Shavelson, Richard J.

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Das Verhältnis von Forschung und Praxis

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Research on teaching and the education of teachers: Brokering the gap

Richard J. Shavelson

Abstract A few thousand years ago, Aristotle pointed out a gap between academic (research) knowledge and practical knowledge. The former is abstract, a generalization based on careful reasoning from evidence. The latter is specific, context-specific. Consequently, factors other than research knowledge come into play when teaching and when preparing teachers. A brief history of research on teaching highlights some of its rich contributions to the understanding of teaching. However, its contribution to educating teachers has, following Aristotle, limitations. Much more is involved in contextualized decisions about teaching action than research can address. Research knowledge is limited, for example, in its ability to inform teachers when and how to act in a situation. It is also limited in its ability to inform teachers as to how they should act considering the moral and ethical consequences of that action. Teachers need and use practical knowledge. Imparting that kind of knowledge is central to educating teachers. The job of teacher educators is to bridge the research-practice gap in preparing new teachers and enhancing capacity of practicing teachers. In a sense, teacher-educators are brokers in a trading zone between research and practice. Brokers should be recognized and trained in that role to advance the education of teachers. This said, preparing brokers fluent in teaching practice and scientific research has its challenges. These challenges include convincing the public and policymakers that more than scientific evidence is needed in preparing and supporting teachers, and convincing higher education institutions that doing so is legitimate and should be respected along with other professional programs such as medicine, law, business, and architecture.

Keywords research on teaching – research-practice gap – academic and practical knowledge – professional development

Unterrichtsforschung und Lehrerinnen- und Lehrerbildung: Das Überbrücken der Kluft zwischen Forschung und Praxis

Zusammenfassung Vor einigen Tausend Jahren verwies bereits Aristoteles auf die Kluft zwischen akademischem bzw. wissenschaftlichem Wissen und praktischem Wissen. Ersteres ist abstrakt, da es eine sorgfältig vorgenommene Generalisierung von empirischer Evidenz darstellt. Letzteres hingegen ist (kontext)spezifisch. Infolgedessen spielen noch andere Faktoren als forschungsbasiertes Wissen eine Rolle, wenn es um Unterricht und die Aus- und Weiterbildung von Lehrpersonen geht. Ein kurzer Überblick über die Geschichte der Unterrichtsforschung soll ein paar ihrer bedeutenden Beiträge zum Verstehen von Unterrichtshandlungen hervorheben. Allerdings ist der Beitrag der Unterrichtsforschung zur Lehrerinnen- und Lehrerbildung, Aristoteles folgend, insgesamt beschränkt. Denn kontextualisierte Entscheidungen, die sich auf konkrete Lehrhandlungen im Unterricht beziehen, umfassen mehr, als Forschung miteinzubeziehen ver-

mag. Das in der Forschung generierte Wissen ist limitiert, weil es Lehrpersonen beispielsweise nicht sagen kann, wann und wie sie in einer konkreten Unterrichtssituation handeln sollen. Ebenfalls limitiert ist dieses Wissen in Bezug darauf, welches Verhalten angesichts der moralischen und ethischen Konsequenzen einer Handlung angemessen ist. Lehrpersonen benötigen Praxiswissen und wenden dieses an. Die Vermittlung dieses Wissens ist eine zentrale Aufgabe der Lehrerinnen- und Lehrerbildung. Dozierende an Institutionen der Lehrerinnen- und Lehrerbildung haben die Kluft zwischen Forschung und Praxis zu überbrücken, und dies sowohl in der Ausbildung als auch in der Weiterbildung von Lehrpersonen. In gewissem Sinne fungieren sie dabei als «brokers», die in einer Handelszone zwischen Forschung und Praxis vermittelnd tätig sind. Solche Brokerinnen und Broker sollten in ihrer Rolle anerkannt und geschult werden, damit sie die Lehrerinnen- und Lehrerbildung weiterbringen können. Dies ist jedoch nicht ganz einfach, denn die fundierte Vorbereitung der Brokerinnen und Broker auf Lehre und wissenschaftliche Forschung ist herausfordernd. Diese Herausforderungen bestehen nicht zuletzt darin, die Öffentlichkeit und die politischen Entscheidungsträgerinnen und Entscheidungsträger davon zu überzeugen, dass Vorbereitung und Unterstützung von Lehrpersonen mehr erfordern als die Vermittlung wissenschaftlicher Erkenntnisse. Hochschulen wiederum müssen davon überzeugt werden, dass dieser Anspruch legitim ist und ebenso anerkannt werden sollte wie in Ausbildungsprogrammen anderer Professionen, z.B. in Medizin, Recht, Wirtschaft und Architektur.

Schlagwörter Unterrichtsforschung – Forschungs-Praxis-Kluft – wissenschaftliches und praktisches Wissen – professionelle Entwicklung

1 Introduction

About 2,300 years ago, Aristotle distinguished *theoretical* reasoning and argumentation from *practical* reasoning and argumentation (e.g., Fenstermacher, 1986). Theoretical reasoning involves both logical (*a priori*) and *scientific* (*a posteriori,* empirical or inferential) reasoning. Theoretical arguments focus on knowledge production and its justification. Practical arguments involve action and the justification for such action. Practical arguments depend not only on theoretical reasoning but also on contextual and ethical reasoning. Science, by its very nature, *cannot be all that is needed to contribute to the improvement of professional practice.*

My recognition of the difference between theoretical and practical argument and its consequence for empirical research informing practice is not new; obviously, Aristotle beat me to the punch a few years ago. Nevertheless, the point has also been made in various ways, especially by the philosopher, Gary D. Fenstermacher (1986; see also Berliner, 2020; Schön, 1983). Yet, somehow, the distinction gets lost in academic and policy discourse. Academia is all about theoretical knowledge, reasoning, and argumentation. Policy discourse purportedly seeks evidence-based or scientifically based education improvement (e.g., Shavelson & Towne, 2002). Policymakers and the public fear anything that lets the proverbial camel's nose under the tent, carrying a bag of

values. Nevertheless, evidence-based education and scientific research carry their own bags of values. Debates about research findings and empirical models, for example, often resolve themselves into debates over hidden values (Shavelson, 2017). There must be more than research, then, to improving practice.

I begin this paper[1] by selectively pointing out contributions that research on teaching have made to the education of teachers. I go back to the 1970s and 1980s, the heyday of research on teaching. The third edition of the *Handbook of Research on Teaching* (Wittrock, 1986) reflects this high intensity research period. (To date, five editions of the *Handbook* have been published.[2]) However deeply involved colleagues and I were, research seemed insufficient to me. I briefly sketch some of my suspicions. If these suspicions are halfway accurate, I ask what then are possible links between research knowledge and practical knowledge and action? I conclude by suggesting how teacher educators, trained as «brokers» in a knowledge trading zone might bridge the research-context gap. I am careful to suggest how to justify their actions to skeptical academics and policymakers. I conclude with a story of one such broker, albeit from medicine.[3]

2 Contributions of research on teaching

As mentioned, the 1980s (and 1970s) ushered in a flood research on teaching. (Note that this was research on teaching and not, as is popular today, research on teacher education.) So, this is where I looked for research's contribution to teaching.

Nathaniel Gage's (1963) first edition of the *Handbook of Research on Teaching* and especially his chapter on «Paradigms for Research on Teaching» was the major stimulus behind this activity. Both the emerging research programs and the research infra-

[1] This paper combines three invited addresses. Most recently, in 2019, Rector Horst Biedermann and Professor Doreen Holtsch invited me to talk on this topic at the Pädagogische Hochschule St. Gallen, Switzerland. The talk carried the title «Research on Teaching and the Education of Teachers: The Great Disconnect.» As reviewers and editors correctly pointed out, the paper is more about bridging the gap with «brokers» than a disconnect. Hence the new title. In 2018, I was invited to talk on «The Role of Scientific Education Research in Professional Action: A Personal Odyssey» at the 6th Annual GEBF (Gesellschaft für Empirische Bildungsforschung) Conference in Basel, Switzerland. In 2017, Professor Gabriele Kaiser invited me to give a lecture entitled «Reflections and Reminiscences on The Measurement of Teaching: Professional Competence» at the Conference entitled «New International Perspectives on Future Teachers' Professional Competencies» at the University of Hamburg, Germany. I want to thank Gary Fenstermacher for critically reading and commenting on numerous drafts. His feedback was invaluable.

[2] In this paper, I focus on the 3rd edition of the *Handbook* (Wittrock, 1986) because I believe that it broadly defined the field at the time and for the future; it had at the same time multiple, highly active research programs; and as I read research on teaching and teacher education today, what was known back then keeps getting repeated and rediscovered today.

[3] In this paper, I relate a personal odyssey, searching for the role that scientific research can plan in contributing to professional practice. Consequently, the paper is written a bit more informally than is typical in a scholarly journal.

structure came together to stimulate this explosion of research, especially in the U.S., Great Britain, Europe, and Australia. I cannot do justice to the over 1000 pages of the 3rd *Handbook*. Consequently, my focus in summarizing the activities at the time will be on the teacher cognition and decision-making program. I do so because it has re-emerged today as a guiding force in teacher education. However, before giving an overview of this research program and its findings, a brief sketch of the range of activity at the time and its relevance to teacher education today seems appropriate.

Lee Shulman's (1986, p. 9, Figure 1.2) introductory chapter in the *Handbook* sketched the various research programs active at the time. The research programs focused not only on teachers and their characteristics and actions but also on students and their capacities, learning and actions, and on teacher-student interactive processes. Debates among proponents of one or another research program were heated, exciting, and exhausting. In a sense, each research program had its hands on and described different parts of the proverbial elephant. Importantly, research on teaching at the time covered the elephant well.

The criterion of effectiveness paradigm, for example, an early research on teaching program, sought to find relationships between teacher characteristics (generic cognitive skills, personality) and student learning and achievement. Researchers largely abandoned the program due to very low correlations. The one exception, an exception that has found support especially among economists proposing education policy from a production-function perspective, was a moderate and consistent correlation between teachers' verbal ability and students' achievement. While *this program could address the question of which teachers to select*, it could not answer the question of how to improve teaching. Put another way, the research program's limitation was that it could not say what produced the correlation between teachers' verbal ability and students' achievement.

Gage's process-product research program took up this question of what teaching activities give rise to student learning. Gage and his many colleagues and disciples sought to link teaching actions (process) to student outcomes (product). Out of the paradigm emerged the basic or technical skills of teaching with empirical evidence of their relation to student outcomes—questioning (high- and lower-order), feedback, reinforcement, and even silence. *Such skills served as the basis for pre- and in-service teacher education, especially at Stanford in its microteaching program*. However, stable relationships were hard to find and experiments that manipulated technical skill training showed at best weak effects. Moreover, the paradigm largely ignored student actions and teaching context.

The time and social mediation research program showed the importance of time on task. David Berliner's *Beginning Teacher Evaluation Study* (Berliner, 1979) showed that the greater the amount of time students spent on academic tasks the higher their

achievement. Research further refined these finding to show tasks of moderate difficulty were most impactful. Indeed John (Jack) Carroll argued that time, and not achievement, was the most important factor in student success. *An implication for teachers is that students need focused time on academic tasks that are within their grasp but a short stretch.*

Walter Doyle (1986) among others opened the field to the sociology and organization of classrooms in his research program. Activity structures, Doyle claimed, form the basic unit of classroom organization. An activity structure was defined as a short block of classroom time (10–20 minutes) in which number of students in the activity, physical arrangement in the classroom (e.g., seatwork, reading group) and shared behavioral expectations came packaged. Teacher behavior is systematically related to the affordances and limitations of the types of structures used in the classroom. Once a structure was identified, the processes carried out were predictable. (Think of a primary school reading group sitting in a semi-circle around a teacher and activities therein.) Moreover, classroom management was embedded in activities; activities give classrooms «order,» time allocation and predictability (Doyle, 1986). *Pre- and in-service teachers, then, might learn to distinguish and use, as appropriate, varying activity structures in their lessons.*

Other research programs dealt with knowledge and structures of knowledge in a discipline. Researchers studied conceptions, misconceptions, and their implications for teaching science, mathematics, history, and so on. *Pre- and in-service teachers, then, might come to understand untenable «mental models» (things float because they are light; sink when heavy) and move students to increasingly defensible explanations.*

The teacher cognition and decision-making program (e.g., Shavelson & Stern, 1981) recognized that other paradigms treated teachers as «black boxes»; the programs' focus were external to teachers' thinking, reasoning, decision-making leading to observable action. These programs only caught the emergent action. This program argued that the technical skills of teaching ignored teacher thinking and decision-making. What was important was the teacher's decision as to when to use which skill. Within this paradigm Shulman (1986, p. 26) formulated a version of his now famous pedagogical content knowledge framework: «I shall distinguish among three kinds of knowledge: content knowledge …, pedagogical knowledge … [and] *curricular knowledge*» (soon to become pedagogical content knowledge in his AERA presidential speech). *Teachers, in- and pre-service,* then, *might be given opportunities to link content and pedagogy together in deciding what and how to teach in their lesson planning and their enactive teaching* (e.g., Borko & Shavelson, 1983).

An important concept underlying this research program was that of «bounded rationality.» Human rationality is bounded by the brain's capacity to handle information. Tversky and Kahneman (1974) showed that people used judgmental heuristics to

reduce this information overload. The cognition and decision-making program applied these ideas to teachers and their capacity to handle the vast and fast-moving information in the classroom (e.g., Shavelson & Stern, 1981). For example, teachers had massive information about students garnered from their everyday interactions. Teachers had to orchestrate instruction taking into consideration goals, content, activities, and individual differences among students. And teachers operated within a classroom and school environment, environments that came with their own constraints and affordances. In order to handle information overload, we found that teachers filtered this information according to, for example, their beliefs about student capacity to learn and how one should teach, conceptions of the subject matter, and ability to handle cognitive complexity. They reduced instructional information overload by attending to or selecting some information and ignoring other information. Operating on information attended to, teachers reached judgments about (a) students' ability, motivation, and behavior, (b) content (e.g., content selection, student grouping, and activity selection, difficulty level, and pacing) and (c) affordances and constraints within an institutional context.

Almost 25 years after the publication of the 3rd *Handbook*, Seidel and Shavelson (2007) asked: «What do we now know about teaching effectiveness?» That is, we asked: «What teaching processes are likely to lead to positive student outcomes?» We compared two «theories»—research programs—as to their capacity to account for the link between teaching and student outcomes. One was Gage's process-product program of the 1970–1980s, and the other was a current (at the time) cognitive-models-of-teaching-and-learning program. The former typically used teaching behavior that is distal from the central student process of learning while the latter used variables («executive processes») closely linked to student learning. We found that components of teaching that were distal to executive processes (domain of learning, organization of learning, social context, time for learning, goal setting, etc.) were not highly predictive of learning. However, as the components moved close to executive functions (execution of learning), they became more predictive of student learning (constructive learning, domain specificity, social construction, goal directed, evaluative, and regulated). *Focusing the enhancement of pre- and in-service education on cognitive teacher and student cognitive components directly related to learning, then, might very well improve teaching and learning.*

Recently, discussion of teaching effectiveness has turned to teacher competence. The focus is on the teacher. The definition has been hotly debated. The question is: What is teacher competence? Is it a set of dispositions (cognitive, affective, and volitional) that underlie teaching? Is it actual, observable performance? Is it a capacity to reason practically and make decisions? Is it some combination?

Blömeke, Gustafsson, and Shavelson (2015a, 2015b; Blömeke & Kaiser, 2017) found a way through the debate recognizing that teacher competence is not binary but rather the definition falls along a continuum from dispositions to performance mediated

by situation-specific perceptual, interpretative and decision-making skills. The model proved to be generative. Indeed, it has led to a great deal of research on teacher perception, interpretation, and decision-making. So, it stands as a modern-day extension of the teacher cognition and decision-making research program begun in the early 1970s. Teacher perception of classroom behavior («withitness» in earlier days) using videos has influenced teacher education programs. Teaching videos and simulations inviting alternative interpretations and possible decisions about action have found their way into research on teaching and teacher education.

Research on teaching, then, has provided considerable academic knowledge for the preparation of teachers and for enhancing in-service teachers' competencies. Moreover, as the walk through the teacher cognition and decision-making program suggests, research has increasingly focused on teachers' impact on students' learning. Finally, the research and applications of this research have become increasingly situation specific—the application of (say) decision making in context. Yet not every situation can be incorporated into the preparation or enhancement of teachers' competencies. Other factors must be taken into consideration when acting practically and professionally. There is a gap between generalizable academic knowledge and its practical application in context.

3 Suspicions that research alone is not going to improve teaching practice

In the late 1960s and early 1970s as a doctoral student at Stanford and a few years later a faculty member, I learned from my mentors that the link between psychological research and professional action was as follows: We did the research and built theories. Teachers took our theories and put them into practice. When our theories did not work well *in context*, we concluded that teachers had failed to translate, adequately, our research into practice. We ignored teachers' complaints that the theories did not meet practical needs. In late 1970s and 1980s we assumed that the «fix» to the gap between research and teachers' implementation of it was a communication problem: Perhaps saying what we knew simpler (and lauder!) was the answer. David Krathwohl and later Lauren Resnick, as Presidents of AERA, established journals or projects that attempted to translate research into practice—the journals and projects were short lived. In the late 1980s and early 1990s I wondered whether the researcher's role in closing the research-practice gap was to change the «mindframes» of policymakers and practitioners (Shavelson, 1988). Perhaps research, by changing how a teaching or policy situation is viewed, could change practitioners' perceptions and decisions and, consequently, their actions. None of these attempts to bridge the research-practice gap succeeded in the end. Why might that be? Could it be that the challenge was thornier than we, the researchers, thought?

4 Others' claims that research alone is not going to improve teaching practice

The answer has always been: «Yes, if we had only listened.» Aristotle had answered the question a couple of thousand years ago. Others throughout the ages sounded similar alarms. Embedded in their alarms came hints about ways forward in bridging the gap. John Stuart Mill (1882) sounded the alarm in the 19th century:

> The art proposes to itself an end to be attained, defines the end, and hands it over to the science. The science receives it, considers it as a phenomenon or effect to be studied, and having investigated its causes and conditions, sends it back to art with a theorem of the combination of circumstances by which it could be produced. (Mill, 1882, p. 476)

Note that, having received scientific wisdom and empirical findings, Art examines these combinations of circumstances, and according to whether any are or are not within human power, pronounces the end attainable or not. Only one of the premises that Art supplies is the original major premise, which asserts that the attainment of a given end is desirable. Finding it also practicable, Art converts the theorem into a rule or precept. Mill is trying to find a way to determine whether science could warrant a specified range of human action. The hint from Mill lies in the recognition of the interplay between Science and Art—both with equal standing.

William James (1983), at the turn of the 20th century, sounded the warning about imposing psychological science on teaching:

> [Y]ou make a great, a very great mistake, if you think that psychology, being the science of the mind's laws, is something from which you can deduce definite programmes and schemes and methods of instruction for immediate school-room use. Psychology is a science, and teaching is an art; and sciences never generate arts directly out of themselves. **An intermediate inventive mind must make that application, by using its originality**. (James, 1983, p. 15, bolding mine)

James' hint is bolded in the quote. An intermediate inventive mind, one that knows the science and one that knows the professional practice. That inventive mind needs to be original. Every context is different, and cookie-cutter practical solutions or normative scientific statements are insufficient to the challenge.

Mid way through the 20th century, Lee Cronbach (1975) observed:

> **The special task of the social scientist** in each generation **is to pin down the contemporary facts**. **Beyond that, he shares with the humanistic scholar and the artist in the effort to gain insight into contemporary relationships**, and to align the culture's view of man with present realities. To know man as he is is no mean aspiration. (Cronbach, 1975, p. 126, bolding mine)

Social and education science plays a role in pinning down contemporary facts. Sounds like Mill. However, more is needed to inform practical action. The scientist and artist

need to work together to pin down contemporary relationships. More specifically, the educational scientist and the teacher educator need to work together.

David Berliner (2008, p. 295), in the 21st century, detailed the limits of psychological science in informing teaching, including:
- Basic research rarely informs a practitioner about what to do in concrete situations.
- Teachers' professionalism can be undermined when research is used to prescribe what teachers should do in their classrooms.
- Classroom contexts are remarkably varied and complex, thus limiting generalizations from research about appropriate teacher behavior.
- Treating educational research as a design science or field of engineering may be more fruitful than regarding it as basic social science research.

Berliner sounds the warning once again. Scientific research rarely informs the practitioner about what to do in concrete situations. Importantly, he warns against using scientific research to prescribe what teachers should do in their classrooms. Such a tack undermines teacher professionalism. He provides a hint as to how to deal with the science-practice gap: treat educational research as a design science. That is, «engineer innovative educational environments» (Brown, 1992, p. 141), iteratively working closely with a practitioner. This is intriguing but there are many teachers in the world, in many classrooms. Is this practical? Do such studies generalize (Shavelson, Phillips, Towne, & Feuer, 2003)?

5 Possible links between academic knowledge and practical knowledge

Fenstermacher (1986, p. 43, bolding mine), working from Aristotle's practical argument, concluded that **«research bears on practice as it alters the truth or falsity of beliefs that teachers have, as it changes the nature of these beliefs, and it adds new beliefs.»**[4] Moreover, teaching is a moral act in context; scientific arguments alone do not bear on this aspect of teaching. *Professional action, then, draws upon but rests on a different logic from theoretical (logical and scientific) reasoning.*

The practical argument goes something like the following (see Fenstermacher, 1986, for details):
- Major proposition: In certain teaching situations—such as when a planned lesson goes off track—reframing the problem that the class is working on often gets students back on track.

[4] In a similar vein, I argued that scientific research bears on practice as it alters the truth or falsity of beliefs—mindframes—that policymakers hold as major premises by changing or adding new beliefs (Shavelson, 1988). I concluded that scientific research contributes to practical action by challenging policymakers' major premises, and by providing alternatives to be explored.

- Practical argument:
  - I perceive the class is off track.
  - I *believe* that changing instructional conditions can help students get back on track.
  - I *know* this from my own and colleagues' *practical experience* in various circumstances.
  - I *know* this from what the *scientific literature* has suggested as a generalization although it is not a contextualized knowledge warrant.
  - Decision: I'll reframe the problem that the class is working on and see if the class gets back on track.

The bridge between scientific research and practical action is suggested in the practical argument. For any teaching situation:

1. First ask pre- or in-service teachers «What do you believe should be done in the situation?» The question asks for a statement of their major premise for action.
2. Next, ask them to justify their major premise.
   a) Probe their beliefs: What have they and other colleagues experienced as working in their classrooms?
   b) Then probe their scientifically justified knowledge: What, if any, scientific literature supports their recommendation?
3. Finally, probe further as to whether another major premise might be explored.

Scientific research, then, *is only one component of the practical action calculus*. The practical action calculus includes (a) teachers' prior beliefs that exert a strong influence on teachers' actions, (b) significant others' (teachers, administrators, teacher educators) practical experience in somewhat similar contexts, and (c) moral consequences of actions. Science supports or does not support a teacher's major premise for action; it can also influence what possible major premises a teacher considers.

So, the big question now is: «How to impact teachers' practical reasoning?»

6 What might teacher educators do to bridge research and context?

Attempts have been made to bridge research on teaching and professional practice. Many bridging practices survive in teacher education and enhancement programs because they appear to be useful, although their scientific justifiability varies greatly. This is not surprising given the magnitude of the enterprise; wisdom of practice is an important ingredient in the practical argument. Hence, what I have to say here is likely to have been tried and either worked or rejected in one or another teacher education program. I begin with what does not work and then move to conjectures about what might.

6.1 What has not worked to improve teaching practice?

Most large-scale attempts to improve practice have not, to my knowledge, endured; they did not bridge scientific knowledge and practice in a practical, supportable way. Fenstermacher and Berliner (1983) pointed out years ago the untenability of the assumption (bridge) that teachers can transfer what is learned in their education program or professional development workshop to their local teaching context. Continuous, consistent follow-up in the teacher's classroom context is essential. Moreover, teachers need detailed feedback on how to improve performance. Maintaining such a systematic approach proves to be costly in time, money, and expertise.

A second doubtful bridge is to assume there is one best way to teach. A closely related bridge is to assume that all teachers should be prepared to teach this way. (Notice the practical argument with a major premise and decision but without the supporting evidence!) Such assumptions ignore teachers' beliefs and abilities and their students' beliefs and abilities. Enhancement of pre- and in-service teachers' competencies needs to consider teachers' dispositions, students' dispositions and adapt to them. Otherwise, I have found that teachers learn the vocabulary of change (e.g., vocabulary of guided inquiry science) and use it to describe their unchanged teaching practice (e.g., Shavelson, 2008; Shavelson et al., 2008). A third doubtful bridge is to create some form of researcher-practitioner partnership. University-school and researcher-practitioner partnerships are examples. Such partnerships tend to be short lived with little evidence of impact for a high cost in time, cost, and expertise. A fourth bridge that has not worked is to create research-based texts and other material to inform teachers of innovations. AERA presidents' attempts, as noted above, were short lived.

6.2 What might work?

So, what might work? I have a couple of ideas that I have mulled over for years. One idea comes from Fenstermacher's work on the practical argument. A second idea comes from the work of a physicist and historian of science. What follows is a set of conjectures that need testing.

Conjecture 1: Practical argument

I wonder if the elements of the practical argument might provide a useful framework for improving (student) teachers' thinking and action. Suppose in university classes or teacher-enhancement workshops, (video) labs, and classroom practice teaching, (student) teachers are asked to justify and perhaps change the contents of their practical arguments. In a series of settings, they would be asked about their:

- major propositions underlying action in a setting,
- beliefs about teaching in this setting,
- experience and that of peers in the setting,
- scientific evidence (if any) that supports or not the proposed action,
- moral consequences of the proposed action,
- consideration of alternative courses of action.

Conjecture 2: Brokers working in a trading zone[5]

The second conjecture follows from William James noting that «Psychology is a science, and teaching is an art; and sciences never generate arts directly out of themselves. **An intermediate inventive mind must make that application, by using its originality**» (James, 1983, p. 15, bolding mine). What might this intermediate, inventive mind look like?

Before answering this question, I need to sketch the notion of a trading zone. Galison (1997), a physicist and historian of science, noted that physicists working in the same area but in different research programs were like different subcultures speaking different languages. Even so, somehow, they develop «an interlanguage that could serve to bring theoretical commitments into contact» (Galison, 1997, p. 815). So, two cultures that think and speak to one another quite differently but that are highly motivated by the same general problem, develop a means to communicate. He noted,

> … anthropologists who regularly study unlike cultures that do interact, most notably by trade. Two groups can agree on rules of exchange even if they ascribe utterly different significance to the objects being exchanged; they may even disagree on the meaning of the exchange process itself. Nonetheless, the trading partners can hammer out a local coordination despite vast global differences. In an even more sophisticated way, cultures in interaction frequently establish contact languages, systems of discourse that can vary from the most function-specific jargons, through semi-specific pidgins, to full-fledged creoles … (Galison, 1997, p. 783)

Suppose, then, that scientific researchers and teachers are two subcultures that think quite differently but share the goal of improving students' education. They find themselves in a trading zone as each has something of value for the other. Coming together in a trading zone, they just might develop a common language to communicate even if it is a pidgin. This said, typically the two subcultures have not come together.

What is needed for this to happen? I believe a catalyst is needed to engage researchers and teachers in the trade of ideas and «goods.» What might such a catalyst look like? In part, the catalyst might be James' inventive, original intermediary. Such a person must, as Galison suggested, have an interest in and understanding of both subcultures. That person would be able to broker the development of a pidgin to enable communication and trading. That person would engage in *trading work*: an exchange of ideas and values among social groups (researchers and practitioners), requiring «*local* coordination despite vast *global* differences» (Galison, 1997, p. 783). Such a person, then, would live between the world of research and the world of teaching with a firm grasp of both. She/he would be able to explain research findings in a language the practitioner could understand and engage in a discussion of how generalizable scientific knowledge might be applied in a particular situation. That same person would, in turn, translate

[5] I am indebted to Professor Noah Feinstein for bringing Professor Galison to my attention albeit in a different context than this, in his dissertation. I learned much from both Professors.

the challenges confronting practitioners into researchable empirical questions. She/he would communicate the questions to researchers as well as undertake some of that research herself/himself.

7 Big challenges when bridging science and practice

Before proceeding with a vision of a broker working in a trading zone, a caveat is in order. In moving forward with practical-argument-based teacher preparation and enhancement, we will confront many challenges. In addition to the challenge of capacity to do what is envisioned, we confront two other big challenges. One challenge is that policymakers and the public are wary of anything other than scientifically based evidence (e.g., Shavelson & Towne, 2002). Proposing that science is only one part of teacher education and enhancement is risky. As already noted, policymakers and the public fear that values may enter teacher preparation and enhancement. The public and policymakers do not agree on values. Indeed, as noted, values often underlie superficial debates. Participants use «scientific evidence» without explicating the value assumptions underlying the research. They offer their findings as scientifically based evidence in support of one or another value-laden position.

However, as argued, scientific knowledge can take us just so far in preparing teachers. Practical knowledge of action-in-situation is essential in teaching. The question, then, is: «How might we warrant (justify) a practical knowledge approach to preparing and enhancing teachers?» Here are a set of conjectures in response:

- Show that the practical argument is based on scientific knowledge *and* extensive situated experience.
- Show case (written, video, role play) studies of successful (and unsuccessful) practice in context.
- Systematically study the impact of coaching and advising (student) teachers on practical propositions for action, decisions for action and consequences of action.
- Remind and show policymakers and the public that such practice including cases (etc.) are widely used in business, law, medicine, and architecture.

The second big challenge is that of organizational and behavioral change at the colleges and universities that prepare and support teachers. In many universities, teacher education is viewed by administrators and other faculty with little respect. At worst, they question whether teacher education belongs at the university.

What is needed from all levels of the university is:

- A change in culture to one of mutual respect and support.
- A common vision of the role and value of professional practice.
- Endorsement of the value of teacher education.

– Incentives for the scholarship of teaching pre-service and in-service at the university (e.g., promotion, tenure, recognition of value and merit).
– Financial support for creating joint research on practice among researchers, teacher educators, and teacher brokers.

8 How might we move the practical argument agenda forward?

I wonder what it would take to prepare a cadre of «brokers» who could work in the «trading zone» between academic knowledge and practical knowledge. Such brokers would understand research evidence and have what William James (1983, p. 15) called an **«inventive mind [to] make that application [of science to practice], by using its originality»** and, I would add, **experience**. The brokers would be recognized for their excellence in both teaching and research (e.g., inquiry into classroom practice) and hold joint appointments in schools and the university. However, such teachers might be difficult to find and difficult to recruit to a joint appointment. Even if found, those holding a firm understanding of research and its findings and who can also apply it in a practical calculus for action would most likely be few.

Perhaps education faculties should consider a *teacher-educator program* that would prepare brokers. That is, perhaps faculties of education should seek outstanding teachers and former teachers in school and district leadership positions. These teachers would be invited to a degree program focused on preparing them at the university to understand, in practical ways, research and evaluation methods, and findings and interpretations. They would be encouraged to explore their practical knowledge in explicating the role of research knowledge in the practical argument. Cases, videos, and the like would be used for discussion and guided practice emphasizing alternative ways to handle myriad teaching situations. At the master's level, the program might culminate in a product or a performance that demonstrates their capacity to broker the development of pre-service teachers or practicing teachers. Graduates holding the master's degree might find jobs spanning the schoolhouse and the university. They might take a leave from school for two or three years to teach in a university teacher-education program. Some may choose to continue their studies culminating in an Education Doctorate (EdD) rather than a PhD.[6] At the doctoral level, students would conduct practical research on teaching, joining research faculty, teacher educators and brokers in doctoral training. In the end, perhaps a new generation of teacher educators would evolve as well as a knowledge base for justifying practical arguments not only to colleagues but also to the public and policymakers.

[6] EdD programs may be found in the U.S. Harvard's Graduate School of Education that only grants an EdD. These advanced programs focus on practice and the practical rather than on pure academic knowledge. Student preparation differs somewhat from PhD programs but is just as rigorous in relevant ways.

9 Concluding comment: Vision of a broker

What might a broker look like? I recently read a recommendation letter for the appointment of a pediatrician to the faculty in a prestigious medical school. The letter is from a pediatrician who, as a student, was mentored over a 4.5-year period (from intern to fellowship resident) by the candidate. The letter captures the essence of what a teacher-education broker having received an EdD might look like. The letter writer describes the context in which trainees work long, overnight shifts under the tutelage of «attendings» (on-duty physicians responsible for mentoring trainees as well as treating patients):

> *One of the side effects of having attendings in-house overnight, as is the case with many programs that staff this way, is that there can be a gradual loss of autonomy for the residents … Given this, one of the things that has always stood out about Dr. KSS, and also one of the things that I liked best about working with her, is that she would empower us to act autonomously within the appropriate limits of our stage of training. I use the word «empower» specifically because through a communication of expectations, thoughtful clinical discussions, facilitated contingency planning, and making herself available for debrief, the net result of working a shift with her was that I was typically aware of some amount of personal growth.*

The letter writer goes on to describe the candidate's ability to develop the trainee's capacity to reason clinically:

> *As a trainee, sorting out substance from style in a supervisor's clinical decision making can be a significant challenge. Whenever I would bring a clinical question to Dr. KSS, or if we were debriefing about something that didn't go as well as it could have overnight, she was always very clear about what was evidence-based and what was a more stylistic issue. The fact that she could do this in a way that never felt judgmental is a testament to her professionalism and skill as a teacher.*

The letter writer then turns attention to personal difficulties of a trainee in a small, elite program. The trainee sometimes felt

> *… like my early training blunders or struggles are hard to move on from. With Dr. KSS, I have always felt like she was only looking at my growth. Knowing that she trusted me was always considered the highest compliment. And I know from talking with my co-residents that this was a common sentiment.*

The writer concludes with reflections on a session at a fellowship conference where excellent clinical teachers/role models were identified:

> *Attributes mentioned included: knowledge, demonstration of clinical skills, excellent communication, having integrity, honest, provides feedback, setting expectations, enthusiasm, encouragement, creation of a positive learning environment, commitment to growth, models professionalism, and can adapt to learners needs. It is my sincerest hope that I have been able to convey above that I think Dr. KSS embodies all of these characteristics.*

Of course, the context and support in which teacher educators work is not the same as in medicine. Nevertheless, the characteristics of Dr. KSS serve as a vision of what

a teacher-educator-broker might know, sense and be able to do. If we «build» such brokers, there is a small chance that additional resources for teacher education might follow.

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Author

Richard J. Shavelson, Prof. em., Stanford University, Graduate School of Education, richs@stanford.edu