
- Have additional metrics for achievement and performance that go beyond current approaches to measuring math, science, language and literacy to assess a broader spectrum of human potential;
- Inform and support development of new pedagogies;
- Act as gap-closing pedagogical tools.

Best design practices for assessment and testing

We need to engage a more diverse representation of the population, and ensure that assessments:

- Enable all learners to show what they know, understand and can contribute to society;
- Accelerate learning and success for children and learners of all ages;
- Include teachers and invite parents and the wider community to contribute to the assessment design process;
- Do no harm and minimize bias;
- Are representative of the subgroups of populations, both within and across countries.

Increased investment targets to meet these challenging goal include:

- Teachers' professional status; professional development that empowers teachers to develop, administer and analyze assessment data, and to learn and apply the "science of learning" principles.
- The development of assessments designed for learning (formative and summative), improvement, and non-competitive and competitive options: these should include a variety of performance types which offer learners flexibility, and are community-relevant and publicly available;
- Assessments and data that enable fuller analyses of the various groups being assessed and the environments in which learning happens.

Recommendations

We call on all key stakeholders in the integrated education system – policymakers, educators, assessment providers and information technologists – to act now on the following recommendations:

Policy Investment

- **Recognize** the powerful opportunities in assessment and testing to drive positive learning outcomes;
- **Invest** in assessments and testing that – in addition to traditional academic, social and other skills that are valuable in education and work – include skills valued by stakeholders that can drive reforms and better engage them within the education curriculum;
- **Provide** complementary funding in five areas:
 1. National standard setting to frame testing;
 2. Controlled communication of results to stakeholders;
 3. Human and technological infrastructure to handle data collection, analysis, and dissemination;
 4. Training to help teachers and curriculum designers refine schooling based on these data; and
 5. Independent review and research on assessments;

- **Connect** data tightly to practice and policies; *fill* gaps through collaboration between policymakers and researchers; and *increase* the number of data specialists at city/school district level to catalyze local action.

Methods

- **Use** best research practices to design assessments that measure key indicators of human potential, beyond easy-to-measure skills;
- **Conduct** more research on conditions and constructs that can lead to creativity in classrooms and lifelong learning, and factor multiple measures and dimensions of student learning into student assessment;
- **Assess** children in both the language spoken at home and the language of instruction, where possible; if not, *interpret* results with caution as low scores may reflect the child's language knowledge, rather than conceptual difficulty with the questions being asked;
- **Identify** and **gather** global best practices on pilot testing and on careful, considerate and refined data management and analysis.

Communication

- **Tailor** the dissemination of results with careful attention to recipients and the intended use of these data for various stakeholders (families, students, teachers, policymakers); *provide* avenues to incorporate stakeholders' goals for the use of data (e.g. rating schools on academic achievement, safety, criterion versus ranking data) into assessment design;
- **Formulate** ethical guidelines on communication and dissemination of data and testing results to ensure these do no harm (e.g. communicating relative weaknesses or strengths rather than absolute sum-scores which may feed into competitive comparisons or ranking);
- **Make** assessment results actionable by linking them to instructional strategies and professional teacher development to address areas of need.

We, the Fellows of Salzburg Global Seminar, commit to accelerate educational transformation for tomorrow's world by working together to advance these goals in our countries and to share good practices. We will initiate, foster and sustain cross-sector collaborations, and become ambassadors of this Statement.

The views expressed in this Statement are those of session participants individually and should not be taken to represent those of any organizations to which they are affiliated.

Next Steps

Since the December 2015 session, Salzburg Global Seminar and ETS have continued their collaboration to take this work forward.

ETS is working on two undertakings that build on the December 2015 session in Salzburg. With respect to developing better data, ETS and the Robert Wood Johnson Foundation convened Understanding the Opportunities for Collaboration Between the Health and Education Sectors in a Culture Of Health in May 2016 to examine the research priorities and data systems needed for improving health and K-12 education in the United States. The second activity focuses on better testing. ETS is collaborating with the Algebra Project, an organization that has developed an experiential mathematic pedagogy designed for students who perform in the bottom quartile of student achievement. The Project will pilot assessments that aim to measure not only what students do not know, but also what they have gained in proficiency, both through the experiential structure created by the Algebra Project and by using standard mathematical models and notation.

Salzburg Global circulated the *Salzburg Statement on Realizing Human Potential through Better Use of Assessment & Data in Education* through its global Fellowship Network and to selected institutions. The Statement also received press coverage in *TES*, the UK-based specialist education publication which connects “the world’s largest online community of teachers.”

The Statement’s recommendations have been integrated into Salzburg Global’s evolving multi-year series on *Education for Tomorrow’s World*. Salzburg Global is now designing follow-on sessions, in collaboration with ETS, focusing on measuring and evaluating social and emotional skills for the 21st century. As participants agreed, teaching and testing systems to foster and assess such skills need to become more sophisticated and mainstreamed. Enhanced systems and data will need to inform more innovative and flexible educational policy making and curriculum development, given that the way we learn and the very future of work will change beyond recognition in coming decades.

Salzburg Global’s program and partnerships will directly support international action to implement the 2030 Agenda for Sustainable Development, particularly Goal 4 on Quality Education. Additional key themes that are currently being explored focus on the role of education and lifelong learning in the integration of migrants and refugees and on the role of vocational learning to realize the “No-one Left Behind”-Agenda of the United Nations.



Louise Hallman



Voldemar Tomusk



Participants (TITLES AND BIOS CORRECT AT TIME OF SESSION – DECEMBER 2015)



James Anyan *Finland / Ghana*

James Anyan is a Ph.D. candidate at the University of Helsinki, Finland. His dissertation examines how opportunities for higher education are distributed in Ghana's public universities for students from the various social levels, with particular emphasis on students from the underserved segments of the Ghanaian society (low-income, rural, women and girls, and students with disabilities). Previously, Mr. Anyan was a consultant for The World Bank Group on higher education. In this role, he worked on projects that assessed equity in African tertiary education access and success and a diagnostic review of higher education in Ghana for the Bank's Country Status Report as well as Ghana's Education Strategic Plan (ESP). Mr. Anyan is an educator with almost a decade's experience with the Ghana Education Service and taught at both the first and second-cycle schools in Ghana. He holds a B.A. in political science from the University of Ghana, an M.Sc. from the University of Tampere, Finland, and an M.Phil. in higher education from universities in Finland, Norway, and Portugal (joint degree). Mr. Anyan is a Fellow of Salzburg Global Seminar.



Raudel Ávila Solís *Mexico*

Raudel Ávila Solís works as an advisor for the Mexican Ministry of Education and has worked in the Public Relations Office of the former Mexican President Carlos Salinas de Gortari. He has also served as an advisor for Enrique Peña Nieto's government. He holds a B.A. in international relations from El Colegio de México and an M.A. in international relations and communication from Essex University, United Kingdom.



April A. Benasich *USA*

April A. Benasich is the Elizabeth H. Solomon professor of developmental cognitive neuroscience at Rutgers University, USA. She is also the director of the Infancy Studies Laboratory at the Center for Molecular & Behavioral Neuroscience (CMBN), the director of the Carter Center for Neurocognitive Research, and a principal investigator within the NSF-funded Temporal Dynamics of Learning Center at the University of California, San Diego. Dr. Benasich's work is centred on the neural underpinnings of cognitive and language development as well as the development of temporally-bounded sensory information processing, shown to be a robust predictor of language impairment and dyslexia in older children. Her research studies address issues relating to the evolution of dynamic coordination and synchrony in the developing brain, their role in organizing lower-level sensory processing, and how such mechanisms impact higher-level functions, such as language and cognition. Most recently, she examined the dynamics of early brain plasticity and the role of attention and sensory recruitment in the construction of cortical sensory maps in human infants. These techniques, particularly in translation, allow the possibility of remediating language disorders well before babies speak their first word and thus could have far-reaching implications. Dr. Benasich holds a Ph.D. in experimental/cognitive neuroscience and clinical psychology from New York University.

Maria Soledad Bos *USA*

Maria Soledad Bos is an education senior specialist in the Education Division at the Inter-American Development Bank (IADB) in Washington DC, USA. In this role, she regularly participates in the design and execution of loans and provides technical assistance to education ministries throughout Latin America and the Caribbean. Ms. Bos participated in the design and execution of loans for ministries of education in Argentina, Paraguay, Ecuador, Colombia, Panamá, Dominican Republic, Costa Rica, Trinidad and Tobago, and Suriname in areas including scholarships, education infrastructure, education decentralization, teacher's professional development, and curriculum redevelopment. Together with the research team on equity in education, she co-authored various articles on equity in learning and the relationship between education inputs and learning. Prior to coming to the IADB, Ms. Bos worked as a research analyst at the International Food Policy Research Institute (IFPRI), doing research on poverty alleviation and food security. She holds a B.A. in economics from the Universidad Nacional de Cuyo in Mendoza, Argentina and an M.A. in public policy from the University of California at Berkeley, USA.



Hugh Burkhardt *UK*

Hugh Burkhardt is a professor at the University of Nottingham, UK. He has led its Shell Centre team since 1980 in a series of major innovative curricula and assessment projects in the UK and the USA. He developed tools that enabled teachers to align their practice with international learning goals in mathematics, and examination providers to assess them in a more balanced way. Professor Burkhardt takes an “engineering” view of educational research and development. For him it is about using prior research, imaginative design, and systematic development to make high-quality tools that help a complex system work better. Further insights are developed as part of that process. A theoretical physicist, he has always seen using mathematics to tackle everyday life problems and decisions as central to a high-quality education and was a pioneer in the teaching of modelling with mathematics.



Maddalena Colombo *Italy*

Maddalena Colombo is an associate professor in the sociology of cultural and communicative processes at the Università Cattolica, Italy. She is also the director of the Centre of Initiatives and Research on Migration (CIRMiB) in Brescia, Italy. At the university, she teaches sociology of education, sociology of educational policy, and sociology of inequalities and differences. Her main areas of interest are education, training, socialization processes and supply, education systems, impacts of migration in schools and the curriculum, social changes in the role of teachers, and innovation in educational systems and practices. Dr. Colombo co-ordinates the Laboratory of Research and Social Intervention and is a member of the managing board of the Centre of Studies on Legal and Civic Education at the University Cattolica of Brescia. In addition, she is a member of the scientific board of Health, Human Care and Social Cultural Assessment at the University Cattolica Roma, faculty member of medicine and surgery, and a member of the European Sociological Association. Dr. Colombo holds a Ph.D. in sociology and methodology of social research from the Università Cattolica di Milano, Italy.





Heinrich Dirk

South Africa

Heinrich Dirk is a project manager at Via Afrika, Media24 Books, South Africa. Via Afrika is a leading publisher of educational material in South Africa, and with their move into digital they expanded their product offering to include Tabtor Maths, a unique mathematics program developed in the USA. Mr. Dirk's role entails the implementation of this tablet-based primary schools mathematics program in the South African education market. To him, there is no greater pleasure than witnessing an individual unlock their true potential and he firmly believes technology allows this on a much larger scale. Prior to this, he ran his own mathematics tutoring service, mixing it with his interest in technology by working within the educational hardware sector. He was responsible for providing technology solutions to schools and teachers by assisting teachers to become comfortable with technology so that they can empower their teaching and improve learning outcomes.



Gregory M. Elacqua

USA / Chile

Gregory M. Elacqua is principal education economist in the Education Division at the Inter-American Development Bank, Washington DC, USA. Prior to this position, he was director of the Public Policy Institute at the School of Business and Economics at the Universidad Diego Portales in Chile. He also served as co-director of the Chair of Globalization and Democracy at the Universidad Diego Portales, and as advisor to three Ministers of Education in Chile as well as to a member of the Education Committee in the Chilean Senate. Dr. Elacqua has been involved in the design of the education reforms signed into law in recent years and currently under congressional discussion in Chile. He has done consultancy work with UNESCO, the World Bank, and a number of foundations and governments on education policy. Dr. Elacqua's research focuses on education policy, the economics of education, school accountability, teacher policy, school choice, and the political economy of the educational system. He has conducted extensive research on schools in Chile and Latin America and has also been active in the politics of educational policy reform. Dr. Elacqua is author of a number of books, journal articles, monographs, and reports comparing various aspects of education cross-nationally for both Chilean and international audiences. He holds a Ph.D. in public policy from Princeton University, USA.



Hisham El-Zayat

Egypt

Hisham El-Zayat is an assistant professor at the Institute of Graduate Studies and Research (IGSR), Alexandria University, Egypt. He is also a nonfiction writer. He has twenty years of teaching experience in Egyptian and Saudi universities. His technical writings are characterized by a personal, human, and artistic touch. Dr. El-Zayat's book on environmental management was highly commended and published by Zayed International Prize for the Environment. He is a member of the Cultural Relationships Committee at IGSR, member of the International Association for Impact Assessment, member of the Association of the Arab Environmental Experts, as well as member of the Syndicate of Agriculturists. Dr. El-Zayat is author of numerous publications, articles and books, and participated in a variety of training courses, workshops, conferences and seminars. He holds an M.Sc. and a Ph.D. in environmental studies from Alexandria University, Egypt.

Mauricio A. Farías Arenas *Chile*

Mauricio A. Farías Arenas is the head of the Inspecting Division at the Superintendence of Education, an institution which is a part of the Quality Assurance of the Chilean educational system. In this role, he is working to increase the accountability of schools and to strengthen the implementation of law, with the aim of assuring basic learning conditions in schools and promoting improvement mechanisms that could increase the quality and equity of the Chilean educational system. Previously, Dr. Farías Arenas was a researcher focused on higher education at Fundación Chile. He also headed the Department of Research and Development at the Ministry of Education in Chile, where he was responsible for research, managing funds, gathering national databases, producing statistics, and managing school subsidies. Prior to that, he served as advisor to the Vice Minister of Education in Chile and worked in the non-profit sector, where he was the principal of a childcare program and a day care program for people with disabilities. Dr. Farías Arenas holds a B.A. in industrial engineering and an M.Sc. in applied economics from the University of Chile, as well as a Ph.D. in international comparative education from Stanford University, USA. His research focused on different aspects of educational inequality in Latin American countries.



Andrea Frick *Switzerland*

Andrea Frick is an associate professor of developmental psychology at the University of Fribourg, Switzerland. Her research area is cognitive development, with a special focus on the development of spatial cognition, mental representations, and imagery abilities. She is currently investigating the questions of how spatial and mental transformation abilities are influenced by active experience, how they affect later academic performance in math and geometry, and how we can promote these abilities early in life. Previously, funded by a scholarship from the Swiss National Science Foundation (SNSF), Dr. Frick worked as a post-doctoral fellow at the University of California, USA. Subsequently, she did a second post-doctoral fellowship at Temple University in Philadelphia, as part of an NSF-funded project devoted to understanding and improving spatial cognition. She later worked as an SNFS Ambizione Fellow at the University of Bern, Switzerland, where she received her habilitation. Dr. Frick holds a Ph.D. from the University of Zurich, Switzerland.



Ayelet Giladi *Israel*

Ayelet Giladi is the general and academic manager of early childhood programs at the NCIW Research Institute for Innovation in Education at the Hebrew University of Jerusalem, Israel. She is also a professor at Kibbutzim College, where she teaches her students how to talk about values in order to recognize sexual abuse in children. Dr. Giladi is a pioneer and recognized expert on the abuse of young children. She conducts research on the issue, consults with a variety of organizations, and conducts training on sexual abuse at an early age. She is the author of numerous prevention programs that are widely used in kindergartens as well as public and private schools throughout Israel. In addition, Dr. Giladi is the founder and director of the Voice of the Child Association for the prevention of sexual abuse among young children. Among her clients are young children with visual impairments, children from various religious backgrounds, immigrant children, especially from Ethiopia, and Arab children. Dr. Giladi is the author of book chapters and several articles in professional journals about the sexual abuse of



young children. She has been featured on Israeli television, radio programs, and newscasts as well as in Israeli newspapers. She has spoken about sexual abuse at an early age to the Knesset (Israeli parliament) and at international conferences in the USA and the UK, and she trains family judges, physicians, nurses, psychologists, educators and schools administrators, social workers, parents and children on the issue. Dr. Giladi holds a Ph.D. in sociology education from Anglian Ruski University in the UK.



Joseph R. M. Hallgarten *UK*

Joe Hallgarten is director of education at the Royal Society of Arts (RSA), where he is leading a program of policy research and practical innovations with oversight of the family of RSA Academies. Previously, Mr. Hallgarten taught in primary schools for five years before joining the Institute for Public Policy Research as head of education. He then spent six years as learning director for Creative Partnerships, the world's largest creative learning program and winner of the WISE 2011 Award. Mr. Hallgarten has also been an advisor to the Department for Education's Innovation Unit and the Prime Minister's Strategy Unit, and a consultant for London 2012's education program. He has published articles on a wide variety of education and cultural issues, including recent reports on the future of international schools, creative capacity building schools, and how schools systems around the world can support innovation. Mr. Hallgarten is a founding trustee for The Ministry of Stories, a children's creative writing centre in London.



Hernán Hochschild Ovalle *Chile*

Hernán Hochschild Ovalle is the executive director of Elige Educar, an NGO working on the social recognition of teachers. He also teaches argumentation to young students in schools. His research mainly focuses on the relationship between indicators of quality of education in Chile (such as national exams) and employability and productivity at work. Due to the success of his work with Elige Educar, Mr. Hochschild Ovalle was named a "Global Shaper" by the World Economic Forum, which put him in an international network of leaders under the age of 30. He is a civil engineer by training and holds a degree in philosophy from the Pontifical Catholic University of Chile.



Yasmine Ibrahim *Egypt*

Yasmine Ibrahim is the officer of graduate recruitment and fellowships at the American University in Cairo (AUC), with over 10 years of professional experience in the fields of educational management, student recruitment and retention, and higher education. Her responsibilities include designing and implementing institutional recruitment strategies, managing major campus events, and initiating and maintaining relationships with educational partners and institutions regionally and abroad. Seeing education as synonymous with development, Ms. Ibrahim has started and is in the process of finishing her graduate degree in development studies, with a research focus on education, participatory development, and democracy promotion in local rural communities. Ms. Ibrahim is a Fellow of Salzburg Global Seminar.

Naziema B. Jappie*South Africa*

Naziema B. Jappie is the director for the Centre for Educational Testing & Placement (CETAP) at the University of Cape Town (UCT) in South Africa. She is a labour rights activist and has a long history of working in the labour movement and higher education sectors in South Africa. Previously, Ms. Jappie worked as a secondary school teacher, as national education officer, and as a lecturer at the former M.L. Sultan Technikon, where she later served as dean of students. She joined the Durban University of Technology as executive director for student affairs after serving as dean of students at the University of the Witwatersrand. She has presented conference papers both locally and internationally and has a passion to work with students in higher education on issues of access, success, and social justice. Ms. Jappie does training in conciliation, mediation and arbitration, as well as adult education. She served as a member of the task team for gender equity in education and has been involved in HEQC national institutional audits and training for quality assurance. She is also a member of the higher education HIV/AIDS (HEAIDS) advisory board, the Hoskens Consolidated Investments companies, and the Institute of Director's SA. She served as vice president of the South African Women's Forte, as president of the SA Student Services Association, and is also a member of the Muslim Women's Shura Council based in New York. Ms Jappie holds a B.Sc. and an M.Sc. in social science, specializing in industrial and labour studies.



Maghan Keita*USA*

Maghan Keita is a professor of history, director of the Institute for Global Interdisciplinary Studies, and chair of the Unit on Critical Language and Cultural Studies at Villanova University, USA. Dr. Keita is also the chair of the Board of Trustees of the College Board. He has spent the majority of his professional life concentrating on issues of education in various venues with a particular focus on excellence, access, and equity in the educational process. This has included areas of student preparation, and professional and curriculum development. Dr. Keita's teaching and research focuses on African, African-American, European and World histories, political economy and development studies. He is the author of numerous works in his area of specialty, including "Race and the Writing of History: Riddling the Sphinx". As director of the Institute for Global Interdisciplinary Studies, he oversees an academic unit whose primary purpose is to provide students with a skill set that will foster critical and analytical thinking and problem solving, preparing them for responsible global citizenship. Dr. Keita holds a B.A. in Chinese language and East Asian studies from Oberlin College, an M.A. in American history from Cleveland State University, and a Ph.D. in African studies from Howard University, USA. Dr. Keita is a Fellow of Salzburg Global Seminar.



Jiyun Kim*Republic of Korea*

Jiyun Kim is a deputy director in the Korean Ministry of Education. She currently works for the International Cooperation Division within the Ministry. Her main responsibility is to support the establishment and operation of foreign educational institutions in Korea (for example, branch campuses of overseas institutions). Dr. Kim is a published author of several research papers concerning the role of student financial aid in promoting college preparation and access. She holds an M.A. and a Ph.D. in higher education from the University of Michigan, Ann Arbor, USA.





Hye-Won Lee

Republic of Korea

Hye-Won Lee has been a research fellow of the Korea Institute for Curriculum and Evaluation (KICE) since 2006. As an English language educator, she has previously taught at several universities in Korea. Her research interests include foreign language pedagogy (English language education), national curriculum development and educational policy, multicultural/multilingual education, learning support for underachievers, teacher education and classroom interaction. Dr. Lee holds a Ph.D. in English language education from the University of Southampton, UK.



Susan C. Levine

USA

Susan C. Levine is a professor at the University of Chicago, where she holds the Rebecca Anne Boylan Chair in Education and Society and is the chair of the Department of Psychology and the director of the UChicago Science of Learning Center. She is an expert in the development of the numerical and spatial aspects of math. Her research focuses on individual variations in the development of early mathematical thinking, the inter-relationship of numerical and spatial aspects of math, and how variations in math talk and activities at home and at preschool affect children's mathematical thinking. Dr. Levine also studies how the math anxieties and stereotypes of parents and teachers, as well as children themselves, can negatively impact children's math achievement and math attitudes. She has developed various kinds of spatial and math assessments, and is working with a research team to develop formative math and literacy assessments that can be used by preschool teachers to guide instruction. Finally, she studies the potential of various kinds of interventions, parent-child engagement with mathematical books, play activities, and technology, to enhance children's math learning. Dr. Levine is a co-principal investigator of an NSF Science of Learning Center, the Spatial Intelligence and Learning Center.



Abby Loebenberg

USA / South Africa

Abby Loebenberg is an honors faculty fellow at Arizona State University's Barrett Honors College, the top-ranked public honors college in the USA, with the largest enrolment. Dr. Loebenberg's lifelong passion has been studies of childhood, education and on linking creative processes with scholarly ones. Her current research is interdisciplinary, applied in nature, and looks at innovating new pedagogical strategies for open-ended, creative courses that target high achieving students in the USA Honors programs. This research challenges the current model for what courses in honors programs look like, and also challenges students to develop conceptually-based, creative approaches to learning in a trans-disciplinary way. This approach moves beyond a professionalization or disciplinary model to education and prepares young people for the job challenges that their future, as yet uninvented careers, may hold. Ms. Loebenberg holds a B.A.S. and B.Arch. in architecture from the University of Cape Town, South Africa, and an M.Phil. (on Rhodes scholarship) in material anthropology and museum ethnography as well as a D.Phil. in social and cultural anthropology from Oxford University, UK.

Amy M. Luitjens USA

Amy M. Luitjens is the director of admissions at the University of Minnesota's Humphrey School of Public Affairs, where she oversees recruitment, admissions, and financial aid for six graduate programs in addition to managing a portfolio of external partnerships. Having worked within a range of post-secondary institutions and program types, as well as on policy reform in state government, she has developed a keen interest in examining how best to innovate efficiently within large systems in order to create authentic, necessary, and effective change for individuals and communities. Passionate about educational access, organizational development, and the intersection of education administration and policy, Ms. Luitjens has served as an advocate for diversity and inclusion programming throughout her career. In her free time, she serves with the philanthropic women's leadership training organization, the Junior League of Saint Paul, on the alumni board of directors at Cornell College, takes advantage of all of the wonderful cultural activities and outdoor offerings that abound in the Twin Cities of Minneapolis-Saint Paul, and bookends her days by walking her dog with her fiancée. Ms. Luitjens holds a B.A. in political science and Spanish from Cornell College, USA, and an M.A. in public administration from Hamline University, USA.



Terry L. Mazany USA

Terry L. Mazany is president and CEO of The Chicago Community Trust, one of the nation's leading community foundations celebrating its 100th anniversary, with assets of more than \$2.3 billion and grants exceeding \$150 million annually to hundreds of non-profits in metropolitan Chicago. Dr. Mazany was selected as the sixth executive in the Trust's hundred year history in 2004. He also served as the interim chief executive officer of Chicago Public Schools. He is a member of the board of directors of the Federal Reserve Bank of Chicago and was appointed to serve as chairman of the National Assessment Governing Board. Dr. Mazany serves as principal investigator for the Chicago region health systems research consortium, as part of the national Patient-Centered Outcomes Research Network. In recognition of the 100th anniversary of the first community foundation, he co-edited *Here for Good: Community Foundations and the Challenges of the 21st Century*. Prior to his work in philanthropy, Dr. Mazany enjoyed careers in public education and archaeology. He holds degrees in anthropology, business, and education, and was awarded Honorary Doctorates from DePaul University and Lewis University, USA.



Zemira R. Mevarech Israel

Zemira R. Mevarech is the president of the David Yellin Academic College of Education in Israel. She is also a full professor of education. Previously, she was the head of the School of Education in Bar-Ilan University (BIU), the vice rector of BIU, and dean of the faculty of social sciences at BIU. Before joining the University, Dr. Mevarech was the chief scientist of the Ministry of Education. Currently, she serves as academic head of the National Committee of Teachers' Professional Development, and served as the head and member of many national and international committees of education, including as academic head for advancing gifted children. Dr. Mevarech's research focuses on mathematics education, metacognition, teacher education, and professional development. She has published numerous studies in these areas and is author of the book *Critical Maths for Innovative Societies: The Role of Metacognitive*



Pedagogies. She also paints, mainly in oil on canvases, abstract, very colorful paintings, and has participated in many art exhibitions. Dr. Mevarech holds a Ph.D. in program measurement, evaluation, and statistics analysis in education from the University of Chicago, USA.



David I. Miller USA

David I. Miller is a Ph.D. candidate in psychology and an NSF Graduate Research Fellow at Northwestern University, USA. He is currently examining how and why some students move into and out of science, technology, engineering, and mathematics (STEM) fields. His research investigates the untapped potential of opening pathways for non-STEM majors to join STEM during college. Mr. Miller holds a B.S. in mathematical physics from Harvey Mudd College, USA, and afterwards conducted science education research through UC Berkeley's Technology Enhanced Learning in Science (TELS) Center.



Catherine M. Millett USA

Catherine M. Millett is a senior research scientist in the Policy Evaluation and Research Center at Educational Testing Service (ETS) in Princeton, New Jersey. Her research focuses on educational access, student performance and achievement, educational equity, and student financing for various population groups in the United States at the postsecondary educational level. Dr. Millett directs the evaluation of the Princeton University Preparatory Program, a rigorous academic and cultural enrichment program for high-achieving, low-income public high school students from Princeton area school districts to prepare for admission to and ongoing success within selective colleges and universities. For a decade, she co-led the evaluation of the Goldman Sachs Foundation's Signature Initiative Developing High-Potential Youth and authored the 2009 report "The Goldman Sachs Foundation: Developing High-Potential Youth a Return on Investment Study for US Programs." She holds a B.A. in economics from Trinity College, an Ed.M. in administration planning and social policy from the Harvard Graduate School of Education, and a Ph.D. in public policy in higher education from the University of Michigan, USA. Dr. Millet is a Fellow of Salzburg Global Seminar.



Koji Miyamoto France / Japan

Koji Miyamoto is the project leader of CERI's Education and Social Progress (ESP) project, and was formally managing CERI's Social Outcomes of Learning (SOL) project. Before joining CERI, he was with the Organization for Economic Cooperation and Development (OECD) Directorate for Employment, Labor and Social Affairs, as well as the OECD Development Centre, and the World Bank. Mr. Koji is an economist by training, working on policies that promote skills development towards economic and social progress. His particular interest is on mobilizing educational innovation to enhance children's social and emotional skills.

Ann Mroz*UK*

Ann Mroz has been the editor and digital publishing director of *Times Educational Supplement* (TES) since September 2013. She joined TES' sister publication, the *Times Higher Education Supplement*, in 1994, where she held a number of roles and helped it relaunch as the *Times Higher Education* magazine in 2008.



Varaidzo Mureriwa*South Africa / Zimbabwe*

Vari Mureriwa is the managing director of the P-STEM Foundation, South Africa's only non-governmental STEM (science, technology, engineering, and mathematics) advocacy organisation. She started the P-STEM Foundation with two Accenture colleagues as a response to the dual challenges of high youth unemployment and a growing STEM skills shortage in South Africa. The intention of P-STEM was to redirect and support South Africa's youth at greatest risk of unemployment into the growing STEM opportunities evident in the country. The focus areas of the organisation were to create awareness of STEM opportunities, spark students' interest in STEM, develop skills and identify and eliminate impediments. As the organisation grew and spread to many communities, Ms. Mureriwa left formal employment to lead and manage the Foundation. Today, through the STEM Community Engagement Model, the P-STEM Foundation operates across 4 provinces in South Africa, working with over 15 000 primary and high school learners, and changing the South African STEM education landscape significantly. Ms. Mureriwa holds a B.Bus. in information systems from Edith Cowan University in Perth, Western Australia.



Mary Goretti Nakabugo*Uganda*

Mary Goretti Nakabugo is a member of the senior management team of Twaweza East Africa, which works on enabling children to learn, citizens to exercise agency, and governments to be more open and responsive in Tanzania, Kenya, and Uganda. One of Twaweza's flagship programs is called Uwezo, Africa's largest annual citizen assessment of children's learning levels. Dr. Nakabugo heads the Twaweza Uganda office and manages the Uwezo program in Uganda. Prior to joining Twaweza, her major work experience has been in the higher education sector. She worked as a senior lecturer and acting director of higher education studies at the University of KwaZulu-Natal in South Africa, as senior lecturer and head of the Department of Curriculum, Teaching and Media at Makerere University, Uganda, as education research fellow to the Irish-African Partnership for Research Capacity Building, based at Mary Immaculate College, University of Limerick in Ireland, and as visiting professor to the Centre for the Study of International Cooperation in Education at Hiroshima University in Japan. Dr. Nakabugo's research interests focus on education and international development, teacher education, assessment for learning, curriculum development and what works to improve learning outcomes in developing countries. She holds a Ph.D. in education from the University of Cape Town, South Africa.





Michael T. Nettles USA

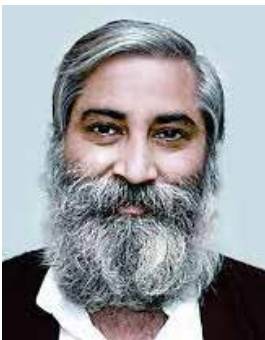
SESSION CHAIR

Michael T. Nettles is senior vice president and the Edmund W. Gordon chair of ETS's Policy Evaluation & Research Center (PERC). His research covers a broad spectrum of education policy topics including educational assessment, student achievement, access and equity, and financing higher education. His publications as well as his advisory board service record reflect his broad interest in public policy, students and faculty, educational opportunity, achievement and assessment at the elementary, secondary, and postsecondary levels. In August 2014, USA President Barack Obama appointed Dr. Nettles to the President's advisory commission on educational excellence for African Americans. Dr. Nettles has served on the board of directors of the National Center for the Improvement of Educational Assessment and has been a member of the international advisory committee on education quality at the Human Sciences Research Council in South Africa. While on the faculty at the University of Michigan, Dr. Nettles was appointed by two USA secretaries of education to serve on the National Assessment Governing Board (NAGB), which oversees and develops policies for the National Assessment of Educational Progress. He served on NAGB for a decade, three of those years as the vice chair of the board. He also served on the College Board of Trustees. Dr. Nettles holds a B.S. in political science from the University of Tennessee, an M.Sc. in political science and higher education as well as a Ph.D. in education from Iowa State University, USA. Dr. Nettles is a Fellow of Salzburg Global Seminar.



Nora S. Newcombe USA

Nora S. Newcombe is a professor of psychology at Temple University and principal investigator of the Spatial Intelligence and Learning Center (SILC), headquartered at Temple and involving Northwestern, the University of Chicago and the University of Pennsylvania as primary partners. She is an associate editor for *Cognitive Psychology* and for *WIREs in Cognitive Science*. Previously, she served as editor of the *Journal of Experimental Psychology: General* and as associate editor of the *Psychological Bulletin*, as well as on numerous editorial boards and grant review panels. Dr. Newcombe is a fellow of four divisions of the American Psychological Association (General, Experimental, Developmental, and Psychology of Women), of the American Psychological Society, of the Cognitive Science Society, and of the American Association for the Advancement of Science. She has been a visiting professor at the University of Pennsylvania, Princeton, USA, and the Wissenschaftskolleg in Berlin, Germany. She is a member of the American Academy of Arts and Sciences and the Society of Experimental Psychologists. Dr. Newcombe holds a psychology degree from Antioch College, and a Ph.D. in psychology and social relations from Harvard University.



Sandeep Pandey India

Sandeep Pandey is a social activist in India. He serves as visiting faculty in the Department of Chemical Engineering at the Indian Institute of Technology, Banaras Hindu University in Varanasi, India. His areas of interest include education for underprivileged children, upholding of human rights, empowerment of marginalized communities, struggles for strengthening of democracy, right to information for transparency and accountability, governance, right to food, employment guarantee, tribal rights, and struggles against exploitation of natural resources

for corporate profit. He has taken out long peace marches for nuclear disarmament, communal harmony, and India-Pakistan friendship. Dr. Pandey serves as the vice-president of the Socialist Party of India. He holds a Ph.D. in mechanical engineering from the University of California, Berkeley, USA.

Heejin Park

Republic of Korea

Heejin Park is a research fellow at the Korean Educational Development Institute (KEDI), a governmental think-tank for research on educational policy and practice in the Republic of Korea. Prior to joining KEDI, Dr. Park served as a visiting professor, lecturer, and researcher at the University of Pittsburgh, USA, and Kyunghee University in South Korea. Dr. Park's main research areas are education policy issues in the perspective of educational equity and equality at the national and international level. Her recent publications include "Foreign Mothers' Cultural and Social Capital and Maternal Involvement in Their Children's Education" and "Minority Students' Access to Higher Education in an Era of Globalization", et al. She holds an M.A. from Alice-Salomon Fachhochschule in Berlin, Germany and a Ph.D. in education from the University of Pittsburgh, USA.



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India

Sandipan Paul has been working in the development sector for the last 7 years, primarily in the area of early childhood development and education (ECDE). He has cross-cutting experience working at program and policy level, with greater focus on policy level technical assistance in ECDE, to country governments, international development organizations, grant making organizations and regional alliances in South and East Asia. Mr. Paul's work involved conducting regional and national level assessments, developing both program and service standards as well as advocacy materials, and providing technical support in setting up national level bodies and councils aimed at policy making in the field of ECDE. Mr. Paul holds a B.A. in economics and an M.A. in development studies. He is a Fellow of Salzburg Global Seminar.



Andrés Peri

Uruguay

Andrés Peri is the director of the Research and Evaluation Department at the National Administration of Public Education of Uruguay (ANEP). Some of his responsibilities include the development of the System of Educational Assessment and contribution to the Monitor of Primary Education - a system of statistical reports for every school. Dr. Peri is also a delegate of Uruguay to the PGB of the Program for International Student Assessment and the National Coordinator of the Latin American Laboratory for Assessment of the Quality of Education (LLECE) study of UNESCO. Previously, he worked as a consultant and researcher for many organizations like The Economic Commission for Latin America, UN Economic Commission for Latin American and Caribbean, UN Population Fund, and World Food Program. He was a speaker at TEDxMontevideo 2014, an event dedicated entirely to education. Dr. Peri holds a B.A. from the Universidad de la República del Uruguay, where he also teaches, and a Ph.D. in sociology with specialization in demography from the University of Texas at Austin, USA.





Lindsey Richland

USA

Lindsey Richland is an associate professor in the Department of Comparative Human Development at The University of Chicago, where she investigates children's memory and analytical reasoning development. Much of her work explores children's emergent ability to think about relationships and make inferences such as through metaphor and analogy. Dr. Richland studies everyday instruction in the USA and internationally to develop practice-relevant tools grounded in theory for improving student outcomes in mathematics and science domains. A CAREER award from the National Science Foundation as well as grants from the Institute of Education Sciences and the Office of Naval Research support her work. Dr. Richland holds a Ph.D. in developmental psychology and cognitive science from the University of California, Los Angeles, USA.



Bethany Rittle-Johnson

USA

Bethany Rittle-Johnson is an associate professor in the Department of Psychology and Human Development at Vanderbilt University, USA. She is also director of their developmental sciences program. Her research focuses on learning of key concepts and problem-solving procedures in mathematics, with an emphasis on experiences that promote learning. She also works to design better measures of children's mathematics knowledge and partners with teachers to study instruction in classrooms. Dr. Rittle-Johnson received funding from the National Science Foundation and the Institute for Education Sciences (IES) and recently co-authored a synthesis of findings from IES-funded research on mathematics learning and teaching. She holds a B.A. in psychology from the University of Virginia and an M.A. and a Ph.D. in developmental psychology from Carnegie Mellon University, USA. She has also completed post-doctoral research at Carnegie Mellon in instructional design.



Harvey S. Sánchez

Ecuador / Mexico

Harvey S. Sánchez is the executive director of the National Institute of Educational Evaluation (Ineval) in Ecuador. Prior to this post, he served as advisor to the secretary of higher education, science and technology, and did consultancy work for the United Nations Development Program, National Autonomous University of Mexico, Ecuador's Government as well as foundations and national governments on topics such as education, wealth, and mobility policies. Dr. Sánchez is a member of the international advisory group of the Program for International Student Assessment at the Organization for Economic Cooperation and Development (OECD), serves as technical counsel at the National Institute for Educational Assessment and Evaluation of Mexico, as special advisor of GITS, and as national project manager for various international organizations. He has given over a hundred talks to various audiences, including academics, policymakers, business leaders, educators, and students. His research focuses on geo-statistics and territorial gaps, education policy, and national metrics for school performances. He is the author of chapters in books, journal articles, monographs, and reports, analysing various aspects of education cross-nationally for Mexican, Ecuadorean and international audiences. Dr. Sánchez holds a B.Sc. in psychology and in actuary, an M.Sc. in nonlinear dynamics and complex systems, and a Ph.D. in geography, all from the National Autonomous University of México.

Voldemar Tomusk

UK / Estonia

RAPPORTEUR

Voldemar Tomusk is an independent scholar and social commentator. He currently serves as director for policy and evaluation at Open Society Foundations, UK. Previously, he held various other positions at OSF's International Higher Education Support Program (HESP). While in HESP, Dr. Tomusk was responsible for managing the Foundation's grant program for innovative and alternative higher education institutions, running its program evaluation and policy development activities as well as the program development in Nepal and the Middle-East and North Africa region. Before joining OSF, he was the acting director for higher education and research at the Estonian Ministry of Culture and Education. Dr. Tomusk has published a significant number of works on higher education and related policies and reforms. He studied engineering, European studies and educational administration, and holds a Ph.D. in sociology of education from the University of Turku in Finland. Dr. Tomusk is a Fellow of Salzburg Global Seminar.



Kaye Wiggins

UK

Kaye Wiggins is a journalist at the *Times Educational Supplement*, where she covers qualifications and assessment. She entered journalism after completing a postgraduate journalism course in 2009. She has written for titles including the *Financial Times*, *Health Service Journal*, *Local Government Chronicle*, and *Third Sector*. Ms. Wiggins holds a degree in modern history from Oxford University, UK.



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Voldemar Tomusk is an independent scholar and social commentator. He currently serves as director for policy and evaluation at Open Society Foundations, UK. Previously, he held various other positions at OSF's International Higher Education Support Program (HESP). While in HESP, Dr. Tomusk was responsible for managing the Foundation's grant program for innovative and alternative higher education institutions, running its program evaluation and policy development activities as well as the program development in Nepal and the Middle-East and North Africa region. Before joining OSF, he was the acting director for higher education and research at the Estonian Ministry of Culture and Education. Dr. Tomusk has published a significant number of works on higher education and related policies and reforms. He studied engineering, European studies and educational administration, and holds a Ph.D. in sociology of education from the University of Turku in Finland. Dr. Tomusk is a Fellow of Salzburg Global Seminar.

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