Chapter 10
Drawing on the Delphi Technique to Explore Areas of Convergence and Divergence Among Expert Opinions in the Field of Teaching

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Abstract The chapter brings together the individual chapter perspectives on theorizing teaching and thus initiating exchanges among the authors on outstanding issues and discrepancies to provide insights for how research on teaching may move forward. The Delphi study conducted for this aim was based on summaries of the answers of all individual chapters on three questions; authors were asked to rate and comment on each other's ideas. Comparing ratings and comments exposed the variability in the contributors' perspectives on (a) the existence, degree of development, and grain size of theories of teaching (first question), (b) the attributes of theories of teaching (second question), and (c) the process of developing theories of teaching (third question). We identify general trends with respect to these issues, leaving a more in-depth discussion for the next chapter.

Keywords Delphi study · Theories of teaching · Theorizing teaching

In the preceding chapters each author/author group presented their own views on theorizing teaching. Obviously, the authors highlighted different ideas on theorizing teaching and accordingly structured their chapters differently. Therefore, we initiated an exchange of ideas on theorizing teaching among the authors on the most

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critical issues on theorizing teaching. The chapter presents the results of this initial exchange whereas the next chapter discusses the convergent and divergent views presented herein in more depth.

1 The Approach Taken

The editors invited the contributors to participate in this synopsis and comparison exercise. They were all kind enough to agree and are thus listed, in alphabetical order, as co-authors for the chapter.

The editors selected three of the five questions all contributors had been given as a guide for writing their individual chapters (for the questions, see Sect. 2). The exercise was restricted to the three questions which were essential to the project since a follow-up exercise addressing all five questions would have been too burdensome. Also, the selected questions had elicited the most detailed responses and thus lent themselves to a more comprehensive analysis of the convergence and divergence of views.

For each chapter, the editors produced a synopsis of how the selected questions had been addressed by the author. For two of the questions, they also developed tables that summarized, rephrased, and organized the ideas to further distill the authors' opinions about the process of developing theories and their constituent parts.

In a member-check phase, the authors then went through the summary document to verify that it accurately reflected their thinking, and some summaries were revised to reflect their comments. The authors were then asked to indicate the degree to which they agreed with the ideas put forward by other contributors and to briefly expand on those aspects with which they disagreed, as well as reflect on the extent to which they thought a consensus view might be achieved in certain areas. It should be noted that to avoid overloading the authors, they were asked to read only the summaries provided, not entire chapters.

A Delphi method study typically consists of several rounds of structured communication with summaries and responses (cf. Linstone & Turoff, 1975), however for logistical reasons the authors in this book were asked to engage in only one round. We feel that even this single opportunity for the contributors to consider each other's answers to the questions posed and reflect on all of the ideas presented in the volume is very illuminating and can pave the way for more similar systematic interactions in the future.

2 Comparing and Contrasting Authors' Points of View

Sections 2.1 to 2.3 present the contributors' answers to the three questions. The questions can be found in the boxes at the beginning of each section. We present the authors' answers in text and/or tables, depending on the kind of information given. We provide a general commentary in the following sections but reserve a more detailed analysis for the next chapter.

2.1 Existence of Theories of Teaching

One question answered by all of you pertained to the existence of theories of teaching: "*Do we already have a theory/theories of teaching? If so, what are they?*"

As shown in Appendix A, answers to this question divide with respect to:

- The existence of theories of teaching (with some authors arguing that such theories definitely exist and providing examples of them, and others being more cautious about their existence);
- Their degree of development (with some authors arguing that they are already developed, others suggesting that we are at the very beginning of developing theories, and still others opining that theories should be thought of as constantly evolving); and
- Their grain size (with authors discussing small theories, partial theories, mid-range theories, general theories, or meta theories).

One could argue that this variation is to be expected given that scholars focus on different aspects of the complex phenomenon of teaching, using different lenses and approaches. However, one could counter that consensus needs to be reached on key issues in order to accumulate knowledge in the field. Therefore, we ask that you briefly (in 400 words max) address the following question:

Could and should consensus be reached in terms of the existence, degree of development, and grain size of theories of teaching? If so, why and how? If not, why?

2.1.1 Consensus Could and Should Be Reached Within Certain Programs and for Certain Purposes (Hiebert & Stigler)

Should consensus be reached on these elements of teaching theories? It depends on their ultimate purpose. If, as we believe, the purpose is to accumulate knowledge and steadily increase the community's understanding (and practice) of teaching, then we believe consensus is necessary on aspects of theories that enable researchers to build on the work of others and accumulate knowledge. This would require consensus on hypotheses that are important to test and revise. Consensus on hypotheses worth testing would require, in turn, consensus on the most pressing problems of teaching along with a common language to facilitate clear communication among researchers.

We are not arguing for consensus across the entire research community. We could imagine multiple productive programs of research progressing simultaneously. However, we are arguing that knowledge will accumulate only within programs, so the number of such programs must be relatively small (smaller than the number that exist now) for the field, as a whole, to show steady progress.

If the immediate purpose of theories is to explain and predict important phenomena, then similar points of consensus are needed. Research programs grow in richness and scope as theories are able to explain more fully and predict more accurately. We believe this happens when researchers pursue solutions to shared problems and can use the findings of others to improve their predictions and explanations. In many ways, we are arguing for the gradual but steady movement toward "normal science," in Kuhn's (1962) terms. Without such movement, the field can appear, from a big-picture perspective, to be accumulating random facts and unverified observations.

Accumulation of knowledge occurs, in part, through replications. Addressing questions of teaching effectiveness will always require sorting out effects that are constrained by context vs. those that have broader application. Replications are among researchers' best strategies for building knowledge that accounts for these constraints. And, replications require consensus among a community of researchers on the big problems of teaching and the hypotheses (local theories) that stand the best chance of addressing these problems.

2.1.2 Clarifying Underlying Assumptions Instead of Aiming to Reach Universal Consensus (Vieluf & Klieme)

Regarding the existence of theories, we believe that the very existence of this book project is proof that researchers have long started theorizing about teaching. Nobody shall deny the existence of THEORY as long as (a) there is ongoing, rigorous scientific debate on characteristics of teaching using general conceptual notions (which can be considered elements of a language of teaching theory), and (b) there are researchers claiming that their discourse on, reflection of or conceptualization of teaching is theoretical in nature. Second, we believe that there is no clear-cut, authoritative rule for deciding when the process of theorizing (or "doing theory", as we prefer to call it) has led to some (intermediate) results that qualify as "a theory". Setting up a demarcation line between "doing theory" and "establishing a theory" is

a scholastic endeavor that does not lead to much scientific progress – at least if you were ready to accept philosophy of science beyond logical empiricism.

What is at stake, however, is the type and quality (or degree of development) of theoretical work on teaching. We think that there can be no universal answer to this question. Definitions of the term "theory" are multiple, so are quality criteria for theories and classification systems differentiating between types of theories. They depend on epistemological and ontological perspectives (see e.g., Abend, 2008; Zima, 2017). Therefore, it seems inevitable that conclusions concerning the status and the degree of development of existing theories of teaching differ depending on these perspectives. We further agree with Abend (2008) who argued that the evaluation of paradigms[1] should be left to the field of philosophy and, as long as there is no definite decision for the superiority of one or the other in the field of philosophy (which may never be the case), theories should be evaluated from within each coexisting paradigm. When researchers have largely similar perspectives and criteria, they should come to similar conclusions. Yet, researchers representing different paradigms are likely to disagree and then it is difficult to decide who is right, because this implies the philosophical question about the "right" epistemological and ontological perspective, which is – at present – not resolved, and possibly cannot ever be resolved. Rather, each perspective has strengths and limitations, so that they may be seen as complementing each other. So we argue against an attempt to reach a universal consensus on what a theory is and how it should look like. However, our argument underlines the importance of always making the own epistemological and ontological perspective and the own criteria for evaluating theories explicit when writing about theories and reflecting about them with the aim of realizing the limitedness of the own claims.

2.1.3 Reaching Consensus on a General Theory of Teaching Is Desirable (Scheerens)

I think that it would be helpful if consensus could be reached on what we mean by "theory". I was inspired by Snow's contribution by distinguishing meta-theory, theory, and grades of theory development. Then, prompted by the way the editors

[1] With the term *paradigm* we refer to a unique combination of ontology, epistemology, and methodology or to "a whole way of doing science, in some particular field" (Godfrey-Smith, 2003, p. 76). This understanding is inspired by Kuhn (1962). Yet, it should be noted that this is not the only meaning of the term discussed by Kuhn and also that we do not fully agree with Kuhn's perspective. In particular, we disagree with his idea that within a field only one research paradigm dominates during times of "normal science". Instead we think that different paradigms co-exist over long periods of time, for example within the field of education. Nevertheless we find the term "paradigm" useful for making the argument that understandings of and normative expectations towards "theories" are likely to depend on (possibly implicit) ideas of researchers about the nature, origin, and limits of human knowledge, on perspectives on the nature and relations of being, and on the preferred research methodology. For this reason we think that consensus on the questions raised by the editors can, at most, be reached among researchers who agree on those more fundamental questions.

framed the theme for this book, I made a distinction between **a** general substantive theory on teaching, and partial theories. A general theory of teaching could be conceived as comprising of a possibly exhaustive set of "building blocks", "sub-theories of teaching (Gage) or "dimensions". Two examples of such building blocks are structure and independence in teaching and classroom management. Partial theories refer to explanatory mechanisms associated with more specific aspects of teaching, like "direct instruction". Models in the sense of conceptual maps of variables in teaching might have less developed explanatory rationales, but just what Snow calls "formative hypotheses" about empirical associations.

The general answer to the question why consensus on a definitional framework on teaching theory is helpful is that it facilitates communication and exchange.

By reflecting on the meaning of a general theory on teaching and seeing this as the union of "building blocks", "sub-theories" or "dimensions", this opens an area of interesting comparison with comparable contributions, some of which also represented in this volume.

The distinction of partial theories and the way they might be connected to formative hypotheses linked with empirical models, points at a level where theorizing and empirical research could be brought together. As such this is probably the most productive level for progress, in both theory formation and empirical research.

2.1.4 Agreeing on Defining Theory Is Prerequisite for Reaching Consensus (Kyriakides et al.)

It is difficult to reach consensus on this question and this is due to the fact that each of us understands the term "theory" differently. So, we believe that it is necessary to provide and reach consensus firstly, on what we define as a theory of teaching. In our view, a theory could not only explain the complex nature of teaching but should also allow researchers to investigate its impact on learning and make predictions and suggestions of what they should observe in order to provide suggestions for improvement. Therefore, it is important to stress that a theory of teaching should be practical and testable. In this perspective, we argue that reaching consensus could be beneficial, but practically it could be very difficult to achieve. This is because, a theory may consist of both generic and contextual aspects which may vary depending on the educational context. Also, different researchers may have different research agendas and make use of their agenda in responding to this question accordingly. We also believe, that to reach a consensus a theory must be parsimonious and clear to the practitioners. To this end, we agree with McIntyre (1995), when he argues about the need for "practical theorizing" in teaching. This could be achieved, at least by focusing on the generic aspects of teaching, which could apply to different educational contexts and backgrounds. Therefore, we believe that it would be beneficial to agree on a more explicit and precise definition of a theory, to avoid receiving replies that do not necessarily reveal disagreement among the researchers but show that each researcher refers to theories of teaching having in mind his/her own research interests and specific research area.

2.1.5 Agreeing on Defining Teaching is Prerequisite for Moderate Consensus (Schoenfeld)

To elaborate on some of the themes in my chapter: where we don't have consensus is on the very definition of "teaching." Until that is clarified, people will be talking past each other. It may be that we need multiple definitions, and that the questions above should be asked for each of the definitions.

Specifically: If you define "teaching" as "the decision-making and actions taken by someone in the act of instruction," then the question is, do we have a theory of decision-making, and how well developed is it? I have argued that we do have such a theory – in my (Schoenfeld's) book *How We Think.* Such a theory is "value free," in that it does not say what a teacher *should do*; it says that if a teacher has certain resources (including knowledge), beliefs and orientations, and goals, then the teacher is likely to act in certain ways. Specifying the theory more completely in any particular context means knowing a particular teacher's resources, beliefs, and goals; that can never be done completely, but it can be done at a level of grain size that supports predictions consistent with teachers' behavior. The theoretical problem has been solved; the practical problems are something else entirely.

Many of the chapters, at least tacitly, take teaching to be a value-laden enterprise: we want teaching to result in specific kinds of student outcomes. First, I believe the focus should be on the learning environment, not simply the actions of the teacher. (This is elaborated on in my chapter.) Second, once one considers desired outcomes, the question has to be: "what outcomes, under what conditions?" There will never be complete consensus, in that different groups value different things; and because concepts such as "understand" can be illustrated but never completely specified. That said, for any particular set of values, one can specify classes of actions that support those values-in-action, and those that are problematic. The grain size has to be fine enough to enable reflection on the question "what will the impact of this particular action be?" along dimensions that count – but that's as much as one can do. Prescriptions don't work, because of the context-specificity of teaching.

2.1.6 Reaching Consensus through Intellectual Competition of Diverse Perspectives (Herbst & Chazan)

We think that the development of a scientific consensus will hinge on our capacity to reconcile community inclusiveness with intellectual competition based on fair and ambitious expectations, such as endurance and productivity.

We are reframing the question as "Will consensus be reached…? " and discuss what we think are the conditions of possibility for the development of such consensus. It seems unlikely to us that such a consensus will be reached, as it is not clear who is in need of such consensus and what material conditions favor such development. While goodwill may support initial investment in consensus development, the success of such effort requires discipline not only to put academics to work together but also to make their ideas work with and against each other. While inclusiveness and goodwill are needed for initial investment, the development of a scientific

consensus cannot rely only on inclusiveness but needs also to aspire to qualities usually obtained through competition, such as parsimony and predictive power. The latter may only come to pass if our voluntaristic, inclusive efforts toward consensus are matched by the constraints imposed through limited resources and expectations of use that a patron, sponsor, or set of stakeholders can control.

These presses for consensus can use help from the policy field. International efforts such as TIMSS or GTI, or national efforts such as NAEP in the US, could become good partners for academics to put theories to work complementing and competing with each other. But that would require from these large studies to request proposals from theorists and establish general expectations for those proposals. It would also require a commitment to support the development of theory of teaching by creating arenas for competition among theories.

Thus, we should aim at establishing an infrastructure for the consensus-development process: Can we agree on a consensus-development process that relies not only on the value to include diverse contributions but also uses the mechanisms of social science to allow the ideas to compete? If so we could collaborate on lobbying large studies to accommodate competing resident theorists that agree on conceptual frameworks that accommodate constructs and instruments from different theories to allow the study of teaching at scale. Such search for consensus in conceptual framing and study design could be followed by parting ways in data analysis when theories might be pit against each other, and a third moment in which the competing theories could look for reconciliation on the basis of their accomplishments in the analysis of study data.

2.1.7 Cultural Embeddedness of Teaching Allows Only for Partial Consensus (Cai et al.)

There are two parts to this question: the "should" part, reflecting the desirability of working towards consensus if it is possible, and the "could" part, reflecting the possibility of reaching consensus. On the one hand, it is desirable to work towards consensus. We agree that there does need to be some consensus about theories of teaching, especially given that the phenomenon of teaching exists across the global community. It would be good if we could communicate about ways to teach students better (that is, to better help them to learn) by leveraging shared aspects of our theories. In this way, theories of teaching can provide us with shared bases to communicate with each other (globally) and also allow us to accumulate knowledge about theories of teaching as they continue to evolve.

On the other hand, even though we agree with the desirability of working towards consensus on a general level, the fact is that teaching is a culturally embedded activity that proceeds from (and is continuously entwined with) premises, conditions, and assumptions that can vary greatly across the globe. So, we believe it is not possible to achieve consensus on every aspect of a theory of teaching. That said, we believe we could reach consensus on the existence of theories of teaching, appropriately defined. However, their degree of development and their grain size are aspects that we believe can only achieve partial consensus at best.

2.1.8 Focusing on Functions and Purposes of Theory to Reach Some Consensus (Biesta)

I think that it would be helpful to reach a degree of consensus. One confusion that probably needs to be cleared up is what the function of theory is (the reference to the distinction between meta-theory and object-theory might be helpful here, but it depends on how meta-theory is understood, that is, whether meta-theory is seen as philosophy of knowledge or as an overarching theory of education). There are at least two rather different functions of theory which relate to different purposes for empirical research. The most important distinction is that between explanation (which in most cases means *causal* explanation) and understanding. If the aim of theory is to explain, then there is still the question what the theory should explain (Should it explain the act of teaching for example? Or should it explain the potential impact of teaching?). If the aim of theory is to understand, then there is again the question what it is that the theory should seek to understand. (Should it understand the decisions and judgements teacher make about their teaching, for example? Should it try to understand the complex network of classroom interaction through the perceptions of teachers and students?) And the 'what' question in both cases suggests that there is also theoretical work needed in order to *conceptualize* the object one wishes to theorize about. After all, in order to develop any theory about teaching, we need to begin with the question how we want to understand teaching *itself*. I see that some authors refer to theory in terms of hypotheses that can be tested in order to generate causal explanations, but that is only one possible role for theory. In addition to all this, theory can also play a heuristic role, that is, that it helps to bring certain phenomena into view. To look at the work of teachers through the lens of effectiveness gives, after all, a completely different picture than looking at it through the lens of affective relationships. My sense is that when some of these issues are clarified (which could be seen as 'meta-theoretical' work), it becomes possible to map different approaches to and engagements with theory around teaching. (For more on this see Biesta et al., 2011; Biesta, 2013, 2020).

2.2 Content of Theories of Teaching

You were also asked to reflect on the following question: "*What should a theory contain and why?"*

Appendix B summarizes the answers given. As can be seen in this appendix, the answers focus on different aspects. Attempting to bring some coherence and structure in a parsimonious way, we selected main ideas from the answers given, slightly rephrased them to enhance consistency, and organized them as shown in Table below.

(continued)

Could you please do the following:

1. Use this table to indicate the degree to which your chapter explicitly discusses the proposed element; for elements not captured, please indicate the degree to which you agree with them using the suggested answering format (entering an 'x' in the column chosen).
2. In a text (of no more than 500 words)
   (a) Please elaborate on 2–3 elements with which you (partly) disagree, explaining the reasons for your disagreement.
   (b) If need be, please:
      - Describe other elements that should be added to the list.
      - Identify any elements which you think are redundant and briefly justify your thinking.
      - Identify any concerns you might have with the proposed structure of the list.

		Included in my chapter	Not included in my chapter		
			Do not agree	Partly agree	Fully agree
A.	**Basic assumption:** A theory is informed by or grounded in epistemological preferences, paradigms, methodologies, and ontological considerations.				
B.	**Considerations about content and structure:** **A theory should …** Explain basic terms (teaching, learning, and the social)				
	Explain what teaching is for				
	Explain how teaching takes place				
	Contain constructs covering various elements and features of classroom teaching and procedures operationalizing those constructs				
	Explicitly provide the rationale for including certain teaching aspects				
	Explain how categories of instances of practice form larger systems of practice such as lessons, units, courses, and programs of study				
	Contain models linking different constructs with student learning and other constructs which have been a priori defined as desirable outcomes of schooling				
	Link teaching to its antecedents				

(continued)

		Included in my chapter	Not included in my chapter		
			Do not agree	Partly agree	Fully agree
	Be specific enough to allow concrete connections among learning goals, teaching aspects, and student outcomes				
	Explain how the intended curriculum can be transformed into learning opportunities for students				
	Concurrently attend to issues of quality and equity				
	Have a multi-level character (taking into consideration the system and school level)				
	Explicitly attend to the conditions under which certain teaching aspects matter for student learning				
	Explicitly attend to the student populations for whom certain teaching aspects matter for student learning				
	Include resources for representing the practice of teaching				
	Include technical language for describing the practice of teaching				
	Include non-technical language for describing the practice of teaching				
	Provide the means to express relationships among different teaching aspects				
	Contain empirically falsifiable propositions				
	Include experimentally falsifiable explanations				
C.	**Considerations regarding the usefulness and usability of theories by practitioners:** **A theory should …** Guide practitioners' cause-effect reasoning that lies at the core of making instructional decisions				
	Be expressible in ways that practitioners can judge its face validity				
	Include a semiotic infrastructure that goes beyond language to support communication about teaching between researchers and practitioners				

Table 10.1 presents the authors' answers and each number represents one chapter. The numbers correspond to the order of the respective chapter in the book (for more information, see the notes for the table). Authors could choose between the two broad categories "included in my chapter" and "not included in my chapter" and were asked to indicate, for the second one, the degree to which they agree with these statements ("do not agree", "partly agree", "fully agree"). The editors included another column ("raising concerns") to list the chapters for which the authors partly agreed with the statement or did not choose any option but raised concerns in comments; the editors put the chapters in that column when the authors stated that the idea was included in their chapter, but they were concerned about some aspects of it or how it was phrased. Concerns were raised for the following reasons (the numbers in parentheses indicate the chapter number according to the table): (a) The ideas presented were considered incomplete (5), (b) the words chosen or the meaning conveyed by some of the statements were deemed inappropriate (5, 7), (c) the applicability of the statement content was limited (2, 5), and (d) authors disagreed with the emphasis implied in the statements about the content and the purpose of a theory (7). In the last column of this table, we also list any applicable authors' agreements and disagreements with these elements as well as their comments thereof. Although the authors listed their (dis)agreements and comments in a continuous text, to support the readability of the text, we decided to present these ideas when outlining each corresponding element, instead of presenting them at the end per author/author group, which would render it difficult for the reader to follow what ideas were expressed for certain elements.

Table 10.1 Attributes of theories of teaching

	Included in own chapter[a]	Not included in own chapter[a]			Raising concerns[a]	Comments[a]
		Fully agree	Partly agree	Do not agree		
A. Basic assumption: A theory is informed by or grounded in epistemological preferences, paradigms, methodologies, and ontological considerations	3, 4, 6	2, 7, 8	5	9		
B. Considerations about content and structure: **A theory should …** Explain basic terms (teaching, learning, and the social)	2, 3, 4, 6, 9	7	5, 8		3, 9	**5 (also applies to other elements, see below):** We don't think that certain aspects are relevant for developing a theory of teaching. For example, we don't see that it is necessary to provide an explanation about the meaning of basic terms such as teaching and learning because then we are losing focus and we are not going to have a parsimonious theory **8:** We only partly agree with the assertion that a theory of teaching should explain basic terms. Theories of teaching may use terms like teaching, learning, and the social, but these are terms from a wider discourse than simply theories of teaching. In mathematics, theorems rest on definitions of terms, but not every theorem needs to be accompanied (in its communication) by the entire collection of relevant definitions. That is, of course there are common terms that are used when discussing theories of teaching, but trying to be comprehensive about them is not really productive or even possible all the time. For some terms, the understanding is tacit (or contextual), whereas it may be helpful to explicitly explain other, more proximal terms, to the theory. For example, it is impossible to clearly and completely define what mathematics is; similarly, it is not necessarily all that helpful to do so when expressing a theory of teaching. To some degree, it must rely on common sense and a certain degree of description. Typically, there is no need for an extensive description of the basic terms **9 (also applies to other elements, see below):** I also see references to learning, and I think first of all that this term is not precise enough (learning to tie one's shoelaces is very different from learning the second law of thermodynamics; so just to refer to 'learning' without specifying what it is about and for, is not very helpful). I also think that not everything that matters in education has to do with learning; learning is only one way in which students can relate to the world, and education should open up other ways of being and relating as well.

(continued)

Table 10.1 (continued)

	Included in own chapter[a]	Not included in own chapter[a]			Raising concerns[a]	Comments[a]
		Fully agree	Partly agree	Do not agree		
Explain what teaching is for	3, 4, 6, 8, 9		2, 7	5	2, 3, 6	**7:** The requirement that a theory should "explain what teaching is for" is vague and there are options for how to make it less vague. We should accept that "what teaching is for" is variable culturally and historically. A theory should support research that seeks to understand how conflicting expectations of what teaching is for are negotiated in the crucible of practice. Our preferred interpretation of the requirement for theory to "explain what teaching is for" is aligned with the recognition that different stakeholders of education systems have different end statements and that those vary over time. The role of research is to understand the world; so, even if scientific understanding is situated historically and geopolitically and eventually should inform how the societies that sponsor it evolve, we seek to maintain a critical distance between scientific practice and social policy making. From this perspective, if we are given a world in which teaching exists, it is reasonable to ask what are the conditions that support that existence and how does variability in those conditions relate to the variability in the phenomenon itself. What are the factors that matter in allowing teaching to be what it is and constraining it from being something else, and how do those factors make teaching be what it ends up being? The answer to those questions emphasizes the irreducibility of teaching, as well as of its ends, as a practice rather than a production function: The ends of teaching are as much of an empirical phenomenon as teaching itself, and to grasp those ends, just as much as to understand teaching, we need a theory of practice. If a theory of practice is to explain what teaching is for, it should try doing so first for teaching that happens in a particular place where the same set of conditions may be operating. Formulating a theory of practice within a twenty-first century advanced post-industrial capitalist democracy that supports the growth of scientific knowledge may be one such way of scoping the enterprise. In that case, it may be feasible to hypothesize the types of stakeholders that matter to the practice of teaching and that may end up playing a role in the theory's capacity to explain what teaching is for. In our case, the four stakeholders knowledge, client, society, and organization added to the teacher's own self seem quite reasonable hypotheses for feeding an effort to explain empirically what teaching is for. The client perspective suggests that teaching is for students' learning, development, or emancipation. The knowledge perspective suggests that teaching is for the reproduction of the conditions of production of knowledge. The society perspective suggests that teaching is for the reproduction and/or progress of society's needs and values. The organization perspective suggests that teaching is for the preservation and growth of the education sector. And the perspective of the self suggests that teaching is for the employment and self-actualization of teachers. A theory of practice would consider how these different ends are present in practice and the explanation of what teaching is for might seek to discover emerging ends of a practice of teaching that emerges in a context where all those forces support and constrain its existence.
Explain how teaching takes place	2, 8, 9		3, 4, 7	5, 6		

Contain constructs covering various elements and features of classroom teaching and procedures operationalizing those constructs	2, 3, 4, 7, 8		6	5	3,9	
Explicitly provide the rationale for including certain aspects of teaching	2, 3, 6, 8, 9		4, 7	5	3, 6	
Explain how categories of instances of practice form larger systems of practice such as lessons, units, courses, and programs of study	3, 7, 8			2, 4, 5, 6	3, 9	**2 (also applies to another element, see below):** In our view, this element does not need to be addressed in a theory of teaching. Building on our response to Question 1, we evaluated the necessity of each element in Table 1 by asking whether a theory needed to contain that element in order to generate important or consequential hypotheses about classroom teaching. We believe that this element is not essential as theories of teaching are developing. In our view, hypotheses have yet to be formulated, tested, and revised that build a picture of the causal mechanisms of teaching that transform the curriculum (with the desired learning goals) into learning opportunities experienced by students and, in turn, into learning outcomes. Initially, this work will need to proceed with units of analysis that are small enough to study in detail and large enough to capture the classroom interactions that yield learning opportunities. As we have argued elsewhere, we believe the daily classroom lesson is the best candidate (Stigler & Hiebert, 2009). We expect that hypotheses regarding student outcomes over longer curriculum units will need to build on what researchers learn from work at the lesson level. Similarly, we believe that hypotheses about causal mechanisms of teaching can be formulated, tested, and revised without prior theorizing on the nested relationships among levels within the larger system of education. Beginning with the level at which teachers work--the classroom--makes most sense to us. However, explanations for student outcomes must consider the conditions under which students (and teachers) are participating. This will likely require appealing to considerations outside the classroom. But, we believe these are best pulled in as they are needed to develop explanations (and better predictions), not as a priori requirements of theories.

(continued)

Table 10.1 (continued)

	Included in own chapter[a]	Not included in own chapter[a]			Raising concerns[a]	Comments[a]
		Fully agree	Partly agree	Do not agree		
Contain models linking different constructs with student learning and other constructs which have been defined a priori as desirable outcomes of schooling	2, 3, 4, 8		6, 7	5	3, 9	**3 (also applies to other elements, see below):** The list includes many important aspects. However, a number of them make sense only within specific paradigms. For example, this element is important within the Educational Effectiveness/Teaching Effectiveness Paradigm (EER/TER), but not relevant, for example, from the perspective of a practice theoretical paradigm. Within the latter it is often explicitly avoided to determine which effects teaching should have from the perspective of the researchers. Instead, the ends and normative ideas included in practices are reconstructed from the empirical material without a priori normative expectations Fritzsche et al. (2010) **9 (also applies to other elements, see below):** The problem with quite a lot of the statements is that they lack context, and particularly the context mentioned above, that is, that it's not clear what kind of function(s) authors see for theory. I see that some statements are about causal explanation as the main (only?) role for theory. In my chapter I make the case that causality doesn't exist in education, and therefore any statement that seems to assume that causality does exist is, in my view, problematic. I also see references to learning, and I think first of all that this term is not precise enough (learning to tie one's shoelaces is very different from learning the second law of thermodynamics; so just to refer to 'learning' without specifying what it is about and for, is not very helpful). I also think that not everything that matters in education has to do with learning; learning is only one way in which students can relate to the world, and education should open up other ways of being and relating as well.
Link teaching to its antecedents	4, 8		2, 3, 5, 7	6	2, 9	**3:** See above under "Contain models linking different constructs with student learning and other constructs which have been defined a priori as desirable outcomes of schooling"
Be specific enough to allow concrete connections among learning goals, teaching aspects, and student outcomes	2, 3, 4, 5, 6, 7, 8				3, 9	**3:** See above under "Contain models linking different constructs with student learning and other constructs which have been defined a priori as desirable outcomes of schooling" **9:** See above under "Contain models linking different constructs with student learning and other constructs which have been defined a priori as desirable outcomes of schooling"
Explain how the intended curriculum can be transformed into learning opportunities for students	2, 7, 8	4	3, 5	6	9	**9:** See above under "A theory should explain basic terms (teaching, learning, and the social)"

Concurrently attend to issues of quality and equity	5, 6, 8	2	3, 7	4, 9	6	**3:** See above under "Contain models linking different constructs with student learning and other constructs which have been defined a priori as desirable outcomes of schooling" **4:** I disagree in the sense that – In my view – a theory of teaching should always address the association with educational outcomes, as a central criterion for judging the prescriptive validity of descriptive measures of teaching or as a measure of teaching effectiveness. Once having established effectiveness, assessing equity is just around the corner by assessing effectiveness for different sub-groups of students. However, explaining why what works for whom (equity) would require additional information and explanation as compared to just assessing effectiveness. The demand that a theory should concurrently attend to issues of quality and equity is therefore too demanding **8:** We were not sure about the element, "concurrently attend to issues of quality and equity." does this encompass two different elements—Quality and equity—Or does this imply that quality requires equity?
Have a multi-level character (taking into consideration the system and school level)	4, 5, 7, 8, 9		3, 6	2	6	**2:** See above under "Explain how categories of instances of practice form larger systems of practice such as lessons, units, courses, and programs of study " **3:** Practice theory has a "flat ontology" (Schatzki 2016), which implies that the criterion "have a multi-level character (taking into consideration the system and school level)" also is not relevant within this paradigm.
Explicitly attend to the conditions under which certain teaching aspects matter for student learning	2, 5, 6, 7, 8		3	4	6, 9	**4:** I partly disagree. An instrumental theory on teaching (instrumental to furthering student learning) should preferably generalize across all kinds of conditions. Only if conditions are defined as quite robust and "crude", e.g., different subject matter areas, or teacher vs. technology transmission, should reference to conditions be attended to. Otherwise, the number of situational conditions soon becomes unmanageable from a research perspective **9:** See above under "A theory should explain basic terms (teaching, learning, and the social)"
Explicitly attend to the student populations for whom certain teaching aspects matter for student learning	5, 6, 8	2	3, 4, 7		9	**9:** See above under "A theory should explain basic terms (teaching, learning, and the social)"
Include resources for representing the practice of teaching	2, 7, 8		3, 6	4, 5	6, 9	**4:** I do not see how a theory is supposed to include resources and I do not see what representing the practice of teaching means in this context **5:** See above under "A theory should explain basic terms (teaching, learning, and the social)"

(continued)

Table 10.1 (continued)

	Included in own chapter[a]	Not included in own chapter[a]			Raising concerns[a]	Comments[a]
		Fully agree	Partly agree	Do not agree		
Include technical language for describing the practice of teaching	2, 6, 7		3, 4, 5	8	2, 6, 9	**5 (also applies to another element, see below):** What we consider important is to elaborate more on the why and how a theory of teaching is related with other relevant theories, and especially with theories of learning. This is important as the two groups of theories should be strongly interrelated. This is especially relevant for the items referring to the use (or not) of technical language. In our view, a theory should make explicit to every stakeholder the main principles and aspects of the theory. In the case when a technical term has to be used this is not a necessarily a problem, since the question is whether not only the research community but also teachers (as professionals) find the theory explicit, clear and useful **8:** We do not agree with the assertion that a theory of teaching should include technical language for describing the practice of teaching (although this depends, perhaps, on what exactly is meant by "technical" language). Fundamentally, we believe a theory of teaching has to be applicable and be able to serve as a guide for teachers to actually enact the principles therein in their classrooms. Technical terms, although they can be helpful in speaking precisely, can easily fall into the trap of obscuring plain meanings. This can prevent teachers from easily being able to make use of theory without an unnecessary additional investment of time and energy to decode language. We strongly believe that the language used in theories of teaching should be made as plain as possible to encourage communication among researchers and teachers. Moreover, the kinds of research that we envision in the two-way street of teaching for theory and theory for teaching are often very "close to the ground," meaning that we are often observing and describing phenomena that should be able to be captured in ordinary language. If a new technical term is truly needed, it should be crafted to help convey its meaning as transparently as possible. It might make sense to move this element to the usefulness and usability category (category C).
Include non-technical language for describing the practice of teaching	7, 8		2, 3, 4, 5	6	2, 9	**5:** See above under "Include technical language for describing the practice of teaching" **8:** It might make sense to move the "technical terms" and "non-technical terms" elements to the usefulness and usability category (category C).
Provide the means to express relationships among different aspects of teaching	2, 4, 5, 7, 8, 9		3, 6		6	

Contain empirically falsifiable propositions	4, 7, 8		3, 5	2	6, 9	**2:** In our view, this element does not need to be addressed in a theory of teaching. We agree with the importance of what we presume to be the motivation for this element--theories grow as propositions are tested and refined. We also appreciate much of what Karl Popper–a primary proponent of making progress through falsifying propositions–said about the development and improvement of scientific theories. However, for theories of teaching, we find more helpful Popper's (1944/1985) discussion of processes for testing and revising hypotheses in the social sciences. Advocating "piecemeal tinkering," Popper saw social scientists as social engineers who achieve their goals through "… small adjustments and re-adjustments which can be continually improved upon. … The piecemeal engineer knows … we can learn only from our mistakes. Accordingly, he will make his way, step by step, carefully comparing the results expected with the results achieved, and always on the look-out for the unavoidable unwanted consequences of any reform; and he will avoid undertaking reforms of a complexity and scope which make it impossible for him to disentangle causes and effects, and to know what he is really doing" (p. 309). Rather than requiring hypotheses that are falsifiable, we suggest requiring hypotheses that can be tested and then refined to increase the precisions of the predictions and the adequacy of explanations. We envision theories of teaching growing incrementally through repeated local tests of targeted predictions rather than through large experiments designed to make possible the falsifying of claims **3 (also applies to another element, see below):** This criterion makes sense only within critical rationalism and is irrelevant from constructivist or poststructuralist epistemological positions **8 (also applies to another element, see below):** We were not sure what the intended difference is between "contain empirically falsifiable propositions" and "include experimentally falsifiable explanations." is the latter meant to be a subset of the former?
Include experimentally falsifiable explanations	4, 7		3, 5, 8	2, 9	6	**3:** See above under "Contain empirically falsifiable propositions" **8:** See above under "Contain empirically falsifiable propositions"

(continued)

Table 10.1 (continued)

	Included in own chapter[a]	Not included in own chapter[a]			Raising concerns[a]	Comments[a]
		Fully agree	Partly agree	Do not agree		
C. Considerations regarding the usefulness and usability of theories by practitioners: **A theory should …** Guide practitioners' cause-effect reasoning that is at the core of making instructional decisions	2, 3, 5, 8			3, 9	6	**3:** One of the two criteria we disagree with more fundamentally is "guide practitioners' cause-effect reasoning that lies at the core of making instructional decisions", because this appears to make a "teaching and learning short-circuit" (Holzkamp, 1993) and suggest to teachers that teaching is a social technology and that they can determine with their behaviour what happens in the classroom and how students develop. Such a view has been contested from many theoretical positions and also based on empirical research (Hartmann et al., 2016) **6 (also applies to other elements, see below):** Again, I find that there is confusion about what a theory is, what should be done to improve instruction, and how to communicate that. The considerations under (C), for example, are important – But they're not part of a theory. The goals of a theory should be to (a) understand something; (b) to, if you wish to work in particular directions, specify what it takes to work in those directions. By way of metaphor: Suppose I wanted to develop a theory of economics. The goal would be to specify how any why an economy works. Then, suppose I wanted to create an economy that eliminated poverty. That's a value statement. I'd be identifying the subset of things, consistent with the general theory, that produced the desired outcomes. Those are (a) and (b). Communicating aspects of these effectively may be necessary to move in the desired directions, but they're not part of the theory. It seems to me that the field needs consensus, first, on what a theory is; second, on desirable goals; third, on the kinds of knowledge and understandings that would enable us to reach those goals. That third point – Which, at some level, is the point of this enterprise – Is a matter of *engineering,* not theory. That's part of the confusion (and beyond any one volume). It's not clear how much the construction of new airplanes over the past decade has added to the theory of aerodynamics – But the engineering knowledge developed has been substantial **9:** See above under "contain models linking different constructs with student learning and other constructs which have been defined a priori as desirable outcomes of schooling"

Be expressible in ways that practitioners can judge its face validity	2, 5, 7, 8	4		3, 9	6	**3:** Another criterion with which we disagree more fundamentally is "be expressible in ways that practitioners can judge its face validity". This criterion implies that theories are generally formulated for practice – An assumption that also can be contested more fundamentally. Given the complexity of the social, limiting theories to what can be formulated in a way that is easily understood by practitioners seems an unnecessary restriction and we argue that the aim of research is more than just informing practice. Science in general needs to support transfer into practice – Yet, this transfer is not part of the theory as such **6:** See above under "A theory should guide practitioners' cause-effect reasoning that is at the core of making instructional decisions"
Include a semiotic infrastructure that goes beyond language to support communication about teaching between researchers and practitioners	2, 7, 8	6	3, 5	4	2, 4, 6, 9	**6:** See above under "A theory should guide practitioners' cause-effect reasoning that is at the core of making instructional decisions" **8:** We were not sure exactly what was meant by "semiotic infrastructure beyond language." for us, going beyond language falls into the category of what we proposed about using artifacts and teaching cases to convey and to store and improve a theory of teaching. If that counts as "semiotic infrastructure beyond language," then we believe the element is at least partly redundant with "include resources for representing the practice of teaching"

[a]*Note*. 2 = Hiebert & Stigler, 3 = Vieluf & Klieme; 4 = Scheerens; 5 = Kyriakides et al.; 6 = Schoenfeld; 7 = Herbst & Chazan; 8 = Cai et al.; 9 = Biesta

Commenting on these elements more generally, some authors also noted the following:

Vieluf & Klieme: The list includes many important aspects. However, a number of them make sense only within specific paradigms. Hence, it appears difficult to argue that theories generally "should" contain these elements. Yet, we do think that they "could", that they can be relevant criteria from a specific epistemological and ontological perspective.
***Kyriakides* et al.**: Table 1 consists of some important aspects but we need to be careful on deciding if those are relevant for developing a theory of teaching. In this perspective, we have used the "partly agree" to stress that we don't think that those aspects of theory of teaching are necessary.
***Cai* et al.**: We would add "A theory should include clear learning goals." Even though some entries in the table involve learning goals, it is important for a theory of teaching to explicitly include clear learning goals (to which the theory is relevant).
Biesta: This list is a further argument that without some kind of map of the different roles/functions/usages of theory, it is difficult to judge individual statements about what theory should include.

2.3 Process of Developing Theories of Teaching

Another question answered by all of the authors pertained to the process of developing (comprehensive) theories: "*In the future, in what ways might it be possible, if at all, to create a (more comprehensive) theory of teaching?"*

We compiled the answers received in Table below to provide a basis for a discussion about what aspects are important for developing theories (for a detailed list, see Appendix C).
Could you please do the following:

1. Please use the table below to indicate the degree to which your book chapter explicitly captures the proposed aspect; for aspects not captured, please indicate the degree to which you agree with them using the suggested answering format (entering an 'x' in the column chosen).
2. In a text (of no more than 400 words)
   (a) Please elaborate on the aspect with which you agree the most and the aspect with which you disagree the most, clearly providing your rationale.
   (b) If need be, please also describe other aspects that should be added to the list.

(continued)

	Included in my chapter	Not included in my chapter		
		Do not agree	Partly agree	Fully agree
1. Making explicit the commitments on which theories are built				
2. Acknowledging the limitations of existing models/theories				
3. Bringing together different perspectives, paradigms, and theories to identify "blind spots" of each and reflect on irreconcilabilities				
4. Reaching consensus on shared rules of engagement (e.g., dealing with tensions among sets of competing values such as ecumenism and consistency, complexity and parsimony)				
5. Developing theories in a way that they provide mechanisms to help teachers move in productive directions				
6. Acknowledging the dynamic and co-evolving character of teaching and theory				
7. Pursuing a piecemeal, bottom-up development of theories, rooted in the analysis and synthesis of empirical research outcomes.				
8. Following a series of steps to develop/enrich theories of teaching (a) Generate concrete hypotheses (drawing on empirical data, if available)				
(b) Continuously test and revise predictions suggested by the hypotheses				
(c) Coordinate the work of teachers and researchers to test predictions and revise hypotheses				
(d) Aggregate findings across classrooms and search for patterns that rise above specific contexts				
(d) Find ways to create sustainable partnerships between teachers and researchers, and build networks of partnerships				
(f) Continue to expand the scope of the theory generated.				

Table 10.2 presents the answers by the contributors where each number represents one chapter (see the notes for the table). The answer categories correspond to the ones for Table 1. Reasons for raising concerns about the statements in Table 2 were: (a) the words chosen for some of the statements were deemed inappropriate (7) or (b) the authors disagreed with how the statements about content and purpose were focused (5, 7). Following a similar approach to that pursued above, instead of listing the authors' comments as a unified text, we preferred to list them in the last column for each aspect under consideration.

Table 10.2 Process of developing theories of teaching

	Included in own chapter[a]	Not included in own chapter[a]			Raising concerns[a]	Comments[a]
		Fully agree	Partly agree	Do not agree		
1. Making explicit the commitments on which theories are built	3, 5, 6, 7, 8, 9	2			4	**3:** We agree in particular with the statement: "Making explicit the commitments on which theories are built". We find it important to be explicit concerning the own stance within the diversity of possible epistemological, ontological and methodological perspectives, because these open up different ways of analysing social phenomena, but also have different blind spots. Positioning oneself within this diversity makes it easier for the reader to critically assess a theory. This necessity becomes especially clear when the theoretical discourse combines different paradigms, as we do in our chapter, which however is rarely done in educational research **4:** I think the term "commitments" in this context is ambiguous. The only "commitment" on which theories are built is to further knowledge. I would rule out commitment to political objectives.
2. Acknowledging the limitations of existing models/theories	2, 3, 4, 5, 6, 7, 8, 9				2, 6	**3:** A second statement we agree with is: "Acknowledging the limitations of existing models/ theories". Because theories can be considered to be necessarily "under-determined by empirical 'facts'" (Reckwitz 2002, p. 257), reflecting limitations of theories appears to be particularly important for their further development, but also to prevent unfounded claims to a singular truth that may not even exist.
3. Bringing together different perspectives, paradigms, and theories to identify "blind spots" of each and reflect on irreconcilabilities	3, 4, 9		5, 6, 7, 8	2	3	**8:** We least agreed with #3 (although we do partly agree with it). Of course, trying to use different paradigms or perspectives may allow us to see things we might not see from a single paradigm or perspective. However, especially if perspectives are irreconcilable, this is really at a high level of abstraction. Within the ongoing back-and-forth of teaching and theory for teaching, we feel that one should at least attempt to choose a perspective or paradigm that is maximally helpful in making progress on the specific problem of practice that is at hand.

4. Reaching consensus on shared rules of engagement (e.g., dealing with tensions among sets of competing values such as ecumenism and consistency, complexity and parsimony)	7, 8	4, 6	5, 9	2, 3	9	**2:** We interpret this strategy to recommend researchers and/or theorists create consensus by talking with each other, comparing "rules of engagement" and "sets of competing values" and moving toward consensus through conversations and debates. Our point of view is somewhat different in two respects. First, although we agree that consensus is useful, we believe the consensus that drives theories forward is consensus on teaching problems and hypotheses that address these problems (see our response to question 1). Second, we believe the most productive path toward consensus is shared observations of potential teaching problems in classrooms. Consensus is more likely when researchers have seen the same phenomena in classrooms and jointly construct hypotheses that should be tested, repeatedly, in multiple settings by multiple researchers. **3:** A statement we disagree with more fundamentally is: "Reaching consensus on shared rules of engagement (e.g., dealing with tensions among sets of competing values such as ecumenism and consistency, complexity and parsimony)". The reason is that searching consensus between different positions is certainly an important part of the process of theory development. Yet, acknowledging and reflecting disaccord also is important. For many issues it appears even questionable whether it is possible to "reach" consensus, because theories always involve assumptions that can hardly be empirically tested – starting with the question whether and how theories need to be empirically tested (see e.g., Kuhn, 1962). Also, in the field of pedagogy some values appear to be fundamentally irreconcilable. Some dilemmas and contradictions inherent in pedagogical practice can only be addressed with reflection, but never be solved (for a more detailed discussion of fields tension within pedagogy see e.g., Helsper et al., 2001). Thus, we think that searching for consensus is an important part of science, but often a process without an end **9:** My concern here is that this statement seems to assume a particular role for theory and, as I have said above, we first need to clarify these different roles and functions before statements such as this one can become meaningful.

(continued)

Table 10.2 (continued)

	Included in own chapter[a]	Not included in own chapter[a]			Raising concerns[a]	Comments[a]
		Fully agree	Partly agree	Do not agree		
5. Developing theories in a way that they provide mechanisms to help teachers move in productive directions	2, 3, 4, 5, 6, 8, 9			7	6, 9	**5 (comment also applies to item 6):** The dynamic character of education as well as its multilevel structure should be considered in establishing a theory of teaching. Moreover, we don't see the point of developing a theory of teaching that cannot be used for improvement purposes. We need to find ways to establish stronger links between research and practice and this should be the ultimate aim of developing a comprehensive theory of teaching. For example, in our chapter we refer to the dynamic approach to school improvement (DASI), which was based on the dynamic model of EER, aims to establish stronger links between the EER and school improvement initiatives. DASI promotes the design of school improvement projects that are based on a theory which has been tested and refers to school factors that need to be considered in introducing a change (Kyriakides, et al., 2021) **6 (comment also applies to item 6):** I find the framing of both questions 5 and 6 to be problematic. The question is, are you talking about a theory of (a) the decision-making a teacher engages in, in the classroom or (b) specific actions that result in desired types of student learning? We have a theory of (a); issues of type (b) implicate a theory of *teaching and learning,* which to me are not the same as a theory of teaching. By way of analogy, consider a theory of human metabolism – The goal being to understand how human environment, intake, and exercise affect one's bodily health. That's a theory that describes the impact of things, for good or for bad – "This is how things work." (the same applies, for example, to a theory of climate change.) That's a theory of type (a): It should explain what happens, no matter what the input. Diet advice is of type (b). What's being confused is what happens when people want to have a theory of "good" or "effective" teaching. That's a matter of applications, of type (b). To continue the analogy, suppose you have a theory of metabolic function. If you want to be healthy, you worry about your intake, your exercise, etc. if you want the earth to survive, you worry about climate change. Clearly then, there's a dialectic between theory and understanding of practice – Analogous to the interaction of teaching and learning. If you want students to emerge from classrooms as knowledgeable, flexible, agentive learners, you study what helps that to happen, and you communicate that to teachers. Communicating useful ideas to teachers is essential for improvement, but it is not part of a theory of teaching, any more than telling people to conserve energy is – While beneficial – a contribution to the theory of climate change. For me, that's why we have to clarify what's entailed in any theory (of teaching, or of teaching and learning) before asking questions of type 5 and 6

						7: In our view, the first order of business is to identify what is the purpose of theory-making. A consensual theory seems a tall order, and it is even taller if we don't even know for what it is that we need a theory. We argue that we (as the research field) need *theory in order to improve research on teaching, and reciprocally, we need research on teaching to contribute to the improvement of theory of teaching*. While the practice field might also need (prescriptive) theories to improve teaching practice, there are many people already doing those things. The existence of different prescriptive theories of teaching is good for our business in that it creates enough variability in teaching that we can justify the need to have general ways of understanding the work of teaching that happens. Furthermore, because change is the currency of policy-making and of the marketplace, we know that those prescriptive theories will continue to emerge. The role of descriptive and explanatory theory then is to provide researchers the means for studying the avowed enactment of those prescriptive theories as well as of intact practice and to be able to compare them as variations in practice (rather than only in terms of their outcomes). We need to ask ourselves what is this moment in our field? At which stage are we? Are we committed to understanding scientifically the world of practice or are we just advocating for a particular vision for practice? If we don't want to be a scientific field, there may be no point in developing a theoretical consensus, as consensus on a prescriptive theory can easily conjure images of colonialism and globalism. But if we think that developing a theoretical consensus is a step toward making *the study* of mathematics teaching more scientific, this consensus needs to be oriented to *empowering research* on teaching. Theory is needed to guide research. The purpose of theory is very practical, it is to enable the development and the confirmation of scholarly knowledge. This may include representing the knowledge we have, but this representation needs to be aimed at knowledge producers, directed to researchers rather than to teachers, and directed to being used in research. If we agree that the need for theory is to empower research, middle range theory can be a mechanism for consensus development. Middle range theory defines conceptually its scope of work and develops its constructs and propositions empirically. Middle range theory helps aggregate and understand results of empirical research as well as direct more empirical research where that research is needed.

(continued)

Table 10.2 (continued)

	Included in own chapter[a]	Not included in own chapter[a]			Raising concerns[a]	Comments[a]
		Fully agree	Partly agree	Do not agree		
6. Acknowledging the dynamic and co-evolving character of teaching and theory	2, 5, 8	3, 7		4	6	**3:** "Acknowledging the dynamic and co-evolving character of teaching and theory" is also in line with the more constructivist understanding of theory building that we lean towards **5:** See comment above in item 5 **6:** See comment above in item 5 **8:** We most agreed with #6, because we believe that progress in increasing the comprehensiveness of a theory of teaching depends on harnessing the two-way street between teaching for theory and theory for teaching. Without an ongoing, explicit, and deliberate interplay between these two, neither can make much useful headway.
7. Pursuing a piecemeal, bottom-up development of theories, rooted in the analysis and synthesis of empirical research outcomes.	2, 3, 4, 6, 8		5	7, 9	9	**2:** Given our responses to the previous questions, it is no surprise that we agree with this approach as a possible way to create more comprehensive theories of teaching. We do not expect useful theories to be fashioned from the heads of theorists. Rather, we assume that hypotheses about teaching effectiveness--about causal relationships between teaching and learning--to emerge from observations of classroom interactions. Hypotheses are then refined as their predictions are tested, empirically, and theories grow as hypotheses build on each other and accumulate over time. We find it interesting that the same process used to create this chapter (a Delphi study) would be especially useful for building on others' work to improve *predictions*. If researchers were addressing the same problems, then comparing predictions and sharing data and rationales could help individual researchers--and the group as a whole, build from empirical outcomes to not only improve their predictions but increase the richness of their explanations or, said another way, their understanding of the problems they are investigating **4:** In my view theories on teaching should not be developed "from the armchair", but, next to obtaining good ideas from any source, be it history or hermeneutics, be strongly tied to empirical research outcomes **9:** My concern is, once more, that much depends on what we see as the roles and functions of theory. In addition, I am not sure that it is possible to build up theory from empirical research outcomes, because such outcomes are generated in particular ways, and thus already contain many assumptions.

8. Following a series of steps to develop/enrich theories of teaching (a) Generate concrete hypotheses (drawing on empirical data, if available)	2, 5, 6, 8	4	3, 7	9		**9:** All these elements (8a-8e) seem to assume that the role of research is to provide causal explanations through hypothesis testing. This is only one role for research and in my view one that is not achievable in education.
(b) Continuously test and revise predictions suggested by the hypotheses	2, 6, 8	4	3, 5, 7	9		**9:** See comment above under (8a)
(c) Coordinate the work of teachers and researchers to test predictions and revise hypotheses	2, 8		3, 4, 5, 6, 7	9		**9:** See comment above under (8a)
(d) Aggregate findings across classrooms and search for patterns that rise above specific contexts	2, 5, 6, 8	7	3, 4	9	9	**9:** See comment above under (8a)
(e) Find ways to create sustainable partnerships between teachers and researchers, and build networks of partnerships	2, 8, 9		3, 5, 7	4, 6		**4:** Anyone is welcome to the process of theory development, particularly also teachers and researchers. "Sustainable partnerships" is a term from organization consultants, who are not needed for obvious cooperation between knowledgeable and interested parties **9:** See comment above under (8a)
(f) Continue to expand the scope of the theory generated.	2, 3, 5, 8, 9	4	6, 7			

[a]*Note*. 2 = Hiebert & Stigler, 3 = Vieluf & Klieme; 4 = Scheerens; 5 = Kyriakides et al.; 6 = Schoenfeld; 7 = Herbst & Chazan; 8 = Cai et al.; 9 = Biesta

In addition to their comments for particular statements, the authors also provided some more general comments:

- ***Vieluf & Klieme*:** With several criteria we agree only partly, because, again, they appear to make sense from specific epistemological and ontological perspectives only.
- ***Scheerens*:** Maybe an addition to the list might be: bringing together authors who have addressed theories on teaching from various perspectives and encourage exchange between them. In other words what the editors of this volume have initiated, and which could hopefully continue.
- ***Kyriakides* et al.:** We don't agree with those that consider important to refer to the content of teaching. The content of teaching is an area that may be of interest to the field of philosophy of education or to those working in the area of curriculum development. We don't think that we have the right to refer to the content because there are other mechanisms and procedures that need to take place to give answers to questions about the content of a curriculum which have to do with the context and other characteristics of a specific educational system. This is also strongly influenced by cultural factors.
- ***Cai* et al.:** We would argue that developing more comprehensive theories of teaching requires an artifact—some kind of embodied object—that serves to store the theory and the ongoing development of knowledge related to the theory. In a sense, the artifact is the theory of teaching made into a thing that can be accessed, shared, modified, and updated as those who are using the theory slowly deepen or widen the theory. In our chapter, we have highlighted teaching cases in China as an example of an artifact and discussed features that this potential artifact must have to successfully embody the dynamic relationship between theory for teaching and teaching for theory (see Cai & Hwang, 2021, for details).

3 Summary

The purpose of this chapter was to offer the scholars participating in this endeavour a venue for an initial exchange of ideas on theorizing teaching, in the form of commenting on a summary of perspectives expressed in the previous chapters. This exercise exposed the huge variance in the contributors' perspectives on (a) reaching consensus about the existence, degree of development, and grain size of theories of teaching (first question), (b) what a theory of teaching should contain (second question), and (c) the process of developing theories of teaching (third question). Below we briefly summarize this variance, reserving a more in-depth discussion for the following chapter.

Comparing the authors' answers to the first question reveals that not only was there no agreement that a consensus could be achieved but it was not even generally accepted that consensus should be a goal. In their responses to the second question, although the authors did not all agree with any one statement, there was more consensus. Most of the contributors agreed that "A theory should explain basic terms" and "A theory should provide the means to express relationships among different teaching aspects", whereas few agreed that "A theory should include experimentally falsifiable explanations" or "A theory should concurrently attend to issues of quality and equity". The third question elicited a similar pattern of responses, although there seems to be more consensus on the process of developing theories (third question) than its content (second question). A notable number of authors seemed to agree with some statements, but once again there was no single statement with which they all agreed. The responses ranged from statements with which a large proportion of the authors agreed (e.g., "Acknowledging the limitations of existing models/ theories" or "Developing theories in a way that they provide mechanisms to help teachers move in productive directions") to statements for which considerable disagreement emerged (e.g., "Reaching consensus on shared rules of engagement" or "find[ing] ways to create sustainable partnerships between teachers and researchers, and build[ing] networks of partnerships").

A thorough discussion of potential reasons for the heterogeneity of author opinions as well as practical options for moving the topic of theorizing teaching forward is presented in the following chapter. Methodological restrictions of the approach taken are also discussed, among others, the challenge that the two levels of reduction in developing the statements for rating and commenting might have caused misinterpretations of each other's intended meanings.

Appendices

Appendix A

Do we already have a theory/theories on teaching? If so, which are they?

Hiebert & Stigler	The authors argue that, "[T]heories of teaching are necessarily so complex that they are only in progress; they are never complete. The status of a theory can be measured by the number of hypotheses that have been formulated, the range of classroom learning events they can predict, and the state of empirical confirmation of these predictions. Using these criteria, we would say the field has theories at the very beginning stages of development. Often, the 'theories' are more like small collections of hypotheses that still need to be fully tested" (pp. 47). The authors also maintain that in the future "small theories" rather than a comprehensive theory of teaching will be useful to teachers (p. 48).

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Vieluf & Klieme	The authors emphasize that "there is a multitude of theories of teaching (for the German speaking context see e.g., Lüders, 2014)", but not providing further detail (p. 84). They present and further develop the *Three Basic Dimensions* [TBD] as one theory of teaching quality. Their theoretical conceptualizations are based on two distinct paradigms: The paradigm of Teaching Effectiveness Research [TER], which includes the Three Basic Dimensions Theory, and the paradigm of Practice Theories. Each paradigm is believed to include multiple individual theories - some broad and general, some addressing a narrower range of phenomena.
Scheerens	The author makes a distinction between different types of theories in the field of educational effectiveness: – *Meta-theory* (i.e., a theory concerned with the development, investigation or description of theory itself). The author provides the example of "context, input, process, and outcome indicators" as a meta-theory illustrating the logical structure of causal conditions leading from teaching to learning. – *Substantive theories on teaching effectiveness* (i.e., defined in close connection to the state of the art of empirical research). The author distinguishes this category into: • *General theories:* e.g., process structure and independence in teaching; classroom management • *Partial theories*: e.g., direct teaching, social-emotional support in teaching. In concluding the chapter, the author notes, "There is growing consensus on core sub-theories on teaching in the sense Gage refers to these, while others prefer to speak of core dimensions […]. Still some contributions might not be called theories by everyone. In an earlier contribution (Scheerens, 2013) I concluded that conceptual maps and dimensional models reflect the state of the art. Snow's levels of theory development supports calling models, and "summaries" of empirical findings "theories" be it at a low level on his scale. Occasional applications of "eclectic" use of more established theory from basic disciplines is seen as an instance of gradual progress towards a higher level of theory. From the perspective of the educational effectiveness paradigm the key issue is the explanation of the findings by means of a plausible and established causal mechanisms." (p. 126)
Kyriakides et al.	The authors refer to different theories of learning that have been developed mainly from educational psychologists and which had an impact on developing specific theoretical models of teaching and learning. Throughout the chapter, they refer to different such theories (e.g., motivation theories, cognitive load theory, organizational theories). The authors also conclude by pointing out that the *Dynamic Model of Educational Effectiveness* provides a starting point for developing a comprehensive theory in the field.

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Schoenfeld	"I claim that we already have a theory of teaching, which specifies that teachers' in-the-moment classroom decisions can be modeled by attending to three major factors: the resources at their disposal (both their knowledge and material resources), their orientations (beliefs, preferences, values, etc.), and their goals (which exist at multiple levels and change dynamically according to evolving events). Beyond that, the Teaching for Robust Understanding (TRU) framework indicates that five dimensions of learning are consequential and comprehensive – the degree to which the environment: offers affordances for rich engagement with content; operates within the students' zone of proximal development; supports *all* students in engaging with core content; provides opportunities for students to contribute to classroom discourse and develop a sense of agency and disciplinary identity; and, reveals and responds to student thinking. Combining these two theoretical frames yields a theoretical specification of what has been called "ambitious teaching."" (p. 159)
Herbst & Chazan	In their chapter, the authors present *practical rationality of mathematics teaching* as a middle-range theory of teaching. According to Merten's (1949) work, middle-range theories lie in between specific hypotheses (amenable to be tested empirically) and grand theories ("being large sets of ideal constructs designed speculatively to be used to read the world", p. 192). Such theories can be developed through the practice of research. The authors conclude: "There are multiple kinds of theories of teaching. Some theories describe the work of teaching. Herbst & Chazan (2017) reviewed how different theories rely on different conceptualizations of teaching, behavioral, cognitive, social interactionist, sociocultural, and more. Practical rationality aspires to explore complementarities and contrasts with all of those. There also are accounts of teaching that attempt to prescribe what teaching should look like in order for it to achieve some desired ends. While not often called theories, expressions like ambitious instruction, complex instruction, direct instruction, equitable practice, inquiry oriented instruction, student-centered instruction, and others have been used to designate some aspirational kinds of teaching that can have the force of prescriptive theory. Insofar as practical rationality is a fundamental theory of teaching, its goals are to describe and explain all kinds of teaching, not to prescribe a particular kind of teaching." (p. 219)
Cai et al.	The authors maintain that "it seems that there are many different potential theories of teaching, but they span a wide range of grain sizes and attend to many different aspects of teaching" (p. 238). The authors also argue that the theories should be seen as being in constant development ("theory keeps evolving along with teaching, and we do not anticipate there will ever be a be-all, end-all comprehensive theory for teaching", p. 322).
Biesta	The author argues that "[W]e already have theories of teaching and in the theorisation I have presented [in this chapter] I have relied upon theories of teaching that have been developed in the past, going back, to begin with, as far as Plato's account of teaching." (p. 278) [The author clarifies: I am saying that there is a very long tradition of theorizing teaching, though in my chapter I don't provide a comprehensive historical overview of such theories, but do position my observations in this longer tradition. To identify all existing theories of teaching is probably quite a big task. There is also the question whether teaching is only seen in a school context and/or as instruction (in German related to Didaktik) or whether a broader notion of teaching is used (in German related to Erziehung; in English for example the question whether moral education is a form of teaching.]

Appendix B

What should a theory contain? Why?

Hiebert & Stigler	Building on Kurt Lewin's claim "there is nothing as practical as a good theory," the authors begin with the proposition that "it is possible to build theories of teaching–practical theories–that are useful for teachers" (p. 24). The authors describe theories as "an interrelated set of ideas intended to explain something" (p. 46). To be useful for teachers, they argue that: "In a general sense, theories of teaching must account for how the intended curriculum, broadly defined, is transformed into learning opportunities that are experienced by students. This means that, in our view, theories of teaching consist of connected sets of hypotheses that predict how specific instructional activities and tasks will produce learning opportunities experienced by students in particular ways. That is, theories of teaching are capable of guiding the cause-effect reasoning that lies at the core of making instructional decisions about what kinds of tasks and activities will yield what kinds of sustained learning opportunities, and they do so with an eye toward studying and improving these decisions." (p. 46). They also add that theories of teaching that are useful for teachers include hypotheses that are "specific enough to be indexed according to the learning goals or outcomes students are asked to achieve" (p. 47).
Vieluf & Klieme	The authors argue that the response to this question depends on the paradigm followed. For example, in the Teaching Effectiveness Research [TER] paradigm, which is based on critical rationalism, "Theory […] usually consists of constructs covering various elements and features of classroom teaching, procedures operationalizing those constructs, and models linking them with student learning and other constructs which have been a priori defined as desirable outcomes of schooling. Teaching effectiveness theories attempt to explain and predict student outcomes, explicitly modelled as effects of the learning environment." (p. 84). And they continue: "According to Kuhn, general principles such as, in the field of education, (a) the idea of the learning environment having causal impact on students' information processing vs. (b) the idea that the classroom is a social sphere consisting of practices, can hardly be contested empirically, although they have inspired much sound empirical work – mostly quantitative in the first case, qualitative in the second case. These general principles belong to the core assumptions of separate paradigms (Practice Theories and TER, respectively) which are basically incommensurable, since they are framing, if not constituting the field of classroom teaching and learning in different ways" (p. 85). The authors conclude by arguing, "Separate paradigms include not only different basic assumptions about the social, about teaching and learning, but also differ with regard to their understandings of "theory" (Kuhn, 1962, p. 94). (…) Hence, answers to the questions what constitutes a theory and what it should contain depend on the perspective." (p. 85). The authors declare themselves "in favor of recognizing diversity of perspectives – also with reference to epistemology – instead of opting for a single set of criteria for a 'good theory'. Because different perspectives always have different blind spots and can complement each other." (p. 85).

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Scheerens	The author first distinguishes between different levels of theories: – *Meta-theory* (i.e., a theory concerned with the development, investigation or description of theory itself). The author provides the example of "context, input, process, and outcome indicators" as a meta-theory illustrating the logical structure of causal conditions leading from teaching to learning. – *Substantive theories on teaching effectiveness* (i.e., defined in close connection to the state of the art of empirical research). The author distinguishes this category into: • *General theories:* e.g., process structure and independence in teaching; classroom management • *Partial theories*: e.g., direct teaching, social-emotional support in teaching. Based on this distinction, he then remarks: "The […] question on what theory at each level should contain has different answers for each of the levels. At the level of meta-theory 'teaching' was framed in accordance with the educational effectiveness research paradigm. This choice yielded a conceptual ground structure, based on a model from systems theory and reference to the scientific method as the epistemological and methodological background. The level of general theory was conceived as containing a potentially exhaustive limited set of sub-theories of effectiveness enhancing teaching processes. The third level, indicated as "partial theories", refers to more specific explanatory mechanisms intricately linked to empirical research outcomes" (p. 124). He further clarifies that "Meta-theory contains first principles, such as logical ground structures, epistemological preferences, methodologies and ontological considerations (defining characteristics). Substantive theory in relation to the educational effectiveness research paradigm is strongly rooted in empirical evidence, distinguishes descriptive components and relationships between these, as well as explanatory conjectures that explain hypothetical as well as empirically supported relationships." (p. 125).
Kyriakides et al.	The authors list different attributes (rather than components) that theories on teaching need to have (pp. 146–152): – Being multi-level in nature, by considering the impact that school and system level factors may have on teacher factors. – Being explicit about why the factors included are associated with student learning outcomes (therefore, the relevant theories of learning and schooling that are considered in defining each factor should be made explicit) – Being explicit about the conditions under which each factor matters (i.e., the context) and the extent to which specific factors and their measurement dimensions matter more for specific groups of students. – Being informed by the dynamic nature of education Simultaneously addressing issues of quality and equity [i.e., "effective teachers are not only those who manage to contribute to the promotion of learning outcomes for all (quality) but also those that manage to reduce differences in student learning outcomes between groups of students with different background characteristics (equity)] (p. 149)

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Schoenfeld	Considering that a theory of teaching needs to explain the teacher's in-the-moment decision making in combination with an environment that is successful in producing powerful thinkers and learners, the author identifies the following components and attributes that such a theory needs to include/have: – Decision-making components: • The individual's resources • The individual's orientations • The individual's goals – Components/attributes of an environment that nurtures powerful thinking/learning: • Disciplinarily rich content and practices with which students engage • Opportunities for students to engage in sense making within their zones of proximal development • Provision that *all* students engage with core content and practices • Opportunities for students to contribute to discussions and progress in ways that support the development of agency, ownership over content, and the development of disciplinary identity • Provision that student thinking be made public and the learning environment adjust accordingly.
Herbst & Chazan	The authors argue that a theory of teaching should have an explicit focus on the practice of teaching. They explain, "A theory of teaching should be a theory of the practice in which teachers engage as opposed to a theory of the individuals who do the practice, though it may articulate with ways of describing the individual resources people bring to teaching. It should aim to describe, explain, and predict this practice. As far as description, it should include resources for representing the practice of teaching that permit to draw similarities across some instances of the practice while also sustaining differences across some other instances of the practice, both within and across individual teachers.

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	The authors argue that a theory of teaching should have an explicit focus on the practice of teaching. They explain, "A theory of teaching should be a theory of the practice in which teachers engage as opposed to a theory of the individuals who do the practice, though it may articulate with ways of describing the individual resources people bring to teaching. It should aim to describe, explain, and predict this practice. As far as description, it should include resources for representing the practice of teaching that permit to draw similarities across some instances of the practice while also sustaining differences across some other instances of the practice, both within and across individual teachers. It should contain some technical language and other semiotic tokens whose definitions are provided, some technical uses of language whose definitions are sought through research, and nontechnical uses of language that support reading and writing without calling attention to themselves. As far as explanation, a theory of teaching should provide the means to express relationships that connect instances of practice, not only in terms of similarity or difference, but more generally in terms of how categories of instances of practice form larger systems of practice such as lessons, units, courses, and programs of study. A theory of teaching should identify some sources or dimensions of complexity as ones that will not be reduced but whose texture is to be dissected and understood. A theory should contain connections among constructs of the theory and other phenomena, both possible causes and possible consequences. As far as prediction, a theory of teaching should contain connections among constructs of the theory and sources of empirical evidence or measures of those constructs. It should contain empirically falsifiable propositions and experimentally falsifiable explanations. It should articulate how the interplay of theorization and empirical research enables theorists to manage critically the objectifying and subjectifying tendencies of social research." (p. 218). And they continue, "At the same time, descriptions and predictions should at least be expressible in ways that practitioners can adjudicate their face validity. But, we do not expect that practitioners will come to adopt the language of educational theorists. This raises the question of whether our field might develop a semiotic infrastructure that goes beyond language and permits researchers and teachers to transact practice without having to rely solely on words. Such possibilities suggest the need for mathematics educators to continue to elaborate theoretically the notion of representations of practice" (p. 218).

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Cai et al.	The authors argue that two components are necessary for a theory of teaching: a *framework to support teachers' thinking* and an *operational* side. They elaborate on this idea, explaining that a theory of teaching should provide a framework that teachers can use as they think through principles of the best ways to teach in a given situation. In addition, [a theory of teaching] needs to have "some operational aspects that address the practical translation of principles into actions" (p. 231). As an example, the authors list the framework for examining the effectiveness of mathematics instruction (Cai, 2014). This framework addresses three critical aspects of effective classroom instruction: (1) students' learning goals; (2) instructional tasks (both as set up by teachers and as implemented in the classroom); and (3) classroom discourse. According to this framework, "the role of teachers is to select and develop tasks that are likely to foster students' development of understanding and mastering procedures in a way that also promotes their development of abilities to solve problems, to reason, and to communicate mathematically" (p. 231).
Biesta	The author argues that "a *theory* of teaching needs to start with a *conceptualisation* of teaching, as it is only once we have an account or proposal of what teaching is, that we can begin to ask such questions as what teaching is for or how teaching takes place. […] I have suggested to conceptualise teaching as the art of (re)directing the attention of another human being aimed at what we might term 'attention formation.' Answers to […] questions such as what teaching is *for* and how teaching *takes place* constitute (elements of) a theory of teaching. In this chapter, I have suggested that with regard to the question what teaching is *for* we should always consider three domains of purpose (qualification, socialisation and subjectification [see note below]), whereas with regard to the question how teaching takes place I have suggested a theorisation of teaching that sees education as an open, semiotic and recursive system that operates with the principle of 'complexity reduction,' bearing in mind that if the complexity of the education system is reduced too much, education turns into indoctrination and thus loses its educational 'identity,' so to speak. It becomes, in other words, a different system." (p. 277) *Note*. – Definition of qualification: "Providing students with knowledge, skills and other things they may need – such as attitudes and dispositions – in order to do something. This 'doing' can either be quite specific and precise, such as becoming qualified for a particular job or profession; but it can also be understood more broadly, such as the way in which schools seek to equip children and young people for their life in complex modern societies" (p. 263) – Definition of socialization: "Providing our students with an orientation into existing cultures, traditions and practices, with the invitation – and in some cases the insistence – that they locate themselves within them" (p. 264) – Definition of subjectification: "Refers to the ambition that students end up as subjects of their own life" (p. 265) [The author clarifies: I am suggesting, therefore, that in theorizing teaching we need to [1] conceptualise teaching, [2] articulate the purpose or purposes of teaching, and [3] theorise how teaching 'works' or 'functions.' In my chapter I provide an answer to each of these questions.]

Appendix C

In the future, in what ways might it be possible, if at all, to create a (more comprehensive) theory of teaching?

Hiebert & Stigler	The authors mention: "Our first response to this question is that we have described what Lipsey (1993) calls "small theories attempting to explain treatment processes, not a large theory of general . . . phenomena" (p. 48). In this sense, we have shown, at least implicitly, our bias against "comprehensive" theories of teaching. This is due partly to our belief that "small theories," focused on teaching processes that lead to particular learning opportunities for students, are the kinds of theories that will be useful for teachers. Our interest in "small theories" also is due to our skepticism that, at this point in the history of theory development and research on teaching, developing a comprehensive theory of teaching is likely, or is even the next best step. However, we certainly endorse the goal of creating more comprehensive "small theories." Our answer to the question of creating gradually more comprehensive (small) theories is contained in our descriptions of building theories of creating sustained learning opportunities. We can pull out a few features of this work that seem especially important: begin with documented connections between the kinds of sustained learning opportunities that yield specifiable learning outcomes; identify features of these opportunities and develop hypotheses about how teachers can create them; continuously test and revise predictions suggested by the hypotheses; coordinate the work of teachers and researchers to test predictions and revise hypotheses; aggregate findings across classrooms and search for patterns that rise above specific contexts; [and, to do this work,] find ways to create sustainable partnerships between teachers and researchers, and build networks of these partnerships. As learning theorists and researchers continue to identify the features of sustained learning opportunities that yield particular learning outcomes, researchers and teachers can continue to expand the scope of their theories of teaching. We want to repeat that the processes we have identified for building more comprehensive theories are tailored to our biases and to the kind of theories in which we are most interested. Stepping back, we recognize that the processes for building theories of teaching will result, in large part, from the kinds of theories the community wishes to build." (p. 49)

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Vieluf & Klieme	The authors argue: "From our perspective, creating "A" comprehensive theory of teaching doesn't seem to be a reasonable goal of scientific discourse. (…) The goal of creating "A" comprehensive theory of teaching, only makes sense within the traditional "statement view" of theory from critical rationalism (Popper, 1965/2005), which assumes a theory to be a coherent set of definitions, axioms, derived hypotheses, and empirical statements testing (i.e. potentially falsifying) these hypotheses." And they continue, "Considering the incommensurability of paradigms, we think that it is desirable that the Three Basic Dimensions [TBD], Teaching Effectiveness Research [TER] in general, and Practice Theories alike will grow and become more and more sophisticated, and, instead of converging into one grand theory of teaching, even diversify into separate (sub-)theories. New paradigms, such as neuroscience, may further start to compete with existing strands of social science and the humanities. Nevertheless, we argue (in opposition to Kuhn) that fruitful exchange between paradigms is possible." Finally, they conclude: "Overall, we can conclude that not only teaching, but also educational research itself, is situated in fields of tension. One such field of tension is between the intention to provide educational practice with clear and convertible recommendations and the wish to do justice to the whole complexity, contingency and ambiguity of social interactions. Multiple perspectives address this tension in different ways. By themselves they are necessarily limited and "under-determined by empirical 'facts'" (Reckwitz, 2002, p. 257). Yet, they all contribute substantially to our understanding of the social world. Mannheim (1931/1995) argued that a "true" picture can emerge from integrating different perspectives. Our aim was not finding a synthesized truth in the middle, but we argue that dialogue between paradigms can be inspiring. Accordingly, our paper is the result of an open process of bringing perspectives together and reflecting on irreconcilabilities with the purpose of 'doing theory'." (p. 87)
Scheerens	Reflecting on this question, the author concludes, "I see this as a continuation of a piecemeal, bottom up development, rooted in the analysis and synthesis of empirical research outcomes. Making sense of the enormous quantity of research outcomes by means of meta-analyses and research reviews stimulates reflection on what is generalizable and what is helpful for further research. Last but not least, the answers that policy makers and practitioners want from researchers call for conceptual synthesis and theoretically meaningful interpretation of the evidence. Again: nothing more practical than a good theory." (p. 126)

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Kyriakides et al.	The authors propose that the Dynamic Model of Educational Effectiveness can be the starting point for developing a comprehensive theory of teaching. To facilitate this work, they propose that several steps need to be taken: – By providing answers to questions [such as, "is orientation equally productive in classes with a high variation in terms of student abilities or socioeconomic background?", p. 150] "the impact of teacher factors on promoting both quality and equity could be better realized and factors deriving from different models of effectiveness which are able to promote equity may be used in developing a comprehensive framework of teaching" (p. 150). – "By acknowledging the limitations of existing models (including the ones of the dynamic model), a theory that may be used so as to provide a basis for educational improvement purposes can be developed." (p. 150) – "The possibilities of combining factors deriving from different models should be examined." (p. 150) – Using different models to develop a comprehensive framework of teaching and learning "may provide a better linkage between different approaches to teaching" (p. 151). "It should also be examined whether domain-specific factors could be included in generic models such as the dynamic model and also if these factors can also be grouped into stages of effective teaching. The possibilities of the development of a comprehensive framework for measuring quality of teaching through combining both generic and domain-specific factors should be examined." (p. 151)
Schoenfeld	The author points out, "As indicated above, the issues facing us as a field are not theoretical: the theory of in-the-moment decision making during teaching and the TRU framework, together, provide a comprehensive theoretical framework regarding teaching for robust understanding. The issue before us is: what would be useful to know in order to flesh out the details of that theoretical framework and provide mechanisms to help teachers move in productive directions?" (p. 181).
Herbst & Chazan	The authors maintain, "For our field to make progress toward a theory of teaching, we need theorists to make explicit the commitments on which they build. We need to develop instruments that can gather information on constructs from different theories so that we can use them to develop better understanding of how competing constructs are related and so that we can have a publicly accessible source of data that many people can contribute to steward and mine. We need to pre-register experiments that will allow different theories to compete to explain or predict the outcomes of these experiments. Framing all that, we need a scientific consensus not only on the need to articulate commitments but also on shared rules of engagement (e.g., to recognize our scholarly practice also as complex and demanding us to hold on to the tensions among sets of competing values such as ecumenism and consistency, complexity and parsimony, and so on) in order to make such progress." (p. 220)

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Cai et al.	The authors mention, "Following the characterization we have given of theories of teaching, we take it to mean that a theory of teaching grows in generality to accommodate differences between subject matter, grade levels, and cultural aspects and grows in connection to other theories of teaching. Growing in generality means that although a theory should span these different areas, we have to keep in mind the specific character and requirements of each of them. For example, the level of higher order thinking between elementary and secondary students is not the same, but the theory of using higher order thinking should still be adjusted to fit the needs of the students. Growing in connectedness means that we should strive to find commonalities and parallel ideas across theories of teaching. For example, despite the seeming lack of overlap between Confucian and Western modes of learning, there may be areas of connection. […] Ultimately, although we believe that theory of teaching can become more comprehensive, we continue to stress that there is a two-way street. Thus, theory keeps evolving along with teaching, and we do not anticipate there will ever be a be-all, end-all comprehensive theory for teaching. Rather, as teaching and theory co-evolve, we anticipate continuous improvements in both." (p. 246)
Biesta	The author argues, "whether the field of educational theory, research and practice will converge on conceptualisations and theories of teaching or will diverge, remains to be seen. From my own perspective any contribution that helps to restore the balance between the discourse on teaching and the discourse on learning would definitely be welcome." (p. 278) [The author clarifies: I might add that in Continental educational theory the first two aims are generally seen as dimensions of Bildung, that is, of education as a process in which individuals become 'cultivated' through their interaction with cultural resources, such as language and knowledge, whereas the third ambition is seen as the ambition of Erziehung. Here I rely, for example, on Dietrich Benner's definition of Erziehung as 'Aufforderung zur Selbsttatigkeit.']

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