



## KoKoHs Working Papers

### No. 5

Toepper, M., Zlatkin-Toitschanskaia, O., Kuhn, C. Schmidt, S. & Brückner, S.

Advancement of Young Researchers in the Field of Academic  
Competency Assessment

Report from the "International Colloquium for Young Researchers"  
from November 14-16, 2013 in Mainz

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*KoKoHs Working Papers* from the BMBF-funded research initiative  
“Modeling and Measuring Competencies in Higher Education”

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# Advancement of Young Researchers in the Field of Academic Competency Assessment

Report from the “International Colloquium for Young Researchers”  
from November 14-16, 2013 in Mainz

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## Advancement of Young Researchers in the Field of Academic Competency Assessment – Report from the International Colloquium for Young Researchers from November 14-16, 2013 in Mainz

### Abstract:

A main task within the “Modeling and Measuring Competencies in Higher Education (KoKoHs)” research program, which is funded by the Federal Ministry of Education and Research (BMBF), is the systematic and sustainable advancement of young researchers. To meet this challenge as well as to gain higher international visibility and to maintain and enhance existing international cooperations, the KoKoHs coordination office has organized the “International Colloquium for Young Researchers” from November 14-16, 2013 in Mainz. The present working paper documents insights into the sessions as well as impressions and critical reflections of the young researchers and international experts attending.

### Keywords:

Advancement of young researchers, International Colloquium for Young Researchers

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## 1 Introduction

As the last progress report<sup>1</sup> showed, the field of modelling and measuring academic competencies in higher education is a neglected research field in Germany. The BMBF-funded research initiative KoKoHs is not only the first German research initiative to promote modelling and measuring academic competencies in the tertiary education sector but also the first initiative in which young researchers are systematically trained for this specific and novel field of research.

A central goal of the KoKoHs initiative is to advance systematically and sustainably the next generation of scientists. Developing young researchers' competencies involves furthering their knowledge of structures, theories, and methodologies (e.g. through workshops) as well as enhancing their international networking skills so that they gain greater visibility and build strong connections within the scientific community.

A great opportunity to meet both challenges was the "International Colloquium for Young Researchers", which took place from November 14 to 16, 2013 at the coordination office site in Mainz. At this conference, young researchers had the opportunity to present their planned doctoral and post-doctoral projects to renowned and prominent international experts from various fields of research (e.g., statistics, psychology and empirical education research) as well as to other young researchers, and then discuss the projects and give and receive feedback.

The international colloquium offered an excellent platform for discussion on the researchers' projects. The 26 young researchers – most of them working within the KoKoHs research initiative - took advantage of this special occasion to discuss the current state of measuring competencies in higher education and to gain important impulses for their own research projects. This opportunity to debate issues and share insights with peers and experts helped strengthen compatibility of the projects and increase their visibility on an international level.

On Friday a meeting about international compatibility was held and attended by all national and international experts, young researchers and project participants. This round table was led mainly by national and international experts, who contributed to the meeting with podium discussions focusing on two essential, general topics of the projects: theoretical and methodical challenges and solutions to measuring competencies.

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<sup>1</sup> For further information see Kuhn, C. & Zlatkin-Troitschanskaia, O. (2011). Assessment of Competencies among University Students and Graduates – Analyzing the State of Research and Perspectives (Working Paper, 59) Mainz: Johannes Gutenberg University.

Aside from the official program of the conference, the two social evenings on Thursday and Friday as well as the “breakfast with experts” offered young researchers the opportunity to network with renowned international experts and to get to know each other on a more personal level, thus ensuring a closer exchange among all the participants of the event.

The present working paper provides insight into the coordination office’s work on advancing the next generation of researchers by sharing information on the activities of this inspiring colloquium. Additional food for thought can be obtained from the critical and constructive reflections, comments and questions of the international experts at the end of this paper. These contributions point out quite clearly the essential challenges faced within the KoKoHs research initiative in terms of theoretical, methodological, and structural tasks.

We want to thank all international and national experts as well as all the participants for their inspiring contributions, which made this colloquium an outstanding event!



## 2 Current state of the “KoKoHs” research program

“Dear Dean, colleagues, international experts, young researchers, and guests,

It is my great pleasure today, and I am also speaking on behalf of Professor *Sigrid Blömeke*, to welcome you all to Mainz. We are very fortunate to have so many colleagues from abroad and from Germany attending, who have been supporting our KoKoHs program since the very beginning. We are also very happy to have gained more recently further support for this conference from a number of renowned international experts. I would like to take this opportunity to briefly recall some aspects of the KoKoHs program and to talk about its current state and progress.

In 2009, our expertise report (Zlatkin-Troitschanskaia & Kuhn, 2010) revealed an extreme research deficit, particularly in Germany, in empirical research on competency assessment of students in higher education. Current publications continue to show how important research in this area is. Consider, for example, the recently published results of the PIAAC study, which focuses on the international assessment of basic competencies of adults. The results show once again very clearly that we are able to offer effective academic education only if we can formatively and summatively assess competency development – while including the various determinants involved, such as basic skills or competencies. Developing suitable measuring instruments and applying them on a large scale is a fundamental prerequisite to planning and evaluating long-term optimization measures on the individual and structural levels (for example adequate didactical concepts).

To address the enormous research deficit, the KoKoHs program has been dedicated to reaching two major goals:

- firstly, to foster research throughout Germany in the area of competency assessment in higher education; and
- secondly, to increase our global visibility and compatibility with international research projects.



Source:ESRI

Thanks to funding provided by the Federal Ministry of Education and Research, we have been able to achieve our first goal: KoKoHs is a fundamental research program. In its current first stage, it involves about 220 researchers from 14 German states as well as from Austria. These researchers work at over 50 higher education institutions in around 70 single projects. Together, we investigate two general questions:

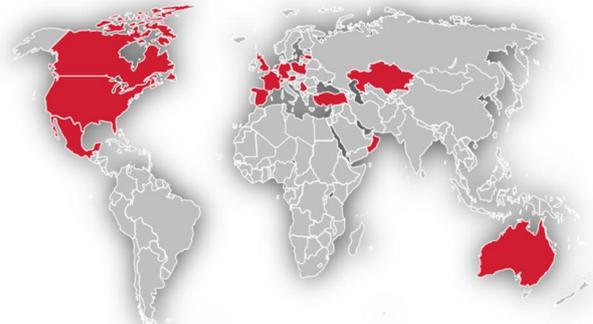
1. How can we theoretically model the generic and domain-specific competencies of students?
2. How can we develop and validate suitable measuring methods to assess these competencies?

So far, we have completed about half of the program: The newly developed instruments are currently being comprehensively tested. From the viewpoint of the coordination office, we are able to look back on an eventful history. I will mention just some of the activities and highlights. We saw some round-table discussions (for example on validation, and on cognitive modeling approaches) and many workshops (on quantitative and qualitative analysis approaches), where participants were able to exchange their ideas, experiences, challenges and so on. We are particularly proud of having secured places for some of our young researchers in the internationally acclaimed methods workshop of the AERA. Furthermore, we are very pleased to have initiated not only numerous international conference papers, but also one national and two international special issues on the topic of "Assessment of Competencies in Higher Education" (to be published in 2015). After this conference, there will be more special events, including the Junior Faculty Conference and the international closing conference, next autumn.

We have received very positive feedback on KoKoHs so far, for example at international conferences such as the EARLI and the AERA. This positive feedback shows us that international researchers also perceive the program to be highly interesting and beneficial. Our initial results are eagerly awaited.

We will gain systematic feedback in 2014 through a comprehensive evaluation of the first phase of the funding program. The evaluation will aim in particular to prepare and provide justification for a second funding phase of the KoKoHs program. This is why we would like to ask the project members for their active support today. Please look into and answer any inquiries we may have on your project. It will be for the benefit of the entire program.

To accomplish our second goal of international visibility and compatibility, we have striven since the very first day of KoKoHs to gain international experts in the related fields of research and to engage with them in vigorous exchange and dialogue. We were able to welcome over 50 international experts from 18 countries on 3 continents at our first international conference in Berlin in 2011, which of course also illustrates the international relevance of the research questions we address.

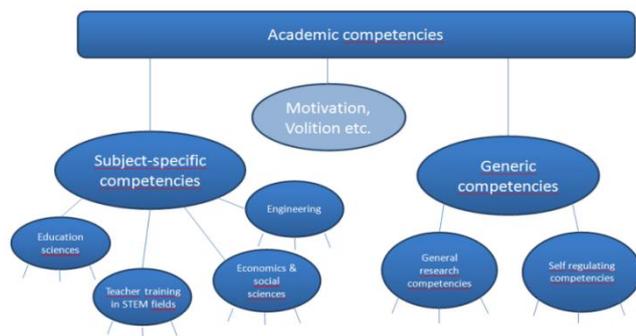


Source: <http://www.powerpointslides.net/powerpointgraphics/powerpointmaps.html>

Since 2011, we have received critical and constructive advice not only from our scientific advisory board, which includes two international experts, but fortunately also from other international experts, in particular Richard Shavelson, who have been supporting the program by providing valuable feedback and input and have given important impulses for its development.

And we are especially proud and happy today to warmly welcome once again our 11 international experts from 4 countries, whom we would like to thank for their tremendous commitment to this conference and to the whole program. Most of them have come from far and wide to Mainz during this (cold and) unattractive season to lend their expertise to all of us during these three days. Thanks to their dedication, we have been able to offer our young researchers and all other KoKoHs members this unique opportunity to receive very intensive counseling and mentoring. As preparation for this conference, the young researchers first received feedback on their submitted project abstracts from two experts in a blind review process. After receiving this feedback, they revised their abstracts and used them to prepare their project presentations for this colloquium. Over the past few days, the young researchers have had the opportunity to discuss specific details of their projects with the experts as well as their peers. And, there will be an additional opportunity tomorrow to address still unanswered questions and to seek further advice at our "breakfast with experts".

Still, I must concede that not all of the young researchers of the program have presented their



Source: [http://www.kompetenzen-im-hochschulsektor.de/403\\_ENG\\_HTML.php](http://www.kompetenzen-im-hochschulsektor.de/403_ENG_HTML.php)

research projects. Currently, there are altogether 59 researchers with doctoral projects and 10 with post-doctoral projects in the program. To invite these researchers as well as the project directors to join in the exchange and dialogue with the experts, we have explicitly chosen today's format as an open panel discussion.

Over the past two days we have seen the breadth and the quality of the projects in the KoKoHs program, as well as the theoretical and methodological challenges that we all need to address together in this program. The two panels are a wonderful opportunity to discuss the key questions of, first, the theoretical and conceptual challenges and, second, the methodological challenges of modeling and measuring competencies in higher education. During the discussions we will focus on general topics relevant to all projects, but the project directors are nonetheless invited to contribute specific questions from their projects. At the end of both panels, Rich Shavelson will summarize key results and will evaluate their relevance for the program. Our aim today is to share perspectives on the future and to agree on specific further steps, while keeping in mind the present issues raised during the discussions.

Finally, I would like to thank (again) all of our participants. My special thanks go to the young researchers, our national and international supportive friends, the scientific advisory board members, who continuously support us on a voluntary basis, not only with this conference but throughout the whole program, and last but not least I want to thank my faculty members and students, who have worked around the clock over the past few weeks and months to make this conference a success – in particular Susanne Schmidt, Sebastian Brückner, Dr. Christiane Kuhn, Miriam Toepper, Charlotte Noll and Dimitri Molerov.

And now, I would like to pass the floor to our panelists. I am looking forward to a day full of stimulating discussions!"

*Olga Zlatkin-Troitschanskaia, Johannes Gutenberg University Mainz, Germany*

### 3 Structure and content of the young researchers' sessions

There were 26 abstracts submitted by young researchers which were reviewed by international experts and supportive friends in a double blind review process. Thereafter, the young researchers received feedback from two experts and had the opportunity to revise their abstracts and prepare presentations of their projects for the colloquium. During the three-day colloquium, the young researchers had the opportunity to discuss specific details of their projects with experts and peers. In addition, they were offered the opportunity in a more informal context to address still unanswered questions and seek further advice during the dinners and evening events on Thursday and Friday as well as during the "breakfast with experts" on Saturday.

The sessions of the young researchers provided an excellent overview of the variety, breadth and scope of the projects within the KoKoHs program. Projects from different disciplines (e.g., education sciences, teacher training in STEM fields, engineering, business, economic and social sciences) were presented



### 3.1 Conference program

Thursday November 14, 2013

Time	Program
From 10:30	Registration
	Two parallel sessions
	Session 1
	Professor Christoph Metzger (Universität St. Gallen)
	Moderated by Professor Li Cao
11:00 – 12:30	11:00 – 11:30 Christina Linninger
	11:30 – 12:00 Stefanie Berger
	12:00 – 12:30 Olga Kunina-Habenicht
	Session 2
	Professor Ronald K. Hambleton (University of Massachusetts Amherst)
	Moderated by Professor Fritz Oser
	11:00 – 11:30 Susanne Schmidt
	11:30 – 12:00 Stefan Behrendt
	12:00 – 12:30 Roland Happ
12:30 – 12:45	Time for discussion
12:45 – 13:45	LUNCH BREAK (light meal)
	Two parallel sessions
	Session 3
	Professor Camilla P. Benbow (Vanderbilt University)
	Moderated by Professor Stefan Hornbostel
13:45 – 15:15	13:45 – 14:15 Sascha Hasse
	14:15 – 14:45 Simone Dunekacke
	14:45 – 15:15 David Buschhüter
	Session 4
	Professor James W. Pellegrino (University of Illinois at Chicago)
	Moderated by Professor Fritz Oser
	13:45 – 14:15 Sebastian Brückner
	14:15 – 14:45 Sarah von der Mühlen
	14:45 – 15:15 Julia-Carolin Brachem
15:15 – 15:30	Time for discussion
Time	Program
15:30 – 16:00	COFFEE BREAK

	Two parallel sessions
	Session 5 Professor Sabine Krolak-Schwerdt (University of Luxembourg) Moderated by Junior Professor Manuel Förster
16:00 – 17:00	16:00 – 16:30 Nicola Brauch 16:30 – 17:00 Sonja Rosenbrock
	Session 6 Professor Jean-Paul Fox (University of Twente) Moderated by Professor Li Cao
	16:00 – 16:30 Lars Jenßen 16:30 – 17:00 Sabrina Mathesius
17:00 – 17:15	Time for discussion
17:15 – 17:30	COFFEE BREAK
	Two parallel sessions
	Session 7 Associate Professor Alicia Alonzo (Michigan State University) Moderated by Junior Professor Manuel Förster
17:30 – 18:45	17:30 – 18:00 Benjamin Anders 18:00 – 18:30 Britta Schreiber
	Session 8 Assistant Professor Edward W. Wiley (University of Colorado at Boulder) Moderated by Professor Li Cao
	17:30 – 18:00 Cora Joachim 18:00 – 18:30 Svenja Hammer
18:30 – 18:45	Time for discussion
19:45	DINNER (Buffet)

Friday November 15, 2013

Time	Program
	Two parallel sessions
	Session 9 Professor Richard J. Shavelson (Stanford University) Moderated by Professor Christiane Spiel
9:30 – 11:00	09:30 – 10:00 Corinna Lautenbach 10:00 – 10:30 Janina Rolof-Henoch 10:30 – 11:00 Elena Bender
	Session 10 Professor David Lubinski (Vanderbilt University) Moderated by Junior Professor Manuel Förster
	09:30 – 10:00 Elisabeth Tomczyszyn 10:00 – 10:30 Jurik Stiller 10:30 – 11:00 Philipp Straube
11:00 – 11:15	Time for discussion

Time	Program
11:15 – 12:00	LUNCH BREAK (light meal)
12:00 – 12:30	Official opening ceremony with the university vice president, the dean, and Professor Olga Zlatkin-Troitschanskaia with an overview of the current state and progress of the KoKoHs program
12:30 – 14:30	Panel discussions with KoKoHs project teams and experts on the topic “Conceptual Questions in Competency Modeling “ (Moderated by Professor Detlev Leutner)  Experts: Associate Professor Alicia Alonzo Professor Camilla P. Benbow Professor Christoph Metzger Professor David Lubinski Professor Fritz Oser
14:30 – 15:00	COFFEE BREAK
15:00 – 17:00	Panel discussions with KoKoHs project teams and experts on the topic “Challenges in Measuring Methodology” (Moderated by Professor Christiane Spiel)  Experts: Associate Professor Li Cao Professor Jean-Paul Fox Professor Ronald K. Hambleton Professor Sabine Krolak-Schwerdt Professor James W. Pellegrino Assistant Professor Edward W. Wiley
17:00 – 17:15	COFFEE BREAK
17:15 – 18:00	Final discussion/Conference wrap-up: Future perspectives and further steps of the KoKoHs initiative (Moderated by Professor Richard J. Shavelson)
19:15	DINNER

Saturday November 16, 2013

Time	Program
9:00 – 11:30	“Breakfast with Experts“

Official closing of the conference

## 3.2 Participants

The coordination office invited 11 renowned international experts (e.g., from the USA, the Netherlands, Switzerland and Luxembourg) with different research focuses (e.g., statistics, psychology and empirical education research) covering various fields of research within the KoKoHs initiative to attend the conference and thereby help establish and expand a strong network of expertise and to help researchers and their projects gain greater international visibility.

Thanks to the tremendous commitment of the international experts and supportive friends, the KoKoHs coordination office was able to offer the young researchers and all other KoKoHs members the unique opportunity to receive very intensive counseling and mentoring. The experts reviewed the submitted abstracts of the young researchers in a blind review process and gave feedback. In addition, the experts took part in all the presentation sessions, so the young researchers had the opportunity to discuss specific details of their projects with them. Furthermore the young researchers were given the opportunity to address unanswered questions and obtain further advice during the more informal dinners as well as during the “breakfast with experts”. In addition to these intensive working sessions, our international experts took part in our two panel discussions during which the topics of “conceptual questions in competency modeling” and “challenges in measuring methodology” were discussed extensively.



Alica C. Alonzo

Institution: Michigan State University (USA)

Position: Associate Professor

Expertise: science education, physics education, teacher knowledge, formative assessment, learning progressions, measurement

Camilla P. Benbow

Institution: Vanderbilt University (USA)

Position: Distinguished Professor, Dean, Peabody College

Expertise: gifted, mathematics and science learning, talent development, educational policy, teacher education



Jean-Paul Fox

Institution: University of Twente (Netherlands)

Position: Professor

Expertise: item response theory, survey methods, psychometrics, Bayesian analysis

Ronald K. Hambleton

Institution: University of Massachusetts Amherst (USA)

Position: Distinguished University Professor

Expertise: applications of item response theory, large-scale assessment, setting performance standards, score reporting



Sabine Krolak-Schwerdt

Institution: University Luxembourg, Campus Walferdange (Luxembourg)

Position: Professor

Expertise: psychological-pedagogic diagnostic, multivariate methods, cognitive social psychology

Li Cao

Institution: University of West Georgia (USA)

Position: Professor

Expertise: theory and measurement of self-regulated learning



David Lubinski

Institution: Vanderbilt University (USA)

Position: Professor

Expertise: individual differences, intelligence, intellectual precocity, psychometrics, talent development

Christoph Metzger

Institution: University of St. Gallen (Switzerland)

Position: Professor (Em.)

Expertise: business education, self-regulated learning, performance assessment, vocational education



James W. Pellegrino

Institution: University of Illinois at Chicago (USA)

Position: Distinguished Professor; Institute Co-Director

Expertise: cognition and instruction, assessment design and use, educational technology, science learning and instruction, mathematics learning and instruction, educational policy, teacher education

Richard Shavelson

Institution: Stanford University & SK Partners (USA)

Position: Margaret Jacks Professor (Em.) & Chief Scientist

Expertise: conceptual, psychological and psychometric aspects in the measurement of cognition, performance, and competition



Edward W. Wiley

Institution: SK Partners, LLC (USA)

Position: Assistant Professor of Education, Senior Measurement Scientist

Expertise: applied statistics, psychometrics, program evaluation

## 4 Feedback and reflections

### 4.1 Young researchers' reflections

#### 4.1.1 Reflection 1

My dissertation project I presented on the International Colloquium for Young Researchers with the working title "Methodological Approach for the Development and Verification of a Competence Model and Measurement Instruments for Teaching Computer Science" is embedded in the Project "KUI" ("competences for teaching computer sciences"). It has the main aims to describe the methodological approach for modeling competencies in computer science teacher education and the testing of these competencies by appropriate measurement instruments. I would like to give impressions about this International Colloquium belonging to three aspects: The organization of the Colloquium, the possibilities to get into contact and the main benefits for my dissertation project. For me the main point in the organization of the Colloquium is that it represented general conference structures. By the double blind review process on the content of my dissertation project I received useful hints on optimizing contents and the structure of the planned presentation. By this step I got helpful remarks on the state of my work and clear hints which aspects I should work on. I believe this process clearly enhanced the quality of my presentation – as well as the quality of the other presentations in the sessions. Furthermore the chance to get into contact and conversation with the invited experts was quite well organized, too. We had several formal and informal opportunities to put our questions to the experts and to discuss our topics. The presentations of the research issues were put into a professional and really constructive context. I can take benefits from concrete and specific feedback on my presentation which was clearly drawn to my research questions. I personally, being involved in computer science teacher education, got many helpful remarks about research methods in teacher education and the state of research in the US, which is usually seen as pioneer research from the German point of view. I profit from concrete comments on my research design, research methods and further literature with regard to my research topic.

*Elena Bender, University of Paderborn, Germany*



#### 4.1.2 Reflection 2

The three days in Mainz were really exciting for me because it was the first time I participated in an international colloquium in order to present my PhD project (“Explaining teachers’ resignation tendency”). First of all, the review process in preparation of the colloquium was very helpful for me as I received two independent reviews and the possibility to revise my work. During the colloquium, I liked that we only had two sessions at the same time, which allowed every one of us to see a wide range of presentations and discussions. I really enjoyed that the general atmosphere was so constructive and supportive. All experts seemed to be very well prepared and interested. The feedback I got was very constructive and helpful with regard to theoretical and methodological aspects as well as concerning the overall relevance and the potential implications of my PhD project. In my point of view, the registration time slot at the beginning of the colloquium could have been a little bit longer and the panel discussions on the second day a little bit shorter or organized in a more interactive way. However, all in all, the “International Colloquium for Young Researchers” was a great experience for me as I had the opportunity to meet 11 international experts and other young researchers and to discuss my work with them. Networking and getting to know each other better was additionally supported by having breakfast, coffee breaks, and dinner together.

*Julia-Carolin Brachem, University of Oldenburg, Germany*



### 4.1.3 Reflection 3

When I started my PhD project in November 2011, I was quite curious to know what it would mean to be part of this huge initiative of KoKoHs. In the beginning, several very well prepared and useful workshops were organized and all participating young researchers got to know each other and learned a lot, especially concerning methods of competency modeling and assessment. In fall 2014 however, that was our belief, the highlight of our years together was still to come – “The International Colloquium for Young Researchers” in Mainz.

We did not exactly know what to expect – a conference only with presentations or a colloquium with comments. The latter would have been quite late to some extent because of us being working on our projects up to two years already. But having the title in mind and that some projects could have started not until 2012 we prepared ourselves for a colloquium, where we would present our projects and, if existing, our findings; where renowned international experts would be given the chance to comment on our concepts.

So we made our way to Mainz, a beautiful town in Rhineland-Palatinate in southwestern Germany. On the 14<sup>th</sup> of November, we arrived. Since there was no official appointment, we had the chance to explore the city a little bit; particularly the Rhine riverside impressed us very much.

The conference was held at the Johannes Gutenberg University of Mainz, a beautiful venue that provided a familiar and constructive atmosphere. The rooms were appropriate, the technical equipment worked, the catering was quite good. I would like to stress that the two dinner venues did actually outdo my expectations, delicious food and, particularly on Friday, a beautiful restaurant in the heart of Mainz.

On the 15<sup>th</sup> of November the conference started without a classical welcome session; we went directly into medias res. In several presentations my fellow young researchers showed their projects and ideas, their competency models and findings. It was very impressive to watch them present their research on a very elaborate and professional level. Admittedly, the structure of the conference (two parallel strands) did not allow us to listen to all of them, but that must be taken into account when 29 young researchers give presentations in two days. Surprisingly, the approaches differed a lot, though the overarching (theoretical) framework was the same (as it was provided by the fundamental research findings of the framework coordinators). But that also should be normal since we come from so many different fields with different traditions and previous research.

Another very special feature, of course, was the presence of the international experts. Until then, I (and probably most of the others, too) had only read their papers or watched them giving keynote presentations as part of international conferences. Now, however, we had the chance to listen to

their comments and to follow their argumentations while we sat next to them. We had the chance to talk to them in the breaks, to tailor our requests and to ask for advice. Here I'd like to briefly describe a little but significant lack of consensus, too. As expected, the international researchers had not completely congruent understandings of the term "competency". Plus, the experts seemed to be, to some extent, unfamiliar with the KoKoHs initiative itself. That might have led to some surprising comments in the beginning of presentations. Here the international senior researchers sometimes stated that they appreciate the idea of modeling and measuring competenc(i)es (which of course is precisely our job). But apart from that the comments referred exclusively concrete to the projects, not to mention the high level these comments had and the high impact they moreover will have on the quality of our projects.

That is indeed the overall feeling I had (and so did my fellow young researchers as I assume) – the conference was an outstanding chance. It may have been an once-in-a-lifetime opportunity – the way that those experts provided an "objective" (at least external) view on our projects will definitely help us find out where to put a focus on in the next month and years.

The scientific program of the second day ended with two plenary sessions on November 15<sup>th</sup>. After a welcome session Prof. Alonzo, Prof. Benbow, Prof. Krolak-Schwerdt, Prof. Lubinski, and Prof. Metzger first discussed conceptual questions (of competency modeling); afterwards Prof. Li Cao, Prof. Fox, Prof. Hambleton, Prof. Pellegrino, and Prof. Wiley spoke about issues and challenges of measuring competencies. The discussions were partly controversial, always lively and focused. The second day ended with a conclusion of Prof. Shavelson, who summed up the areas of consensus as well as the controversies. In particular the simple but fundamental clarification of how different researchers (or researches working under different paradigms) operationalize skills/competency/(cognitive) ability/(cognitive) disposition (as I mentioned above) might be an exciting field.

On the 16<sup>th</sup> of November the conference ended with a more informal opportunity of getting in touch with each other – we were having breakfast together. Again it turned out to be a constructive, a familiar atmosphere and several discussions and project-related consultations did probably even excel the impact of the previous days.

To sum up, I'd like to thank the organizers of the KoKoHs initiative for their work! The conference was held in a nice town, the university provided perfect conditions for intense discussions, and the experts were extremely open-minded and motivated and willing to provide valuable information and comments.

*Jurik Stiller, Humboldt-University of Berlin, Germany*

## 4.2 Experts' reflections

The following sections contain the experts' original comments and reflections on the colloquium. These texts have not been modified on purpose. The intention of publishing these comments in their original versions is to show the authentic critique of the experts. We would like to point out that the controversial discussion on the complex issue of modeling and measuring competencies in higher education within the experts' comments reflects somewhat the controversial positions and convictions within the scientific community. We are convinced that these critical but constructive statements could help all of us think about these controversial aspects in principle and make further progress within the KoKoHs research initiative.

### 4.2.1 Comments on structure

#### 4.2.1.1 KoKoHs – A drop in a bucket or a snowball setting off an avalanche?

Using common sayings opens up a wide range of associations. The one I would like to focus on refers to a time dimension, namely the period needed until the effects of a research program like KoKoHs will show practical effects. Asking public authorities for funding research routinely provokes questions about what the practical gains of such a project might be and how long one might have to wait for their appearance. If it is possible to tell that a project lies in the field of natural sciences and deals with pure research, the potential financier is likely to withdraw his question because everybody knows that in this case a clear answer cannot be given. In the social sciences the circumstances are usually quite different. The claimant has to provide proof that the research to be conducted will end up with an improvement in her or his field of interest otherwise the chance to get subsidies will decline dramatically.

The KoKoHs program is in its first phase, which lasts for three years and is devoted to working on two tasks: generating theoretical models of the structure and development of competencies during studies at a university in different academic disciplines (engineering sciences, social and business sciences, teacher education in different subjects, education and psychology, multidisciplinary competencies) and producing measuring instruments which allow for the diagnostics of these competencies. In a second phase of another three years it envisages field studies of the processes and the results of the academic achievements of students.

Up to this point no practical utility was visible. However, one can imagine that the findings of this research might help in discovering weaknesses in the arrangement of the respective academic study courses as well as inspiring ideas about how to improve them and make them more efficient. But

even if effects of this kind occur, the world outside the university will not be affected by the changes the study paths have undergone. Let us assume for a moment that alterations based on results of the field studies mentioned above will raise the success of the course of studies involved in the medium term, i.e. so that graduates leave universities showing higher levels of competency than their predecessors. Again, this will not necessarily result in immediate and apparently noticeable improvements in the different fields of practice which graduates enter. To get a noticeable result in such a case it would be necessary for all members of a whole cohort of post-graduates to be better educated than their forerunners and to start jointly as employees in companies or as teachers in schools and initiate observable ameliorations of production which on their part lead to a measurable better output at these locations. That this would happen is not only very unlikely but almost entirely impossible (partly because all entrants usually need at least some years to gain experience in their field of occupation to become more professional).

To put it in other words, improvements in (higher) education – whatever this means in detail – never result in direct measurable effects in society as a whole. It would take many, many years until any change in the world outside the educational institutions might be perceivable. And even if such an effect might occur after years and might be remarked on it would be nearly impossible to trace it back to its origin.

On the other hand, not arguing in terms of aggregates (cohorts, the world outside the university) but on an individual basis, better educated persons might have better opportunities to get a job. That this is true can be observed by studying the correlation between grades (i.e. degrees of competency) and success in job history. However, grades are always relative to a peer group. This means that if all individuals in a peer group are better educated, again the best graduates will have the best opportunities. Therefore the effect of better education shared by all peers cannot be registered in terms of better opportunities.

What does this mean for a program like KoKoHs? Nobody will be able to determine whether its outcomes are only a drop in the bucket of improvement problems of university education, whether they set off an avalanche of pedagogical reforms or whether they do not have traceable effects on praxis outside the university. However, around two years since the program started, we can already state that KoKoHs projects have initiated the beginning of a deeper understanding of the educational processes of higher education as processes of imparting and acquiring academic competency. This is an example of basic research in social sciences which in the long run provides the knowledge necessary for interventions in study programs – interventions which are no longer merely based on intuition, speculation and hopes but on accurate causal insights into the microstructure of competency development processes. It is this potential that justifies the money spent on the

program and that motivates the great effort of many excellent researchers in developing competency models and measuring instruments in this field. The funding of such a research program by public authorities is a good signal that one has understood that progress in this field requires a considerable amount of stamina and that it would be wrong to expect rapid success to be visible to everyone.

*Klaus Beck, Johannes Gutenberg University Mainz, Germany*

#### 4.2.1.2 Reflection on the International Colloquium for Young Researchers

##### Research of high relevance

Teacher education needs to prepare and support future teachers in their transition into practice by developing their professional competencies so that they can accomplish their challenging and manifold tasks for the students' benefit and to their own satisfaction.

The variety of research projects within the framework of BilWiss-Beruf (role of broad educational knowledge and the acquisition of professional competency of teacher candidates for career entry) made me aware more than I have been hitherto, that – in order to reach the above-named *overarching goal* – in particular *three questions* deserve further study: Firstly, which are the teacher students' cognitive and motivational prerequisites? Secondly, how far can these prerequisites be influenced? And thirdly, which are the main institutional as well as personnel actors and their respective demands and constraints? Answering such questions is of great interest as well independently of each country's specific teacher education system as specifically for Germany's three phase system (university studies, induction phase accompanied by the "Studienseminar", first period of in service).

##### Some specific observations and "however's"

It is convincing to use Shulman's triad – teachers' content knowledge, pedagogical knowledge and pedagogical content knowledge – as a central *theoretical grounding*. However, instead of focusing on these three dimensions separately or only partially, their concurrence should be taken more explicitly into account as a probable key factor of successful teaching. Moreover, "knowledge" should not be seen as knowing content in a narrow sense only, but be understood as a rich repertoire to perform in educational situations, that means as teachers' real comprehensive competencies.

Among the projects a rich variety of survey studies of different scope are to be found. Yet, in the continuation of this research more *interventional studies* are desirable focusing on variations of shaping and linking phases of teacher students' transition into practice.

According to the focus on transition very often a time frame mirroring the *phases of teacher education* from university to in service is used in order to capture teacher students' or young teachers' competencies respectively. However, it seems crucial to define, what is meant by "competencies" at different stages and how far comparison and measurement of changes are possible considering the different phases' specific goals.

Throughout the projects, elaborated instruments are used to measure variables of interest, quite often taken from a preexisting set of instruments which were designed for a preceding or more comprehensive project. Though, it has to be ensured that not an already existing test but the *underlying research question should define a study's design* including the outcomes to be measured and leads to an adequate construction or selection of instruments. In line with this, *mixed method designs* are the best choice for many projects in order to capture the behaviors' whys and wherefores and to approach "real life". So, in addition to the predominantly chosen quantitative, standardized measurements, supporting qualitative studies are strongly recommendable for many of the projects.

#### Outlook

Since in the end, with regard to the overarching goal, all research projects should contribute to the advancement of teacher education practice, I look forward to reading the concluding chapter of each single project report, in order to find out about the main implications and recommendations based on its research findings.

*Christoph Metzger, University of St. Gallen, Switzerland*

## 4.2.2 Comments on Methodologies and Program

### 4.2.2.1 Collecting and analyzing data and making inferences when dealing with competencies

In most of the about 70 projects in KoKoHs (e.g., 2012 conference on 'Modeling and measuring competencies in higher education'), data related to competencies required in higher education are collected. The data are needed to support data-based decision making. This follows the common trend in educational research, which is expected to be driven by data. At different levels of the education system (e.g., school, class, teacher, student) different types of data are collected and analyzed in order to come to a conclusion. The data are expected to be an important source of information to assess improvement and to review the effectiveness of teaching and learning

programs. High quality data are becoming more important directly stressing the importance of high quality measurement instruments and profound statistical techniques.

In competency assessment and modeling, various complexities arise in measuring but also in analyzing structural relationships. These challenges follow directly from the fact that the competency concept comprehends different constructs or cognitive dispositions to handle specific tasks or situations (Blömeke, Zlatkin-Troitschanskaia, Kuhn, and Fege, 2013). The multidimensional nature of competency makes it much more difficult to measure accurately all its aspects. It requires a thorough understanding of all subdomains, how they are related, and how to measure each subdomain.

As remarked by Koeppen, Hartig, Klieme, Leutner (2008), competencies are expected to be context-specific. It will not be possible to use a general standardized assessment method. On the contrary, each measurement instrument should capture the context (e.g., individual situation) of the competency to reflect the specific nature of the competency.

Another important aspect of measuring competencies is the operationalization of the competencies. This comprehends the necessary path to relate assessment data to competency performance. This translation from competencies to different constructs, which are measurable using psychometric methods remains challenging. The multidimensional and the context-specific characteristics of a competency complicate further the development of a measurement instrument.

The complexity of assessing competencies is perhaps better understood when considering Shavelson (2013), who identified and described seven competency and assessment components (i.e., complexity, performance, standardization, fidelity, level, improvement, and disposition). They require careful attention in defining instruments and assessing competencies. It provides a general framework of criteria, and subsequently specifies the (theoretical) assessment, which meets all criteria, optimal to assess the competency.

In practice, in the projects of KoKoHs, it was observed that not all criteria were always perfectly met. For some competencies, other factors could have influenced the assessment results or some competency components were not exactly represented by the instrument. After defining the theoretical and operational concept, the implemented tasks and/or items targeted to measure each specific feature of the competency were not always producing consistent observations.

#### Latent variable modeling

To validate an instrument and to investigate how to interpret the scores, the latent structure underlying the data needs to be evaluated. A latent variable analysis will provide information about the validity and reliability of the competency scores. When measuring and modeling competencies where the latent dimensional structure is often high-dimensional and complex, such a latent variable

analysis is very important. It will give support to interpret correctly the competency scores, to address specific features of the measurement instrument, and to test hypotheses.

The collected data should support such a latent variable analysis. However, obtaining high-quality complete data is difficult. Issues of missing data, questions that do not differentiate properly, and inconsistent response behavior, among other things, can complicate the analysis. Ignoring issues of missing data or ignoring observed data can endanger the analysis and the statistical inferences. At the same time, collecting more data to address shortcomings is often not possible, for example, due to time constraints and/or economic reasons.

Developments in latent variable modeling support the analysis of complex data. More advanced latent variable models can deal with different levels of analysis, incomplete designs, missing data, among other things (e.g., Muthen, 2002). Instead of collecting more data, a latent variable model can be used to address peculiarities and to address violations of common measurement models.

In conclusion, in competency modeling, it is essential to appropriately model the data to make correct inferences. The latent variable modeling framework can address the specific features in competence modeling and can be used to make profound conclusions.

*Jean-Paul Fox, University of Twente, Netherlands*

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#### 4.2.2.2 Comments on and Reactions to the International Colloquium for Young Researchers on Modeling and Measuring Competencies in Higher Education

I consider it a privilege to have been asked to participate in the International Colloquium for Young Researchers held in Mainz, Germany in November 2013. These comments and reactions are intended to provide an impression of the work presented at the meetings as well as the objectives of the larger set of KoKoHs Projects as I currently understand them. I have organized these remarks in terms of four substantive topics: (1) the scope of the KoKoHs portfolio; (2) models of competency; (3) issues of measurement, validity and modeling; and (4) human capital development.

##### The KoKoHs Portfolio

The portfolio of work presented at Mainz, and the additional information provided about the full set of projects being pursued under this initiative, indicate that the KoKoHs enterprise is impressive in its scope. Attempting to model and measure a domain as broad as competencies in higher education is a significant challenge from a number of perspectives. It was clear from the papers presented and discussed that the range of competency domains is rather large and thus I was not able to obtain a coherent picture of how the domains were chosen as well as how the work within and across domains coheres in terms of approach and intended outcomes. This is not to say that there isn't coherence at this level of description of the work but rather to question how one actually communicates how the work is conceptualized and its scope as well as the intended outcomes from this initial round of funded projects. Thus, I think it will be very important for the leaders of this work to find ways to define and present the rationale behind the organization of the work as well as some of its delimiting features. Accompanying this would be a clear sense of the intended outcomes from this initial round of work and a justification for choices made at the outset so as to maximize the benefits of the investment as well as to project what is likely to be needed as a followup set of activities. It is clear that the individual and collective set of projects will have made substantial progress in meeting the goals of Modeling and Measuring Competencies in Higher Education and it will be especially important to find ways to communicate what has been learned relative to what was intended and what remains to be done to most profit from the initial investment. I suspect that communicating about the work of KoKoHs will require a thoughtful approach to the information needs and goals of multiple audiences who might be expected to benefit from the work. Clarifying those audiences and their information needs would be very beneficial with respect to this critical communication and reporting function.

## Models of Competency

Competency can mean many different things depending on the nature of the domain as well as who the audience is that has been asked to consider the nature of competency and its implications. One thing that was not clear from the work presented is whether there is a consistent conceptualization of how the various projects are defining and modeling competency. I was left with the impression that the nature of the model being used to drive various empirical efforts varied widely in the nature of the components of competency that were included in the model as well as the “grain size” or level of detail associated with the constructs in the model. This poses a significant challenge in making connections across projects and across domains. What needs to be done is to clarify these issues related to modeling and describe the nature of the similarities and differences in the models as well as a rationale for the variations and their potential implications. Each of the projects I heard about was interesting in its’ own right and was using various reasoned descriptions of the competencies under exploration. But the nature of the model seemed to be highly variable and driven by multiple factors including what data and measures might be available versus a comprehensive conceptual model of the domain in terms of psychological and educational constructs. Thus, I would suggest that some time and effort be put into a consideration of the models of competency under exploration that includes an analysis of similarities and differences and whether there are deep epistemological and conceptual issues differentiating the work. This will be very important in determining what the collective KoKoHs work implies for higher education reform.

## Measurement, Validity and Data Modeling

My comments in this section are connected to those above regarding the nature of the models of competency and the constructs contained in those models. One of the things that struck me across the various presentations was the great diversity of measures being used in the empirical work and the extent to which they might be considered valid relative to the constructs of interest. In some cases an extensive effort was underway to develop measures of constructs and engage in processes of data collection to validate those measures before using them in further empirical work. This struck me as very important work when trying to model and measure competencies in diverse areas of higher education. The work I heard on measurement development seemed to be well grounded in methods of assessment development, psychometric methods, and validity analysis. However, there also was work presented in which various measures were being used to represent constructs of interest where there was no information presented as to the validity of the measures nor their measurement properties. Thus, it was very unclear what would be learned by employing those measures in more sophisticated data modeling approaches – cross-sectional, longitudinal, hierarchical, multivariate etc. – without first establishing the properties of the measures regarding

reliability and validity. I recognize that in some cases the projects were working with measures that were pre-existing and they may have had little control over what measures and data were available. Nevertheless, there does appear to be a need to be more cautious about the nature of the measurement and modeling enterprise lest various conclusions are reached based on less than adequate data. In a project such as this that is concerned with modeling and measuring competencies, issues of the validity of measurement should be foremost. Thus, I recommend that careful discussion of the validity of the measures chosen and the appropriateness of the data analytic methods be a paramount feature of the presentation and discussion of the work.

#### Human Capital Development

The KoKoHs Project has allowed for the recruitment and development of a very large cohort of new educational researchers. These are bright young scholars who are working on projects that will either be their dissertations or lead to dissertations and they are doing so as part of a community of scholars working on issues of competency in higher education. This is an extraordinary investment in human capital development and one that Germany needs to think about with respect to the future of educational research in the country. The talent pool is extraordinary and they appear to be well trained in research methodology. Thus, it is important to think beyond KoKoHs in terms of how the country and the educational research enterprise will profit from this investment and continue to support the development of these young scholars and researchers. To not do so is failing them and may end up wasting the large human capital investment that has already been made in these young people. In addition, these young researchers will be well poised to carry the work forward since the challenges of modeling and measuring competency in higher education will have only been partially met when this initial round of work under KoKoHs concludes.

*James W. Pellegrino, University of Illinois at Chicago, USA*

### 4.2.3 Comments on theory

#### 4.2.3.1 Reflections on the KoKoHs “International Colloquium for Young Researchers” Mainz, November 14-16, 2013

My reflections on the 2013 KoKoHs “International Colloquium for Young Researchers” are divided into two sections. In the first, I explore strengths of the KoKoHs program in terms of the connections that it affords. In the second, I raise questions that the colloquium caused me (and my students) to consider and that might be worth further exploration as the KoKoHs work advances.

## Connections

From my perspective, perhaps the greatest potential of the KoKoHs program has to do with the connections that are being made: across scholarly communities, across disciplinary departments, and across methodological traditions. The problems that KoKoHs is attempting to address are large, requiring this collaborative, bridging work; the possibility of success due to these connections is quite exciting!

The KoKoHs program is creating a different kind of scholar: one that is not confined to expertise in either learning or measurement, but who can bridge both worlds and think thoughtfully about how measurement might contribute to honest evaluation and improvement of higher education. Often, the work of doctoral students (and scholars more generally) becomes so narrow that even conversations across scholarly communities can be difficult. The KoKoHs beginning scholars, who are becoming conversant with the discourses of and participants in different scholarly communities, will help to forge collaborations that are needed to address global concerns about higher education.

In addition, the KoKoHs program is bringing together people and ideas that often reside in different departments or colleges across university campuses. The similarities of purpose across KoKoHs projects—aiming, through measurement, to prepare young adults to perform complex professional tasks—means that the pooling of effort and cross-fertilization of ideas has the potential to move efforts in many departments forward. At the same time, comparisons across professions can help to illuminate what is unique about particular professions and, thus, the features of preparation for particular professions. For example, what is different about the communication that an engineer or a teacher must learn to do? On a personal note, as someone whose formal post-secondary education occurred exclusively in colleges of engineering and who is now located in a college of education, it was enjoyable to think about the similarities and differences across the preparation occurring in these two often disconnected areas of campus.

Finally, I was pleasantly surprised to see the connections being made between quantitative and qualitative work in the KoKoHs projects. Although measurement ultimately requires some means of quantification, qualitative data can help to illuminate the phenomenon being measured. A continuing challenge going forward, I think, will be how to capture the richness of professional competency that can be available using qualitative approaches with the efficiency of more quantitative approaches.

## Questions (with a Focus on Teacher Education)

Immediately upon my departure from Mainz, I returned to Michigan State University, where I was teaching a doctoral course entitled *Learning to Teach*. One of the main foci of the course had been engaging with the complexities of learning to teaching and trying to understand what it is that teacher candidates need to learn in their university-based teacher education programs. Still a bit jet

lagged and with my head filled with ideas from the KoKoHs colloquium, I framed much of the subsequent class session (which had a focus on the transition from university-centered aspects of teacher education, such as courses, to field work or student teaching) in terms of questions that arouse from my musings on the KoKoHs conference.

- 1) Language: What is it that we are trying to accomplish/measure in teacher education? Are these “competencies”? Or does some other word or phrase better capture what it is that we value as outcomes of teacher education? What are the affordances and constraints of different word choices and subsequent framings of our work?
- 2) Goals: Graduates of teacher education should not be expected to perform like experts, but what should we expect them to be able to do? (For my students, this served somewhat of a synthesis purpose: Given what we had talked about over the semester, what should graduates of teacher education take from their programs to be “well-started beginners” in the context of today’s schools?)

*I see current work on “well-started beginners” and of “high-leverage practices” (see references below) to be quite promising in this respect. A sub-question concerns the relationship between ongoing work in KoKoHs (across fields) and this current emphasis in US teacher education.*

- 3) Goals: If we base our models of competencies on requirements of current jobs, is there room for reform? Is there room for graduates to adapt to the ever-changing contexts of schools? (How do we develop models of competency that challenge the status quo and prepare graduates for contexts that may be quite different in the future – without really knowing what may be required?)

*Alicia C. Alonzo, Michigan State University, USA*

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#### 4.2.3.2 Prospects and Challenges in Modeling and Measuring Competencies in Higher Education: Reflection on the International Colloquium for Young Researchers in Mainz, Germany

This reflection paper describes my experience and reflection on the International Colloquium for Young Researchers which took place at Johannes Gutenberg University Mainz Germany from 14-16 November 2013. It was my honor and pleasure to be invited as a member of the international expert panel to participate in this international collaborative research with the participants coming from Germany, Austria, Belgium, Luxemburg, Netherlands, Switzerland, and United States of America.

Funded by the German Federal Ministry of Education and Research (BMBF), the Modeling and Measuring Competencies in Higher Education (KoKoHs) program was launched in 2011. The Program is funding 70 projects from selected universities and research institutes in Germany. These projects focus on basic competency research and assessment of the achievement of university students and doctoral candidates in the area of economic, social, educational, and engineering sciences, and teacher education. In addition to its focus on science, technology, engineering, and mathematics, the Program highlights the importance of general research competencies and self-regulation as crucial academic and professional skills across disciplines.

The Colloquium demonstrated a great effort of the KoKoHs Program to ensure compatibility of each project with the key international approaches (Blömeke, Zlatkin-Troitschanskaia, Kuhn & Fege 2013; Kuhn & Zlatkin-Troitschanskaia, 2011), and to foster young researchers carrying out their doctoral or post-doctoral research within one of the 70 projects. This paper reflects my experience at the Colloquium in multiple roles, i.e., as a researcher, professor, expert panel member, and colleague.

I have to admit that over my past 20 years of teaching and research in Canada and US, I only had limited experience of working with colleagues in the German speaking countries. My interactions with these fine colleagues incurred mostly at the professional conferences, including European Educational Research Association, European Association for Research on Learning and Instruction, and American Educational Research Association. In particular, I had the pleasure of meeting with Christoph Metzger first at a poster presentation during the 2007 AERA conference in Chicago, and this time again at the Colloquium in Mainz. I am glad to share with him the same interest in the research of self-regulated learning (SRL). I am looking forward to continuing our collaborative research in the future.

My lack of extensive interactions with my esteemed European colleagues presents disadvantages and advantages in this reflection. The disadvantages came from my ignorance to the higher education system in Germany. This ignorance may lead to my inadequate appreciation of the

challenges in modeling and measuring competencies in the context of German higher education system. Putting in a mundane word, I am looking at their shoes and trying to guess how their shoes fit, rather than being in their shoes to feel the fit of the shoes. In addition, my reflection is largely based on my understanding of the education research in the USA, and particularly on my research of self-regulated learning of the USA university students. My reflection, therefore, bears limited generalizability to the SRL research of the university students in Germany, and even far less to other areas included in the KoKoHs research program, even though my research shares the same population with the KoKoHs program.

On the other hand, my ignorance to the German higher education system and my limited research of SRL might present advantages in this reflection by giving me fresh eyes as an outsider. I hope that this reflection would offer a different point of view to the tasks and challenges that my German colleagues are facing in their ambitious endeavor of building a comprehensive system to define and measure competencies in higher education. For the rest of the paper, I will describe the prospects of the KoKoHs program, discuss the challenges that I observed in the Mainz Colloquium, and offer some suggestions to tackle these challenges.

### Prospects

My awareness of the KoKoHs research program started in the early part of 2013. I was excited when I received an invitation to meet with Olga Zlatkin-Troitschanskaia and the KoKoHs research team at the 2013 AERA conference in San Francisco. I was overwhelmingly impressed with the KoKoHs program of its scale and ambitious purpose of developing a comprehensive system to define and measure competencies in higher education in Germany. As far as I know of, such a concerted effort to construct a nationwide system in developing theory and specific measurement instruments of competencies in higher education across disciplines has not been attempted in other nations previously. In addition to its interdisciplinary nature, the KoKoHs program stood out as a methodological integrative program “aiming to provide crucial impetus to fundamental research on competency assessment in higher education” (Blömeke, Zlatkin-Troitschanskaia, Kuhn, & Fege, 2013). To achieve these purposes, the KoKoHs program tried to address two key research questions. (1) “How can we model domain-specific and/or generic competencies in selected subjects while taking into account the specific curricular and job-related features? (2) How can we transform these theoretical models into suitable measuring instruments? How can we validate the test score interpretations? (Blömeke, Zlatkin-Troitschanskaia, Kuhn, & Fege, 2013).

Throughout the Colloquium, I have been impressed with the enthusiasm, motivation, English proficiency, and professionalism that the young researchers demonstrated in addressing these

important questions. Their eagerness and dedication to develop and grow as a researcher are second to none. Their dedication and determination empower them with energy and resourcefulness to join forces with the high caliber research teams across Germany. I appreciate and admire the foresight of the Funding Agency--the German Federal Ministry of Education and Research and the Coordination Office of the KoKoHs program in cultivating this army of young researchers. In addition to energy and enthusiasm, these young researchers demonstrated not only desires and effort to achieve, but also resourcefulness in tackling the daunting task of developing a nationwide system of modeling and measuring competencies in high education in Germany.

The Colloquium marked a milestone in developing theory and measurement instrument of modeling and measuring competencies across a wide variety of subject matter areas. In the aspect of theory, all projects at the Colloquium relied on Weinert's (2001) definition of competencies as the latent cognitive and affective-motivational underpinnings of performance. In this theoretical framework, competencies include cognitive disposition, i.e., academically gained knowledge, as well as the motivational, volitional, and social dispositions to apply the gained knowledge flexibly in different situations (Blömeke, Zlatkin-Troitschanskaia, Kuhn, & Fege, 2013). As Macha and Schuhen (2011, p. 38) summarized:

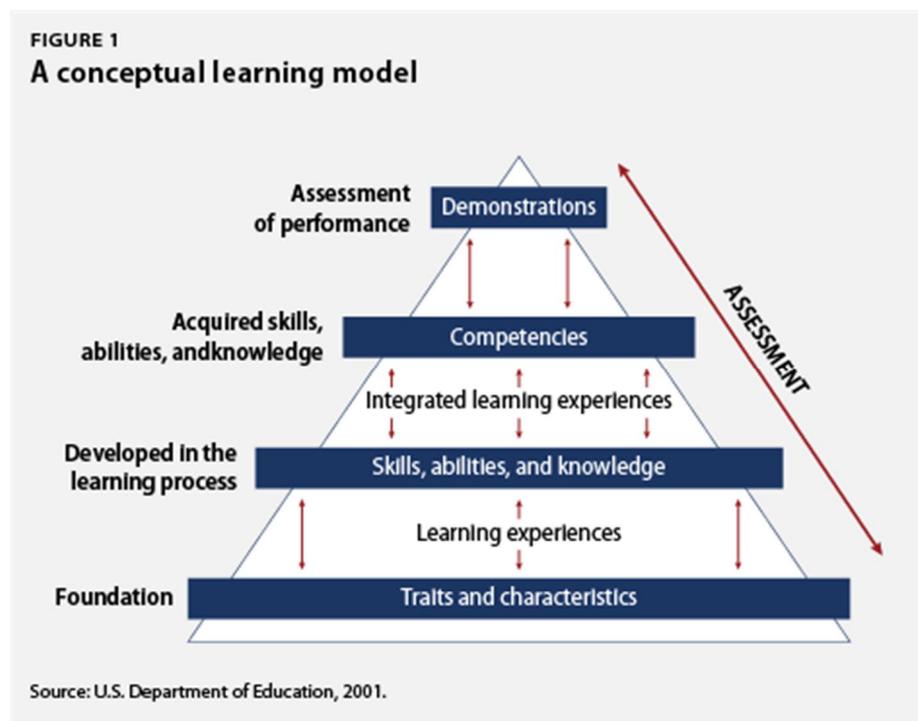
One can specify the definition by Weinert (2001) as follows: “[Competencies are] the readily available or learnable cognitive [structures or processes of cognition and knowledge] abilities [memory, language, perception, attention, etc.] and skills [actions which are applied in recurring tasks] which are needed for solving problems [overcome barriers between a given state and a desired goal] as well as the associated motivational [concerning the motives which have an impact on the action or decision], volitional and social capabilities and skills which are required for successful and responsible problem solving in variable situations”. Thus the existence of competency relies on three crucial dimensions:

- 1) cognitive abilities and skills = knowledge which is needed in order to
- 2) solve new problems and
- 3) the necessary motivational, volitional, and social capabilities and skills.

About the same time with the publication of Weinert's (2001) definition of competencies, competency-based education emerged across postsecondary education in the United States, as a result of the development of information technology. These initiatives “put a public spotlight on alternative ways to deliver postsecondary education that not only document whether a student has achieved a level of competency but also validate the learning that's occurred” (Soares, 2012, p. 1). These innovative education models differ from traditional education by focusing strictly on the

demonstration of competency regardless of how long it took a student to gain that competency (Soares, 2012). In these initiatives, competencies are viewed as “the bridge between traditional credit hour measures of student achievement and the learning revolution. A competency is specifically defined as “a combination of skills, abilities, and knowledge needed to perform a task in a specific context” (US Department of Education, 2002, p. vii).

As the first panel discussion of the Conceptual Questions in Competency Modeling highlighted, the premier challenge of the KoKoHs program and the Colloquium was to achieve a clear definition of competencies. A closer look at the conceptual model of the competency-based initiatives in the US may shed some light on this fundamental issue of modeling and measuring competencies in higher education. The following figure, from the National Postsecondary Education Cooperative’s report “Defining and Assessing Learning (US Department of Education, 2002),” provides a visual characterization of competencies, depicting how they are related to skills, abilities, and knowledge; and how they can be demonstrated in the process of assessment of performance.



As Figure 1 described, *traits and characteristics* are the foundation of learning. They represent the innate makeup of individuals upon which further experiences can be built. *Skills, abilities, and knowledge* are acquired through learning experiences in school, work, and participation in community affairs etc. *Competencies* are the outcome of integrated learning experiences, in which skills, abilities, and knowledge are focused on the performance of a task. Different combinations of skills, abilities, and knowledge that one has acquired define the competencies that an individual possesses. Finally, different combinations of competencies possessed by an individual are combined

in carrying out different demonstrations or tasks. *Demonstrations* result from the application of competencies (Soares, 2012).

Differentiating competencies from skills, abilities, knowledge is of particular importance in modeling and measuring competencies in higher education. First, specific articulations of competencies help colleges and universities by informing and guiding the basis of subsequent assessments at the course, program, and institutional levels. Secondly, specific competencies enable faculty and students across campus, as well as other stakeholders such as employers and policymakers, to have a common understanding about the specific competencies that university graduates should master as a result of their learning experiences. Finally, specific competencies provide directions for designing learning experiences and developing measurement instrument to assess student application of these competencies in different contexts (US Department of Education, 2002).

The definition of competencies of Weinert (2001) and that of the US competency-based initiatives (US Department of Education, 2002) both highlighted an outcomes-based approach to education where the emphasis is on what comes out of postsecondary education—what graduates know and can do. The Colloquium represented an extensive interdisciplinary effort to implement and empirically test Weinert's (2001) definition of competencies. In particular, the inclusion of the affective and social dimensions in modeling and measuring competencies positioned the KoKoHs program and the Colloquium towards a more comprehensive approach to characterizing and investigating competencies in higher education than the one adopted in the US competency-based initiatives which focused mostly on cognitive aspect (US Department of Education, 2002). Consequently, the KoKoHs program and the Colloquium are working towards conceptualizing and measuring competencies of higher education in a more holistic fashion.

### Challenges

While the Colloquium reflected a more comprehensive approach to defining and measuring competencies across disciplines in higher education, the projects presented at the Colloquium also faced tough challenges in operationalizing Weinert's (2001) definition of competencies in different subject matter contexts. These challenges were reflected in almost every project and particularly through the key questions in the two panel discussions at the Colloquium. In the second panel discussion of Challenges in Measuring Methodology, these challenges were concerned with: adopting adequate research design and methods for measuring competencies in higher education, developing appropriate operationalization for assessing competencies, and using robust measuring methods of analysis for the KoKoHs projects, particularly in the longitudinal assessment of competencies, and ensuring validity and reliability in all KoKoHs projects. While systematically addressing each of these

important questions is beyond the scope of this reflection paper, I will focus on teacher self-regulation as one specific area to illustrate the challenges and offer some suggestions to tackle these challenges.

I applaud the KoKoHs program for placing a top priority on validity and reliability in defining and measuring competencies so that they are applicable within and beyond specific disciplines inside and outside of higher education entities. The projects at the Colloquium demonstrated great efforts in both aspects. For instance, self-regulation was viewed as an important professional competency of teacher candidates in the SEKO project at the Colloquium. Drawing on data from a longitudinal study, Henoch (2013) proposed a study to investigate (1) stability of teachers' self-regulation patterns throughout the phase of teacher education and the first years in the teaching profession; and (2) influence of individual (e.g., cognitive abilities) and institutional factors (e.g., different academic tracks, courses on time or stress management) on the development of teachers' self-regulation. In this research, teachers' self-regulation was operationalized as teacher candidate's ability to "handle one's own resources consciously and in awareness of possible resource losses." Teachers' work-related self-regulation was measured with the Occupational Stress and Coping Inventory (AVEM; Schaarschmidt et al., 1999). The analysis focused on increase and decrease of self-regulatory types as well as transitions between the four hypothesized patterns of self-regulation.

Henoch (2013) study demonstrated a great effort in operationalizing competency of self-regulation as a professional competency among teacher candidates. Of particular importance in this study is that both individual factors and contextual factors were examined in the development process of teacher self-regulation. The results of the study certainly contribute to a better understanding and measurement of teachers' competency in work-related self-reflection (Sitzmann & Ely, 2011). More research studies like this are needed. In particular, studies that follow Weinert's (2001) theoretical framework and include academic, motivational, volitional, and social factors would help piece together a larger and more comprehensive view of teachers' self-regulation as a domain-specific as well as generic professional competency across subject matter disciplines, including sciences, social sciences, and teacher education.

Henoch's (2013) study represented a great first step toward defining and measuring competency of self-regulation among the teacher candidates. At the same time, it also demonstrates that the tasks and challenges that my German colleagues are facing in developing a nationwide system of modeling and measuring competencies in higher education. The sheer amount of work ahead is tremendous and definitely challenging. Figuratively speaking, Henoch's study adds a piece of solid brick in building a giant edifice of modeling and measuring competencies in higher education in Germany. Nevertheless, I am confident that the goal of establishing a valid and reliable system can be achieved with the continuous incredible work of my esteemed German colleagues, with the energy and

dedication that the young researchers demonstrated at the Colloquium, and with the strong support of colleagues from abroad.

I am also confident that readers will find the KoKoHs program as illuminating and satisfying as I have. It is truly a landmark work. It reveals great strides in the sophistication and precision with which competencies in higher education can be conceptualized, assessed, and developed. In this sense, the KoKoHs program and the Colloquium have gone a long way toward capturing the state of modeling and measuring competencies in higher education in Germany. And most of all, I hope the leaders and researchers of other countries become aware of this ground breaking endeavor and more appreciative to how important modeling and measuring competencies is to higher education and to society at large.

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## 5 Summary and outlook

### 5.1 Summary of the discussions and conference wrap-up

The two panel discussions on Friday provided an opportunity for all researchers within the KoKoHs initiative to connect with international experts and get an impression of how external professionals debate and reflect on central research questions within the research program. Furthermore, the panel discussions enabled KoKoHs researchers to hear the experts' assessment of the progress of the research program and what they consider to be the next steps.

During the panel discussions two fundamental aspects of the KoKoHs program were discussed: Panel I dealt with conceptual questions in competency modeling; Panel II dealt with methodological challenges on measuring competencies in higher education. These discussions were organized as follows: the group of eleven international experts was divided, one half discussed conceptual questions on modeling competencies, the other half discussed methodological challenges. Both panel discussions were moderated by members of the scientific advisory board of the KoKoHs research initiative. In the following sections the main points for discussion, argument and critique are summarized.

#### Panel I - Conceptual questions on competency modeling

The first panel discussion dealt with issues related to defining the construct of competency, differences in possible interpretations, and differentiation between competency and performance as well as other cognitive constructs such as intelligence. The experts were invited to define and explain their understanding of the meaning of competency based on experience in their fields of research.

At the beginning of the discussion, language and wording problems as well as translation issues concerning the construct of competency were mentioned. Some experts pointed out that competency may not be an appropriate term to use when trying to enter American journals as it is not used in the same sense in the English language. The experts explained that in the USA competency is seen as something you have or do not have (you are competent or incompetent), so it is understood more as a basic requirement. What researchers within KoKoHs call competency could eventually be compared to "high-leverage practices" in the USA. High-leverage practices have underlying knowledge and skills and are part of evidence-based practices in the USA and of research on questions such as "Is there a difference at the end of an intervention?" and "How do we measure it?" To test these issues and to reach the next step, value added measurements are needed.

Another topic discussed during Panel I was how to differentiate between competency and other cognitive constructs such as intelligence or knowledge. To distinguish intelligence from competency,

one expert defined intelligence as “the capacity to develop capacity.” Also experts assumed that cognitive abilities, such as intelligence, are rather external to competency models but certainly influence them. Moreover, experts recommended that knowledge be looked at in a way that it can be used for competency modeling. They suggested the difference between competency and quality be considered and that knowledge and content as well as reasoning and arguing, thus processes of learning (following Blooms taxonomy<sup>2</sup>), be looked at. The difference between competency and performance was presumed to be very important (going back to Chomsky<sup>3</sup>); first, researchers have to define what exactly they want to test (dispositional aspects of competency or performance) and then they need to select a method of assessment depending on the model chosen. Presumably there should be a link between competency and performance within the research models.

#### Recommendations for the KoKoHs initiative

The international experts recommended a deductive research method for modeling and assessing competency in higher education. Research in this field should start with a phenomenon and then be transferred and developed into models and theories. In this regard, universities alone should not define competencies comprehensively for the tertiary sector. Definitions should be expanded with a more practical view in order to identify specific competencies required in various professions.

Additional advice given was to spend less time working out very specific details of the models, and more time gathering the data and testing it, as one expert said, “You have the bones and need to put flesh on it.” Three steps for research were advised: think about a model, validate it, and then use it.

Furthermore an expert found a gap in research: lack of awareness of mistakes and their influence on competency development. In addition to the complex issue of competency development, an expert mentioned that the wide variety of individuals themselves and their prerequisites need to be kept in mind. As recent studies have shown, school children learn differently and at different stages. Moreover, researchers have to keep in mind the level of competency development they are looking at and that there will not be a single answer to the question as to how competencies are developed. Additional aspects such as motivation and passion should be looked at together with cognition.

Experts do not expect higher education institutions to take into account the results of the research within KoKoHs and apply them to teaching. However, they are convinced that if progress is seen –

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<sup>2</sup> For further information see: Bloom, B., Englehart, M., Furst, E., Hill, W. & Krathwohl, D. (1956). *Taxonomy of Educational Objectives: The Classification of Educational Goals: Handbook I: Cognitive Domain*. New York: Longmans, Green.

<sup>3</sup> See also: Chomsky, N. (1968). *Language and Mind*. New York: Harcourt, Brace and World.

drawn on what has been shown – people eventually will go, even reluctantly, where the evidence is and will apply evidence-based models in teaching.

#### Panel II - Methodological challenges

The second panel discussion opened with personal introductions. The experts included an example of methodologies suitable for competency measurement.

After the round of introductions, the issue of setting standards for research questions in competency assessment was addressed. As knowledge, processes and affective aspects are all part of the understanding of competency within KoKoHs, experts were asked if there should be a dispositional or rather knowledge standard for competency assessment.

Experts were concerned that the answer to this question would depend on the main focus of the task as well as on the money, time, and resources available. So, there is no standard for all questions in this field of research and solutions depend on conditions, goals, resources and so on. Moreover, researchers have to set standards in their data collection and measurement according to what they really want to know and what they will focus on. One expert expressed that within the young researchers' projects the sampling designs were all at a professional level and that they had a lot of potential but pointed out that the young researchers have to look at the basics and what they want to know and to start from there.

#### Further recommendations

Later in the panel discussion, the experts were asked to give further recommendations on methodological aspects of measuring and assessing competencies in higher education. One main argument within all answers was the advice of using mixed-method approaches. Projects should not begin with a specific test design in mind; researchers should be open-minded to different methods and test designs. Also, informal settings could provide further information (interviews with students or experts in informal settings). In addition, qualitative data (including experimental approaches) or adding control groups should be used with respect to internal validity. Moreover, the use of other methods (e.g., online activities such as "rich" data on how much time students spend on information research) and their combination with large-scale data could enrich the research process.

Furthermore the experts recommended that researchers pay attention to specific details of their data to get a more holistic view of the sample ("more pieces of the puzzle") and to look at the overall data to make interpretations. Researchers have to know their data and should not look at combined data otherwise they might lose their focus. They should always ask why they are using a specific statistical measure and approach.

The experts agreed that it is difficult to determine the outcome of the KoKoHs data, whether a meta-analysis of the data would be possible, and if so, which structure it should have. One option would be to bundle the data based on overlaps in the results of the research projects, but researchers have to be careful when bundling data sets. Also, it could be helpful to identify key variables in the projects and to synthesize the findings that relate to specific areas of competency, but this would have to be a valuable synthesis. A meta-analysis seems to be too far away for some experts, not only because of the structure and heterogeneity of the projects but also because of more practical problems like access to the data.

#### Recommendations for a second funding phase of the KoKoHs initiative

The experts were asked to conclude by giving further suggestions for a second funding phase of the KoKoHs initiative. They mentioned researchers within KoKoHs should be thinking about the central goals of a second phase, the best instrument to measure competency, the most advanced work to present, as well as alternative forms of intervention. The experts recognized the excellent human capital within KoKoHs and pointed out the importance of promoting and capitalizing on it.

Another suggestion was to integrate technology more into research and to reflect on learning technology for example via computer simulations. The experts also pointed out that, in terms of the iGeneration, technology will change the way we teach in the future and therefore should be put on the agenda.

Some experts expressed concern over missing data within the projects. They recommended collecting more complete data sets (e.g., by offering incentives to people who complete the assessment) in order to gain more statistical power. However, there would be many theories on how to handle incomplete designs, which could help progress. In addition, the impact of the studies and of the whole initiative on the future has to be kept in focus.

The experts found the framework of the initiative and the team projects with various experts very good and felt the projects could benefit from each other with regard to combining instruments, methods and experiences. They suggested the project researchers think about establishing a shared database. They believe that in the long run there should be a well-structured and well documented shared database with all data sets and in the short term there should be an overview of the key variables, target groups and instruments of the data sets.

Finally the results of the German research program should be compared with cross-national and international perspectives.

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## 5.2 Comments on conceptual and measurement challenges in modeling competency

Conceptual and measurement challenges in modeling competency are sizable. What seems so straight forward — just build a test to measure, for example, business planning competency. But upon even cursory examination of what that means and would entail makes the measurement of competency complicated. What is competency? Is it an underlying ability or a capacity to perform? Is it generic, domain specific or both? Can it be measured by selected-response items or is there an implied performance dimension involved that goes beyond selecting a response? How should scores be scaled? Whatever your answers to these questions, be assured you will find as many disagreeing as agreeing with you.

The conference, *Modeling and Measuring Competencies in Higher Education*, has taken up the challenge with myriad answers to the questions posed above. Impressively, the projects presented and the discussion of the challenges have taken seriously the need to build a conceptual model of the competency (or competencies) in question, test items and tasks have been generated adhering to the model, scores scaled and models tested with sophisticated statistical methods. This is no mean achievement over what has been true of the past.

Of course bumps have been encountered along the road; they are to be expected as researchers break new ground to meet the growing demand to measure competencies in higher education. These bumps include the quality of the measurements that go into competency modeling. For example, there is a tendency to find an existing test (e.g., in economics or engineering, often in English) and modify and translate it for use in the German higher education context, in part in response to then funding agency's demand for timely results. The findings from the recent AHELO (Assessment of Higher Education Learning Outcomes) feasibility study (OECD, 2013) suggest how difficult this can be. Or in some cases, claims are made in comparative studies (e.g., across universities within Germany or between different nations) while questions arise about the representativeness of samples for making such comparisons. And there is a tendency to use multiple-choice test items focusing on knowledge because they are simple to construct and can be found readily "off the shelf." Moreover there are occasions when some method other than self-report might provide better evidence of behavior (the construct ultimately of interest in a study) but such behavioral measures are more challenging to build, more time consuming to take, and more difficult to statistically model. In some cases there is a tendency to let the statistical model (e.g., item-response theory) drive the conceptual and measurement modeling of competency when such a statistical theory might be too constraining for the task. And, sometimes researchers, being part of a

larger project with teams from multiple universities find themselves attempting to statistically model data where the limits of the original data collection create what I consider to be insurmountable challenges that can only be solved by making heroic assumptions. Finally, there is a tendency to over-interpret the findings from large-scale statistical modeling by drawing huge inferential leaps from an estimated parameter in a model to what is true in the “real world”; such inferences beg for qualitative studies testing out the proposed interpretations of the parameters.

These bumps are normal science. The first years of the KoKoHo project might well be looked upon as a “pilot study.” A great deal of knowledge—what to do and what not to!—has been garnered from the project. The project has run fast accomplishing a remarkable amount in a few years. It is now time to take stock, assess what has worked and what has not, and to focus on where to invest its next three years of research on the conceptualization and measurement of competency, and then move forward. So says an idealist! We’ll see what reality holds.

In the spirit of taking stock, I would like to remark on one important area of competency modeling and measurement where fundamental differences may exist, an area that has important implications for the future. I say “may exist” because I am not sure we disagree. But the evidence from exchanges I have had with colleagues at the conference suggests that we do disagree.

The disagreement lies in how we define competency; differences in definition lead to differences in measurement and psychometric approaches. The disagreement possibly lies in a distinction between competency and performance. The difference harkens back to Chomsky’s distinction between competency and performance (Wikipedia, [http://en.wikipedia.org/wiki/Linguistic\\_competence](http://en.wikipedia.org/wiki/Linguistic_competence), accessed 1/7/14):

Linguistic competency is the system of linguistic knowledge possessed by [native speakers](#) of a [language](#). It is in contrast to the concept of [Linguistic performance](#), the way the language system is used in communication. The concept was first introduced by [Noam Chomsky](#)<sup>[1]</sup> as part of the foundations for his [Generative Grammar](#), but it has since been adopted and developed by other linguists, particularly those working in the generativist tradition. In the generativist tradition competence is the only level of language that is studied, because this level gives insights into the [Universal Grammar](#), that generativists see as underlying all human language systems. [Functional theories of grammar](#) tend to dismiss the sharp distinction between competency and performance, and particularly the primacy given to the study of competency.

Chomsky was speaking about linguistic theory; we’re talking about modeling competency, say, in business planning or engineering design. Nevertheless the distinction seems to have entered our competency discussion and has been used to justify one or another approach. My bias, as will be

seen, is closer to the functional theorists than the universal theorists. I do not believe the distinction is fruitful for our work. Indeed, in psychological and educational measurement—whether selected-response knowledge tests or constructed response performance assessments—we are always dealing with observed performance and making large leaps of inference to the underlying competency intended to be measured.

What seems to be a widely agreed upon definition of competency is some combination of Weinert's (2001) and Hartig, Klieme and Leutner's (2008) definitions. For example, the latter defined competency as "complex ability ... that ... [is] closely related to performance in real life situations" (p. v). When I tried to unpack these definitions of competency, I (e.g., Shavelson, 2012a, b) noted that the construct of competency is a complex ability closely related to performance in real-life settings that can be characterized with the following seven facets:

- 1) Complexity—a complex physical and/or intellectual ability or skill;
- 2) Performance—a capacity not just to "know" but also to be able to do or perform;
- 3) Standardization—tasks, responses, scoring-rubric, testing conditions (etc.) are the same for all individuals;
- 4) Fidelity—tasks provide a high fidelity representation from situations in which competency is to be demonstrated in the real world;
- 5) Level—performance meets some level of "good enough" to be competent;
- 6) Improvement—the abilities and skills measured can be improved over time by education, training, and deliberative practice;
- 7) Disposition—personal and social characteristics such as identity, perspective taking, self-regulation, social responsibility that motivate high levels of learning and performance.

When these facets are combined, we might define competency measurement as tapping complex physical and/or intellectual skills to produce observable performance on a common standardized set of tasks that simulate with high fidelity the performances that are expected to be enacted in "real world" ("criterion") situations to which inferences of competency are to be drawn, with scores reflecting the level of performance (mastery or continuous) on tasks where improvement can be made through dispositions that facilitate learning and deliberative practice.

There is a lot in the unpacking that has substantial measurement implications. For example, a competency measurement should be criterion or domain referenced, not norm referenced. The tasks should look like or be a high fidelity simulation of the tasks encountered in "the real world" be it a classroom (real?) or on-the-job performance. This is not the place to do so (see Shavelson, 2012a, b).

At issue, however, is whether “knowing,” both declarative and procedural knowledge, counts as measures of underlying competency in the Chomsky sense such that they are applicable to multiple “real-world” situations in which doing is the end task. If this reasoning holds, and studies of the predictability of general ability, *g*, to performance in school and on the job suggest they do (Sackett, Borneman, & Connelly, 2008), then a model of competency featuring cost-efficient selected-response measures of declarative and procedural knowledge in a domain would be what is sought. In this case, multiple-choice testing and IRT modeling would be the preferred approach to modeling and measuring competency. I believe that a majority of the papers at the conference and the discussions of those papers are consistent with this version of competency and its measurement. The approach is characterized by panel (a) in Figure 1.

An alternative conceptualization of competency measurement is based on what McClelland (1971) “criterion-sampling” (Figure 1). He stressed the performance side of competency. He reasoned that, if test scores are intended to predict performance in, say, business planning, then sample business planning tasks from the real world and see how individuals perform on them. Competency measures, then, should sample tasks and responses found in the situations that are the object of inference from tests. The nature to competency test items would be like “performance tasks” sampled from the very situations to which inferences from test scores are to be drawn. In this case some combination of selected- and constructed-response items would comprise a competency assessment and the item responses might be modeled with generalizability theory instead of, or in addition to, IRT. These said new advances in psychometric modeling would be needed (e.g., Gorin & Mislevy, 2013).

<i>Psychometric</i>	<i>Criterion-Sampling*</i>
<ul style="list-style-type: none"> <li>• Divides complex, holistic tasks into micro tasks amenable to paper-and-pencil assessment on unidimensional scales</li> <li>• Focuses on respondent responses (0, 1 scored) while permitting some operant responses</li> <li>• Elicits “fast thinking” rather than deliberate thinking on micro tasks</li> <li>• Maintains tight security on test items</li> </ul>	<ul style="list-style-type: none"> <li>• Samples whole tasks from “real-world” domains</li> <li>• Samples “operant” as well as “respondent” behavior</li> <li>• Elicits complex abstract (“slow”) thinking (“operant thought patterns)</li> <li>• Provides information on how to improve on tasks (“cheating” is not possible if you can do the criterion task)</li> </ul>

Figure 1. Contrast in approaches to competency measurement: (a) psychometric and (b) criterion-sampling. (Note: “respondent” responses correspond to selected responses; operant responses correspond to constructed response found in concrete situations).

The distinction between the two approaches to competency measurement can be seen in, for example, automobile driving tests. No one would reasonably believe that scoring perfectly on a multiple-choice driving test could be used in place of actually observing a person driving a car. To be

sure, the driving test is accompanied, at least in California, by a multiple-choice test of driving laws, regulations, fines, etc. That is because only a sample of tasks can be observed with the hands-on driving test and some of what needs to be tested is genuinely knowledge, not performance.

In the end, the driving test suggests rapprochement between the psychometric and criterion-sampling approaches and might serve as a “model” for modeling and measuring competencies in higher education. Such competency measurement would include both selected-response items and performance-tasks. The former would tap knowledge but not sufficient essential for performance; the latter would tap essential observable behavior with high-fidelity simulations of actual tasks. Such an approach would clarify conceptual issues and lead to innovations in statistical modeling of competency test scores.

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