“East Asian” Pedagogy and Metaphysical Anxiety: Whence Singapore? Whither Australia?

Plenary Address (Extended Version)

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Context and Objectives

Over the last decade much handwringing and doom-saying about Australia's – and Western countries generally, with the principal exception of Finland – performance in international student assessments, particularly in TIMSS and PISA

Today, five tasks:

1. Briefly consider TIMSS 2011 and PISA 2012 **results**

2. Briefly report on research findings from TIMSS 2011 on **instructional practices** in Singapore and Australia

3. Report some findings from a large research project on **instructional practice** in Singapore in an effort to understand the strengths of the Singaporean instructional regime, its underlying logic, its relationship to student achievement, and its limits and opportunity costs.

4. Briefly report on current efforts to **reform** the instructional regime in Singapore

5. Consider whether these findings have important **implications** for Australian education

1. Australia and Singapore's Performance on TIMSS 2011 & PISA 2012

TIMSS 8th Grade Mathematics 2011

	Singapore	Australia	Deficit (A-S)	International Average
Grade 8 Maths (High/Adv) (>550/>625)	78/43	29/9	(-49/-34)	17/3
	% Correct	**% Correct**		**% Correct**
Math Content				
Overall Mathematics Score	74	54	-20	50
Number	77	52	-25	43
Algebra	72	38	-34	37
Geometry	71	45	-26	39
Data and Chance	72	59	-13	45
Math Cognitive Domains				
Knowing	82	57	-25	49
Applying	73	47	-26	39
Reasoning	62	36	-26	30

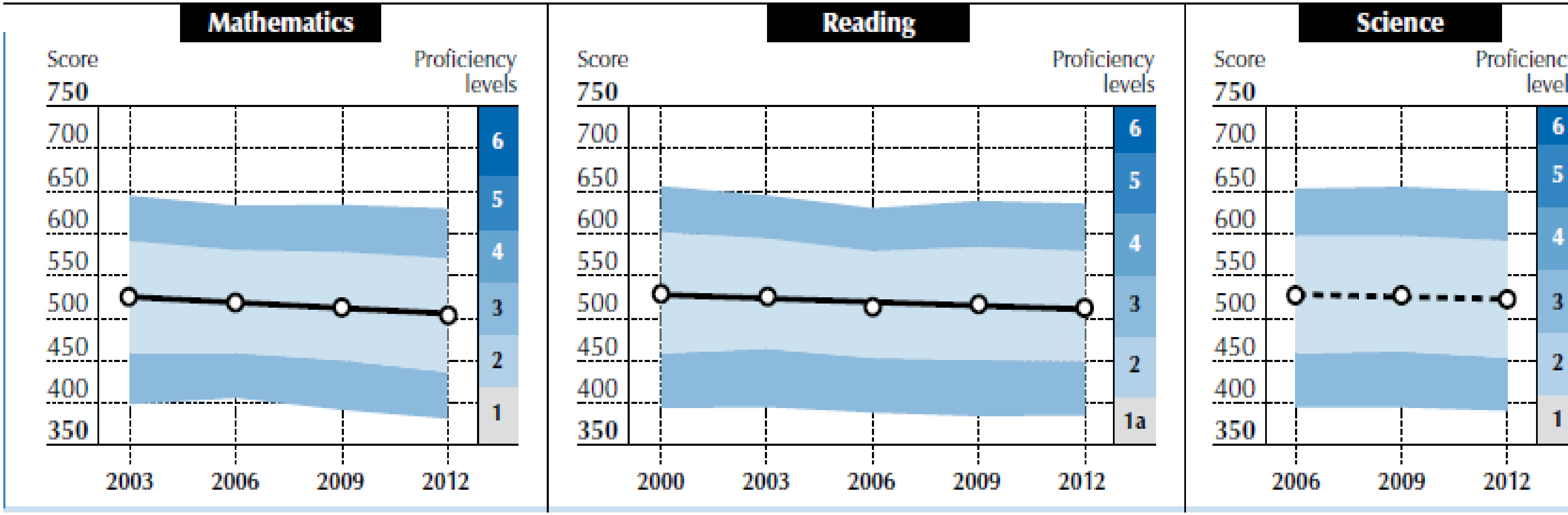
TIMSS, 2011, Ch.2. pp. 90, 114; Appendix E, p. 462

2012 PISA Overall Scores for Math, Reading & Science

Country (Rank Order by Math Score)	Overall Math	Overall Reading	Overall Science
1. Shanghai-China	613	570	580
2. Singapore	**573**	**542**	**551**
3. Hong Kong	561	545	555
4. Chinese Taipei	560	523	523
5. Korea	554	**536**	**538**
6. Macao-China	538	509	521
7. Japan	536	538	547
8. Liechtenstein	535	516	525
9. Switzerland	531	509	515
10. Netherlands	523	511	522
12. Finland	519	524	545
13. Canada	518	523	525
19. Australia	**504 (-69)**	**512 (-30)**	**521 (-30)**
22. New Zealand	500	512	516
OECD Average	494	496	501
25. United Kingdom	494	499	514
35. United States	481	498	497

Source: PISA 2012, Vol. 1. p.19.

Australia PISA Scores, 2003-2012



PISA 2012 Subscales for Mathematics

	Singapore	Australia	International Average
Mathematics Sub-Scales	**% of Students at Levels 5 & 6 (>607)**	**% of Students at Levels 5 & 6 (>607)**	**% of Students at Levels 5 & 6 (>607)**
Formulating	**44.6**	**18.7**	16.8
Employing	**39.6**	**13.7**	13.1
Interpreting	**32.6**	**17.2**	14.3
Change & Relationships	**42.4**	**17.9**	14.4
Space & Shape	**42.8**	**14.3**	13.4
Quantity	**37.4**	**15.4**	14.0
Uncertainty & Data	**34.0**	**15.7**	12.4

Global Index of Cognitive Skills and Educational Attainment

	2014 Rank	2014 W'd Index Z Score (SD > Mean)*	2012 Rank	2012 W'd Index Z Score (SD > Mean)*
South Korea	1	**1.30**	2	**1.23**
Japan	2	**1.03**	4	**0.89**
Singapore	3	**0.99**	5	**0.84**
Hong Kong China	4	**0.96**	3	**0.90**
Finland	5	**0.92**	1	**1.26**
United Kingdom	6	**0.67**	6	**0.60**
Canada	7	**0.60**	10	**0.54**
Netherlands	8	**0.58**	7	**0.59**
Ireland	9	**0.51**	11	**0.53**
Poland	10	**0.50**	14	**0.43**
Denmark	11	**0.46**	12	**0.50**
Germany	12	**1.41**	15	**0.41**
Russia	13	**0.40**	20	**0.26**
United States	14	**0.39**	17	**0.35**
Australia	15	**0.38**	13	**0.46**

2. PISA Shock & Metaphysical Panic

Panic: "an excessive or unreasoning feeling of alarm or fear leading to extravagant or foolish behaviour, such as that which may spread through a crowd of people." (OED)

Metaphysical Panic

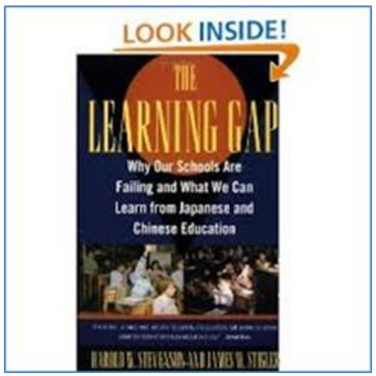
Economic Panic

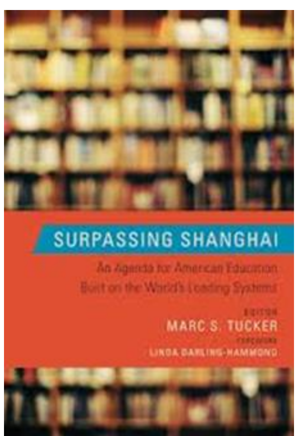
Cultural Panic

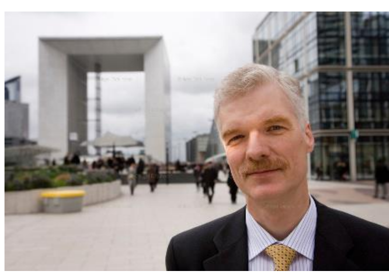
Sovereignty Panic

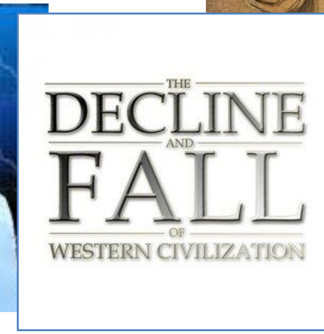
Pedagogical Panic

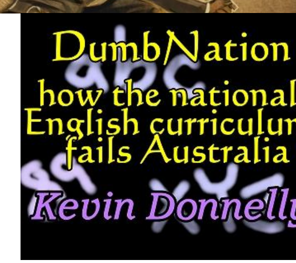
Political Panic



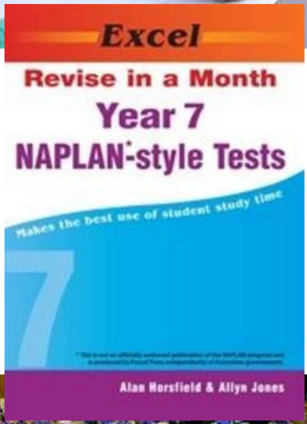








Government Responses to Pedagogical Disorder



Top-performing schools

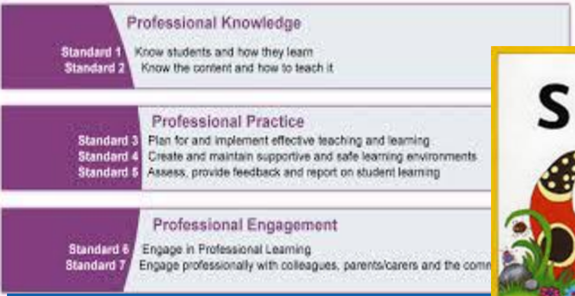
* Only schools which had published scores for all NAPLAN categories in Years 3, 5 and 7 were included in this table. This table was based on the combined average score of the five NAPLAN categories across the three year levels from 2008 to 2011.

PRIMARY SCHOOL
(Year 3/5/7 - 2008 TO 2011*)

	School	Average score
1	Somerville House	530.6
2	Anglican Church Grammar School	528.9
3	Ironside State School	528.5
4	Matthew Flinders Anglican College	527.5
5	Bardon State School	526.8
6	Rainworth State School	526.0
7	All Saints Anglican School (Merrimac)	523.3
8	St Hilda's School (Southport)	522.1
9	St Joseph's School (Bardon)	521.4
	MacGregor State School	520.7

HIGH SCHOOL
(Year 9 ONLY - 2008 to 2011)

	School	Average Score
1	Brisbane Grammar School	647.1
2	Somerset College	645.6
3	Brisbane Girls Grammar School	645
4	Brisbane State High School	635.3
5	Somerville House	633
6	All Hallows' School	631.9
7	St Joseph's College - Gregory Terrace	630.3
8	St Aidan's Anglican Girls' School	629.2
9	St Peters Lutheran (Indooroopilly)	627.8
10	Matthew Flinders Anglican College	626.4



3. How Might we Explain Differences in Student Achievement Scores Between Singapore and Australia?

EXPLAINING EAST ASIAN ASSESSMENT PERFORMANCE: EAST ASIAN PEDAGOGY

Eight ontological claims:

1. East Asian parents, students and teachers share a "Confucian" **cultural orientation** to teaching and learning that emphasizes the (instrumental) value of education, effort & hard work, modest conceptions of self efficacy and self concept, and strong commitments to obedience, responsibility ("filial piety") and competitive achievement

2. East Asian languages (principally Chinese) confer a number of **linguistic and cognitive advantages** to students, for example, demands on working memory in Mathematics

3. East Asian pedagogy assumes a **theory of learning** which proposes that conceptual understanding is a function of procedural fluency through drill, practice and memorization, and is not prior to, or independent of, procedural fluency and memorization

4. East Asian **curricula** are generally detailed down to the topic level and highly prescriptive and tightly aligned to the national high stakes assessment system

5. East Asian **classroom instruction** is teacher-dominated, didactic, content focused, exam driven, mastery oriented, and heavy on basic skills and homework

EXPLAINING EAST ASIAN ASSESSMENT PERFORMANCE: EAST ASIAN PEDAGOGY

Eight ontological claims:

6. East Asian systems are characterized by tightly coupled **institutional arrangements** and forms of **pedagogical alignment** sharply focused on meritocratic assessment and performativity

7. East Asian countries generally invest heavily in **teacher** selection, training and professional development, hierarchical and prescriptive rather than professional forms of **instructional governance** and bureaucratic/performative forms of **teacher accountability**

8. Limited (or non-existent) forms of democratic accountability that permit extended **policy life-cycles** (in the case of Singapore, > 40 years), long term planning, policy coherence and institutional alignment.

One metaphysical claim:

The combination of these claims causally explains the superior academic performance of East Asian students in international assessments

3.1. Instructional Practices:

TIMSS/PISA Data
NIE Core 2 Research Program

3.1. TIMSS Data

Curriculum Resources:
8th Grade Mathematics (2011)

% of Students Whose Teachers Use…	Singapore	Australia	Finland	Internat. Average
Textbooks as basis of instruction	**59**	**25**	88	77
Workbooks or **Worksheets** as basis of instruction	**51**	**11**	26	34
Concrete Objects or Materials that help students understanding quantities or procedures as basis for instruction	**10**	**56**	9	23
Computer software for mathematics instruction as basis for instruction	**11**	**12**	1	7

Source: TIMSS 2011, Mathematics, ch. 8 (p.394)

Instructional Practices:
8th Grade Mathematics (2011)

	% of Students Doing the Following Every Lesson			
	Singapore	**Australia**	**Finland**	**Internat. Average**
Teacher Instructional Activities				
Work problems (individually or with peers) with teacher guidance	**41**	**64**	83	55
Work problems together in whole class with direct teacher guidance	40	43	28	48
Work problems (individually or with peers) while teacher occupied by other tasks	**8**	**25**	6	14
Memorize rules, procedures and facts	**21**	**32**	13	45
Explain their answers	**30**	**46**	36	60
Apply facts, concepts and procedures	**46**	**60**	37	49

Source: TIMSS 2011, ch. 8 (p.400)

Classroom Assessment Practices: 8th Grade Mathematics (2011)

	Singapore	**Australia**	**Finland**	**Internat. Average**
% of Students Whose Teachers Give Test Questions Every 2 weeks or More	**39**	**16**	1	*45*
% of Students Whose Teachers Give Test Questions Always or Almost Always				
Involving Application of Mathematical Procedures	**76**	**84**	82	*77*
Involved in Searching for Patterns and Relationships	**16**	**30**	35	*31*
Requiring Justification or Explanations	**10**	**37**	45	*37*

Source: TIMSS 2011, ch. 8 (p.410)

What are we to make of this?

Singapore's instructional regime more conventional / traditional, Australia more cognitively demanding.

But given this, how come Singapore does so much comparatively better in TIMSS and PISA than Australia?

Is it ***because*** of its unique cultural formations & institutional arrangements ***rather than*** or ***despite*** its instructional practices?

Or is it the case that Singapore's instructional regime, for all its conventionality, is simply better over and above the importance of cultural factors?

And, if this is the case, what might this mean for **Australia,** pedagogically speaking?

3.2. Core 2 Research Program in Singapore

Core 2 Research Program: Key Research Questions

1. **How** do teachers teach in Singapore?

2. What is the **character** and **intellectual quality** of instructional practice in Singapore?

3. **Why** do teachers teach the way they do?

4. To what extent has pedagogical practice **changed** since the introduction of *TLLM* in 2005?

5. What impact does instruction have on **student achievement and the development of 21st Century skills**?

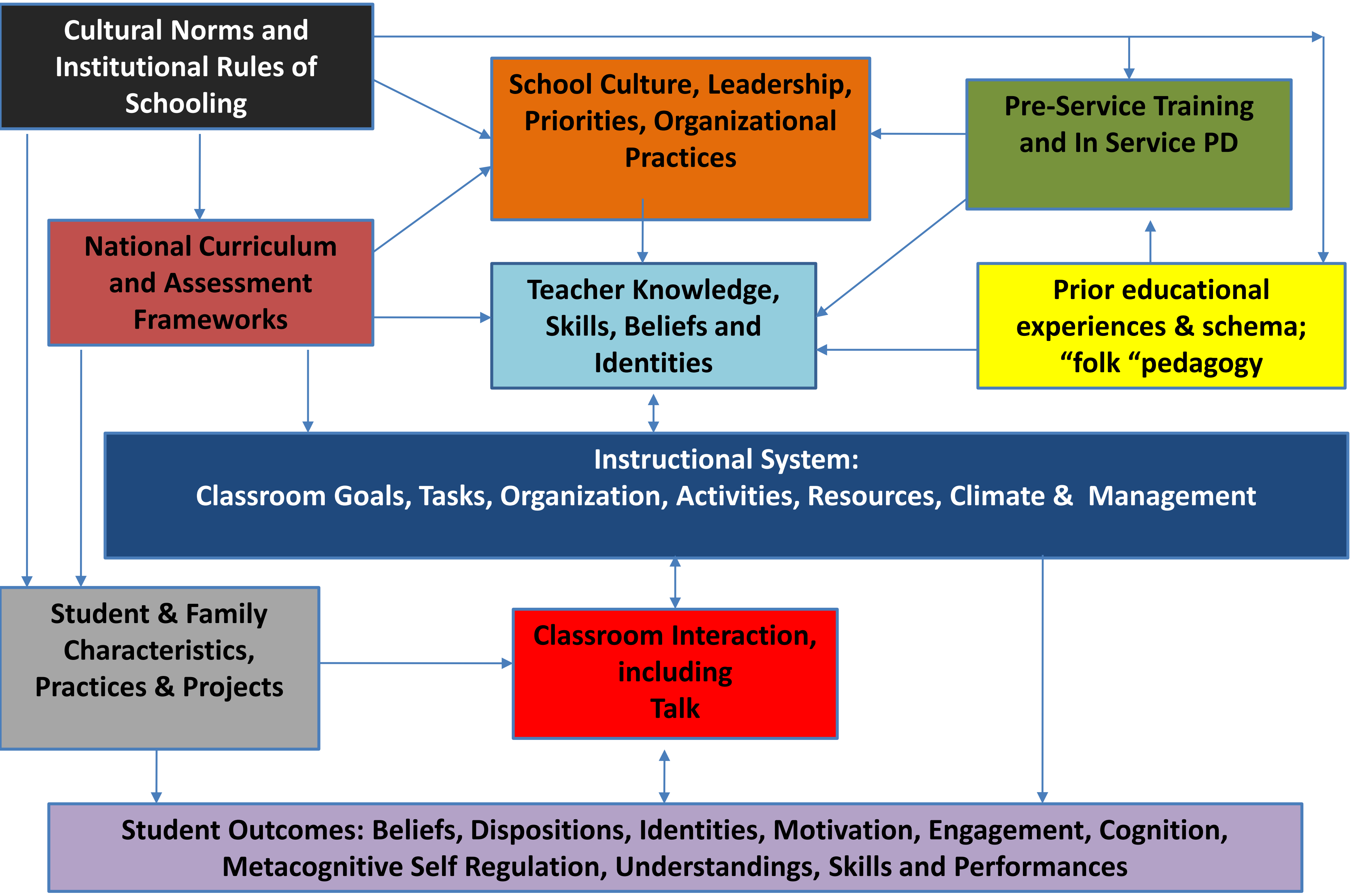
6. What factors **constrain** the ability of the system to secure substantial and sustainable pedagogical improvements?

7. How might the **quality of teaching and learning** in Singapore be improved, given Core 2's research findings?

Core 2 Research Design: 3 Nested Projects

	Panel 2	Panel 3	Panel 5
Design	Repeated measures non-experimental design	Cross sectional	Cross sectional
Sample	Schools: 62 Classes: 454 Students:16895 Teachers: 2100	Schools: 31 Lessons: 625 Units of Work: 117	Schools: 31 Lessons: 625 Units of Work: 117
Type	Survey (x 2) of P5 and Sec 3 students. Survey of teachers	Classroom observation, coding and analysis	Collection and analysis of instructional tasks (n=385), student work (2,897), 115 teacher interviews, 209 T surveys
Assessment of student learning	Pre and Post assessments of all P5 and Sec 3 in Mathematics *or* English		
Analysis	Descriptive and Multivariate	Descriptive and Multivariate	Descriptive and Multivariate

Teaching and Learning: A New Institutionalist Perspective



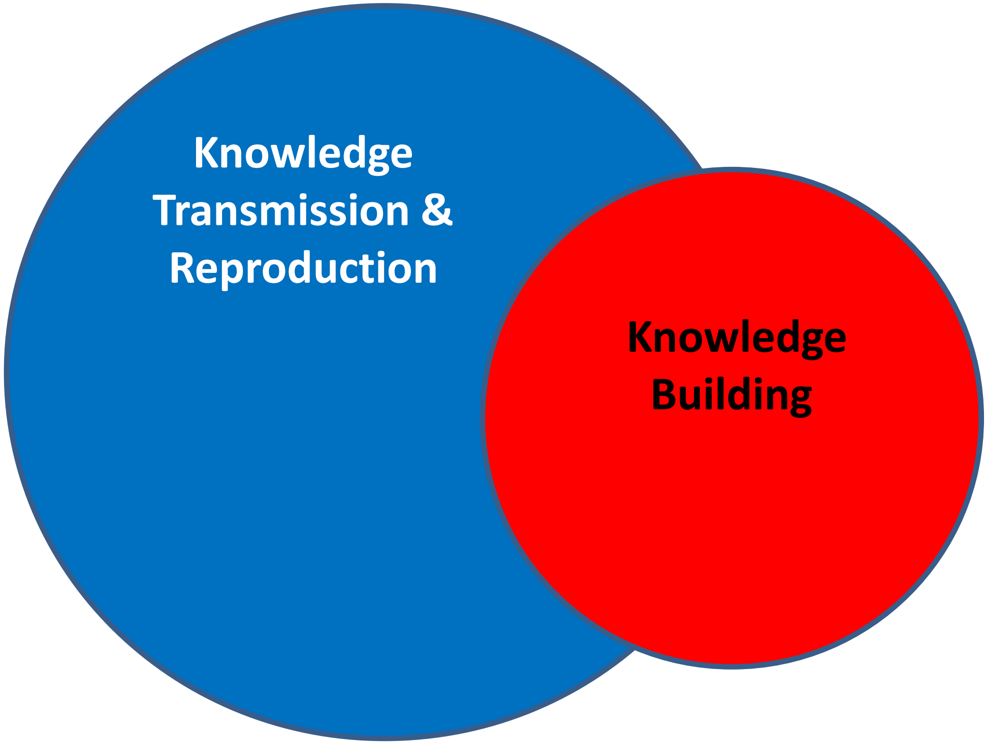
Key Finding 1.

In general, Singapore has developed a **pedagogy** that is pragmatic, fit-for-purpose, instrumental, hybridic and sharply focused on preparing students for local semestral and national high stakes and international assessments.

In effect, classroom pedagogy in Singapore is highly **performative** in orientation focused on mastery and exam preparation.

While Singapore's performative pedagogy ensures a very strong emphasis on **knowledge transmission and reproduction**, it also includes elements of a **knowledge building pedagogy**, cognitively speaking, although this emphasis is relatively weak (as we saw in the TIMSS data …)

Singapore's Two Pedagogies



Singapore's Hybridic Pedagogy…

Knowledge Transmission & Reproduction Pedagogy

- Primary focus on the transmission, acquisition and mastery of curriculum based domain-specific propositional knowledge and skills and the preparation of students for semestral and high stakes assessments. Typically strong focus on factual and procedural knowledge and limited explicit focus on conceptual knowledge.
- Involves extensive use of traditional and direct instruction strategies and some use of high leverage instructional strategies that enhance student learning but primarily those with a strong procedural and summative focus

Knowledge Building Pedagogy

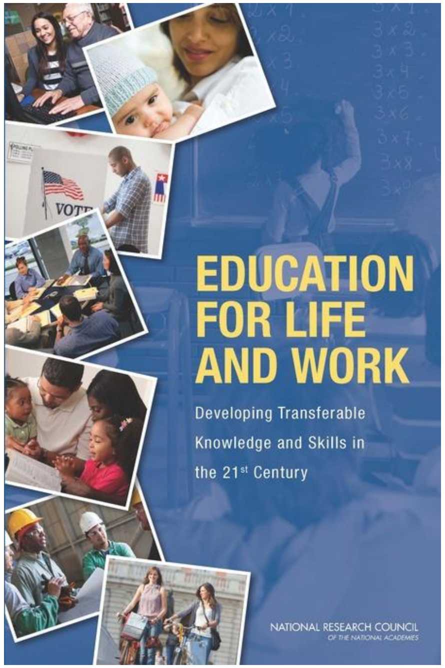
- Strong focus on **deep(er) learning**, conceptual understanding, metacognitive self-regulation, knowledge transfer and development of domain-specific expertise by engaging in knowledge building practices or tasks

- While KBP requires the acquisition of domain specific propositional knowledge and procedural skills, it particularly emphasizes the design and implementation of **Instructional tasks** that requires or encourage students to *do* knowledge work by participating in domain-specific **knowledge building practices**, including those that generate, represent, communicate, deliberate, justify knowledge claims against given epistemic norms and apply them to new problems or contexts. In effect, a strong focus on **disciplinarity** – engaging in domain-specific knowledge practices.

- In principle, involves extensive use of **high leverage instructional strategies** that foster conceptual understanding but evidence for this in Singapore is slight**.**

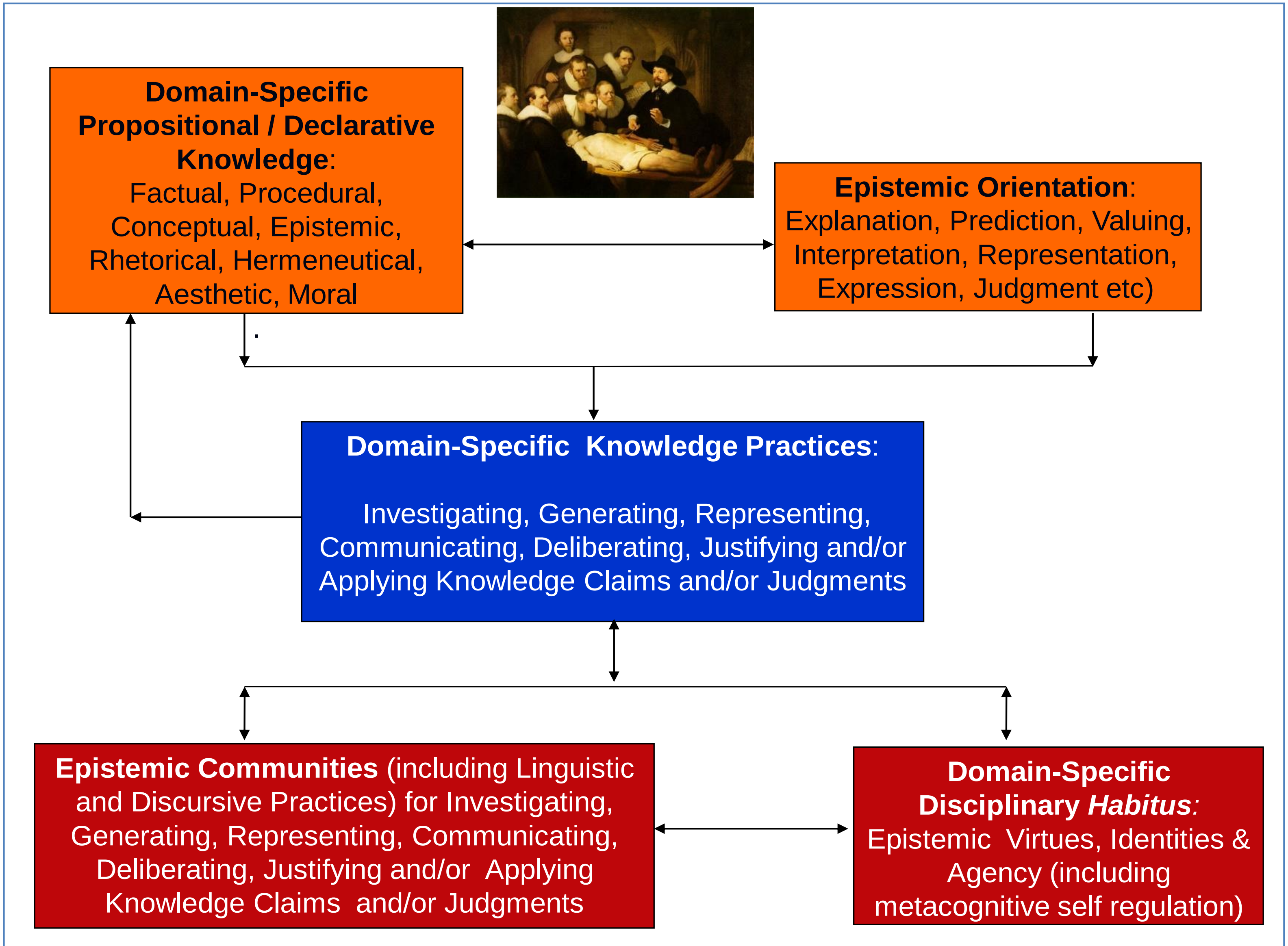
Deep(er) Learning?

"We define "*deeper learning*" as the process through which an individual becomes capable of taking what was learned in one situation and applying it to new situations (i.e., transfer). Through deeper learning (which often involves shared learning and interactions with others in a community), the individual develops expertise in a particular domain of knowledge and/or performance. The product of deeper learning is *transferable knowledge*, including content knowledge in a domain and knowledge of how, why, and when to apply this knowledge to answer questions and solve problems. We refer to this blend of both knowledge and skills as "21st century competencies." The competencies are structured around fundamental principles of the content area and their relationships rather than disparate, superficial facts or procedures. It is the way in which the individual and community structures and organizes the intertwined knowledge and skills—rather than the separate facts or procedures per se—that supports transfer. While other types of learning may allow an individual to recall facts, concepts, or procedures, deeper learning allows the individual to transfer what was learned to solve new problems."



Pellegrino, J. and Hilton, M. (2012). *Education for Life and Work: Developing Transferable Knowledge and Skills in the 21st Century*. Washington, DC: American Academy of Sciences, pp. 69-20

Anatomy of Disciplinarity



Disciplinarity and Pedagogy

A pedagogy that has strong disciplinary features is one that

- Supports the **acquisition and conceptual understanding** of extensive networks of established domain-specific knowledge and skills

- permits students to ***participate*** effectively (via *epistemic* as well as *cognitive* ***apprenticeships***) in distinctive disciplinary practices and conversations in classrooms organized as ***epistemic communities of practice*** *focused on*

- the generation, representation, communication, deliberation, justification and application of disciplinary ***knowledge claims*** appropriate to academic and non-academic institutional settings *in order to*

- cultivate, in developmentally appropriate ways, ***epistemic norms and virtues*** (including meta-cognitive wisdom) and ***disciplinary*** understandings, skills and identities *that*

- Enhance ***disciplinary agency and epistemic rationality***, prepare young people for the epistemic and normative demands of contemporary institutional settings, including knowledge-economy work places and democratic political communities, permit them to join and participate in historical communities of memory and meaning, and develop rich understandings of themselves, nature and others.

Disciplinary Habitus…

"…learning disciplinary knowledge entails more than acquiring basic skills or bits of received knowledge.

It also involves developing identity and affiliation, critical epistemic stance, and dispositions as learner participate in the discourse and actions of a collective social field.

As such, knowledge is not held in archives and texts, but is constructed through ways of speaking, writing, and acting."

> Kelly, G. J., Luke, A., & Green, J. (Eds.). (2008). What counts as knowledge in educational settings: Disciplinary knowledge, assessment, and curriculum. *Review of Research in Education*, 32. p. ix.

Disciplinarity & Knowledge Building: Theoretical Perspectives

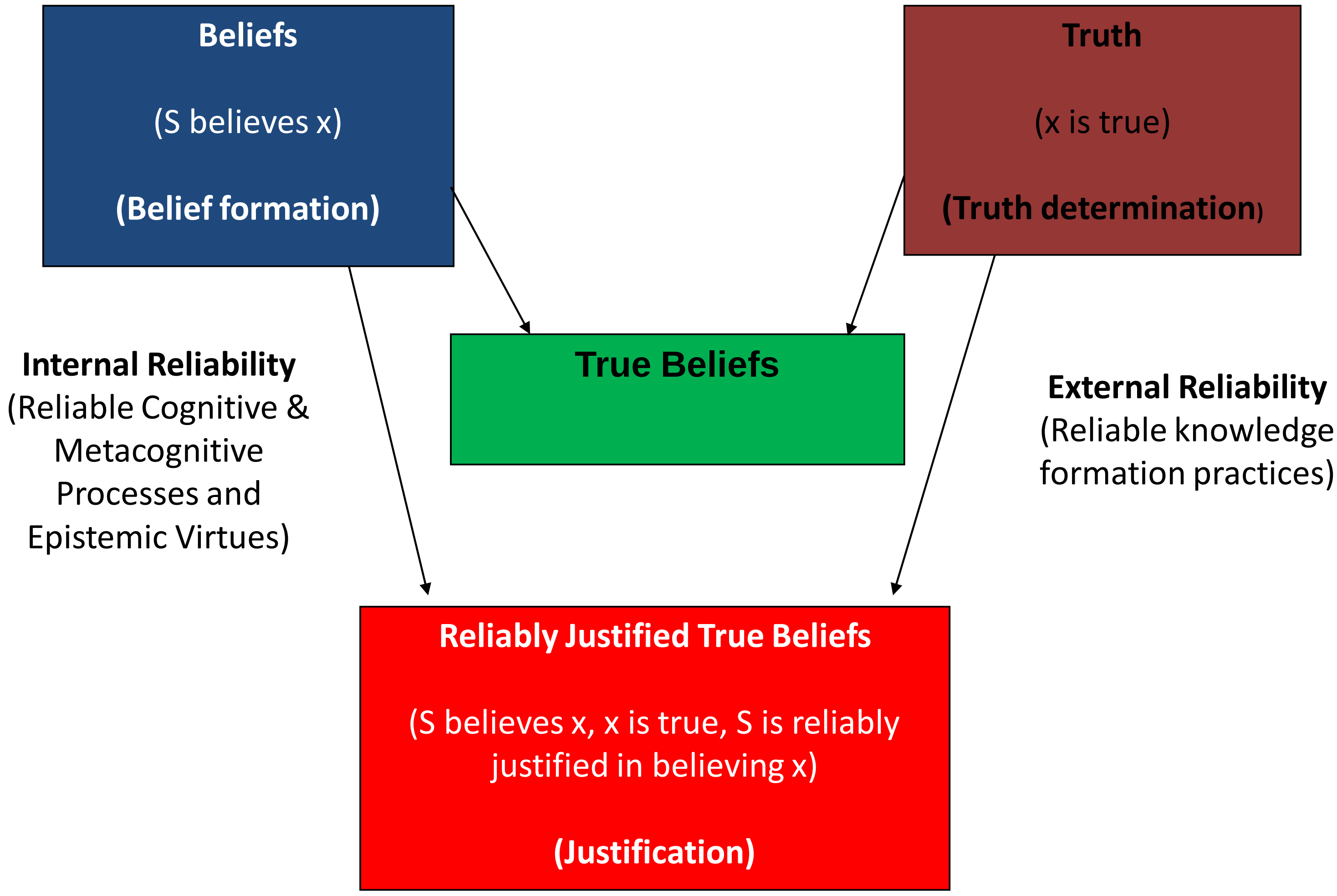
- **History and philosophy of science** (Kuhn, Lakotos, Feyerabend, Chalmers, Shapin)
- **Cognitive science / theory of learning**: (Constructivist learning theory, sociocultural learning theory (situated cognition, cognitive apprenticeship, community of practice) (Bransford et. al, Meyer, Vygotsky, Bruner, Brown, Collins, Lave and Wenger, Rogoff, Resnick, Sfard, Berieter and Scardamalia, Sawyer, Tharp and Gallimore)
- **Epistemology**
  - Classical epistemology (Setup, Pritchard, Williamson)
  - Social epistemology (Goldman, Fuller)
  - Virtue epistemology (Williams, Greco, Zagzebski and DePaul, Kvanvig)
  - Education (Adler, Seigel, Robinson, Hirst, Peters)
- **Disciplinarity**, functional linguistics and the sociology of knowledge (Anderson and Valente, Burke, Toulmin, Bernstein, Schwab, Young, Christie, Maton , Moore)
- **Instructional Theory** (Alexander, Boaler, Doyle, Bossert, Cohen, Shulman, Ball, Coe, Mercer and Hodgkinson, Ford and Forman, Black and Wiliam, Creemers and Kyriakides, Stein et. al., Hattie, Heibert, Lampert, Muijis, Newmann, Pellegrino, Galton, Kennedy James and Pollard, etc.)

The Origins of Disciplinarity: "The New Philosophy" versus Scholasticism,.

Sir Francis Bacon ("Renovator of the Arts") on either side of bust of Charles 11

In 1592, in a famous letter to his uncle, William Cecil (Lord Burghley, Principal Secretary, Lord High Treasurer, Lord of the Privy Seal) to Elizabeth 1, Sir Francis Bacon declared "all knowledge" to be his province and vowed his personal commitment to a plan for the full-scale rehabilitation and reorganization of learning. Thirteen years later in 1605, still frustrated by the intellectual slumber, sterile "disputations," "vain altercations" and "contentious distempers" of medieval scholasticism in English universities, Bacon, by then a successful courtier to King James 1, published one of the most influential works of the European Enlightenment, *The Proficience and Advancement of Learning,* later incorporated into his incomplete master work to reform European intellectual life, *Instauratio Magna Scientiarum.* In it, he maps out a new epistemic regime based on a new empiricist conception of knowledge, a new taxonomy of knowledge ("History," "Poesy" and "Philosophy") and an inductive and scientific approach to knowledge generation. For Bacon, scholasticism needed to be repudiated in favour of a new "experimental philosophy" in which knowledge was not so much derived from appeals to ancient authorities or texts, or dialectical disputations among scholars, but from careful observation, experiment, inductive reasoning and deliberative argumentation (Spelling et al, 1857-1874; Shapin, 2006, for references on Bacon; Hogan, 2007)

The Justification of True Belief



Key Finding 2.

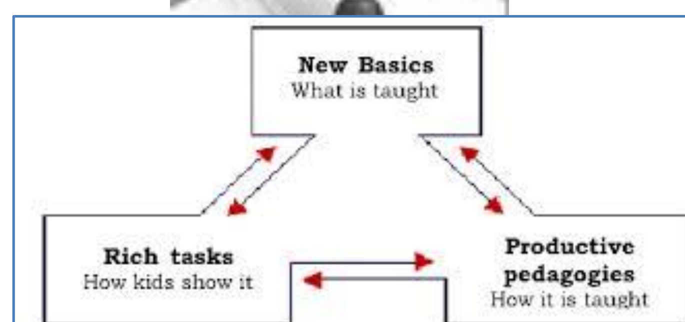
In Singapore, we found that the **intellectual quality of knowledge work** in the classroom is primarily dependent on the design *and* implementation of **instructional tasks** rather than the specific instructional strategies that teachers employ or, surprisingly, extended epistemic talk in classroom (of which there is very little).

Moreover, we found that instructional tasks were largely responsible for the organization of **instructional practices** more generally during the lesson..

Theoretically speaking, these are not especially new insights …. just neglected ones!





Tasks?

Walter Doyle (1983)

"The instructional task is the actual work that students …[do] as they try to understand the curriculum material presented to them. This is cognitive work but in might occur within individual heads only or include the understandings that grow out of interactions among students or between students and teachers. This work could range from memorization and making obvious connections between what one already knows to evaluation, application, problem solving and critical thinking."

Academic tasks "form the basic treatment unit in classrooms" and are, therefore "the primary determinant of how the curriculum is experienced by students" and the principal feature of classroom life that mediates between the curriculum, teacher instructional behaviour and student learning.

W. Doyle, Academic work. *Review of Educational Research*, *53*, 1983, p.160.

Why Tasks?

"We wish to emphasize …[that] no particular teaching practice or strategy assures that students will undertake work that makes high-quality intellectual demands on them... *Our key point is that it is the intellectual demands embedded in classroom tasks, not the mere occurrence of a particular teaching strategy or technique, that influence the degree of student engagement and learning."*

F. Newmann, A. Bryk and J. Nagaoka, *Authentic Intellectual Work and Standardized Tests: Conflict or Coexistence*. Chicago: Consortium on Chicago School Research, 2001, p.31.

Instructional Tasks and Intellectual Engagement: The National Association of Mathematics Teachers

"In effective teaching, worthwhile mathematical tasks are used to introduce important mathematical ideas and to engage and challenge students intellectually. Well-chosen tasks can pique student's curiosity and draw them into mathematics. The tasks may be connected to the real-world experiences of students, or they may arise in contests that are purely mathematical. Regardless of the context, worthwhile tasks should be intriguing, with a level of challenge that invites speculation and hard work. Such tasks often can be approached in more than one way, such as using arithmetic counting approach, drawing a geometric diagram and enumerating possibilities, or using algebraic equations, which makes the tasks accessible to students with varied prior knowledge and experience."

Quoted M. Kennedy, *Inside Teaching*. C.ambridge, MA: Harvard University Press, 2005, p.9

Instructional Tasks.

Instructional tasks = discrete, purposeful, goal-directed student learning activities focused on some form of knowledge work that

- regulate **opportunities to learn** and the exercise of specific forms of cognitive, epistemic, collaborative, discursive, textual, digital and metacognitive agency (and therefore determine the kind and quality of **knowledge work** students engage in during lessons)
- shape the overall **structure of instructional practice** during the lesson
- **mediate** knowledge work in the classroom and knowledge work in the workplace

Two generic (not domain-specific) kinds of instructional tasks

1. **Knowledge transmission tasks**
   - Focus on the acquisition and mastery of domain-specific knowledge and skills

2. **Knowledge building tasks**
   - In addition to the acquisition and mastery of domain-specific knowledge and skills, a strong focus on deeper learning, conceptual understanding, the development of domain-specific expertise, knowledge transfer and metacognitive wisdom

Knowledge Building Pedagogy

Knowledge building pedagogy two dimensions: epistemic and cognitive

1. **knowledge building, epistemically speaking**: engaging in domain-specific knowledge practices in communities of epistemic practice that variously generate, represent, communicate, deliberate and establish the public warrant or truth, moral or aesthetic value of domain specific knowledge claims supports, development of domain-specific (disciplinary) expertise, and effective knowledge transfer to new situations

2. **knowledge building, cognitively speaking**: engaging in cognitive activities (reasoning, explaining, interrogating, interpreting, inferring) that supports deep(er) learning and develops *conceptual understanding* (extended and richer cognitive schemas and networks), metacognitive wisdom and self regulation and enables effective knowledge transfer and application

Note:

- *2 a partial function of 1*
- *1 and 2 linked pedagogically through instructional task design and implementation*

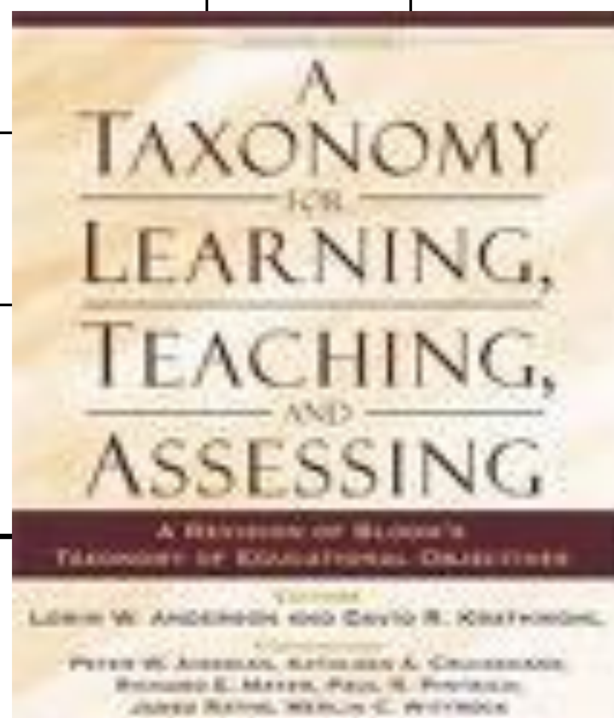
Constructivist model of learning as KB

Learning is a set of constructive processes in which the individual student (alone or socially) builds, activates, elaborates, and organizes knowledge structures. These processes are internal to the student and can be facilitated and fostered by components of teaching. Moreover … higher order learning and a deep understanding of learning content are based on the quality of knowledge building and, thus, on the execution of learning activities. Learning activities should [generally] evoke both basic information processing and domain-specific processing.

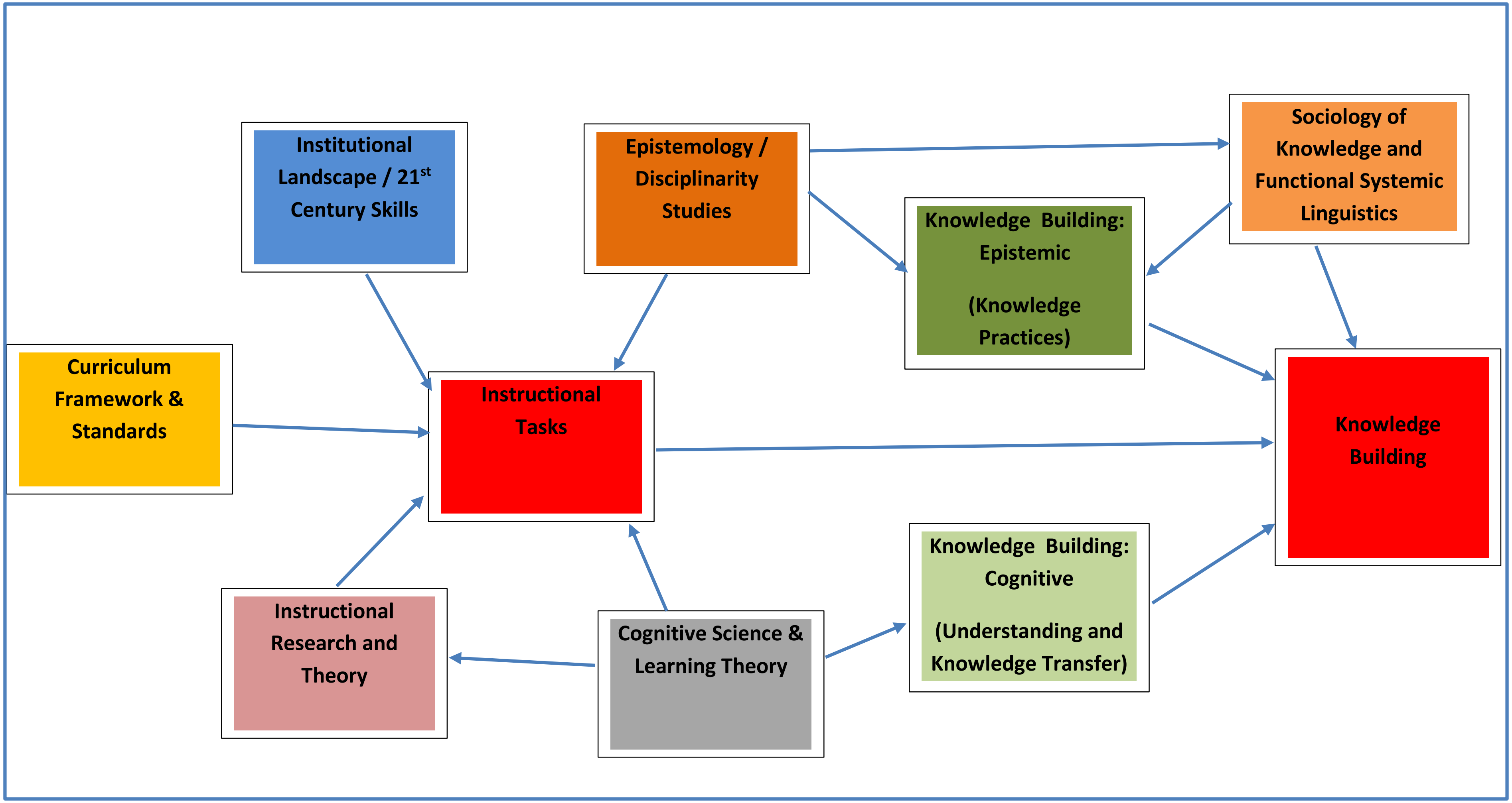
T. Siegel and R. Shavelson, "Teaching effectiveness research in the past decade: the role of theory and research design in disentangling meta-analysis results." *Review of Educational Research,* 77, 4 (Dec 2007), p. 462

Beyond Anderson and Krathwohl's Taxonomy of Knowledge and Cognition

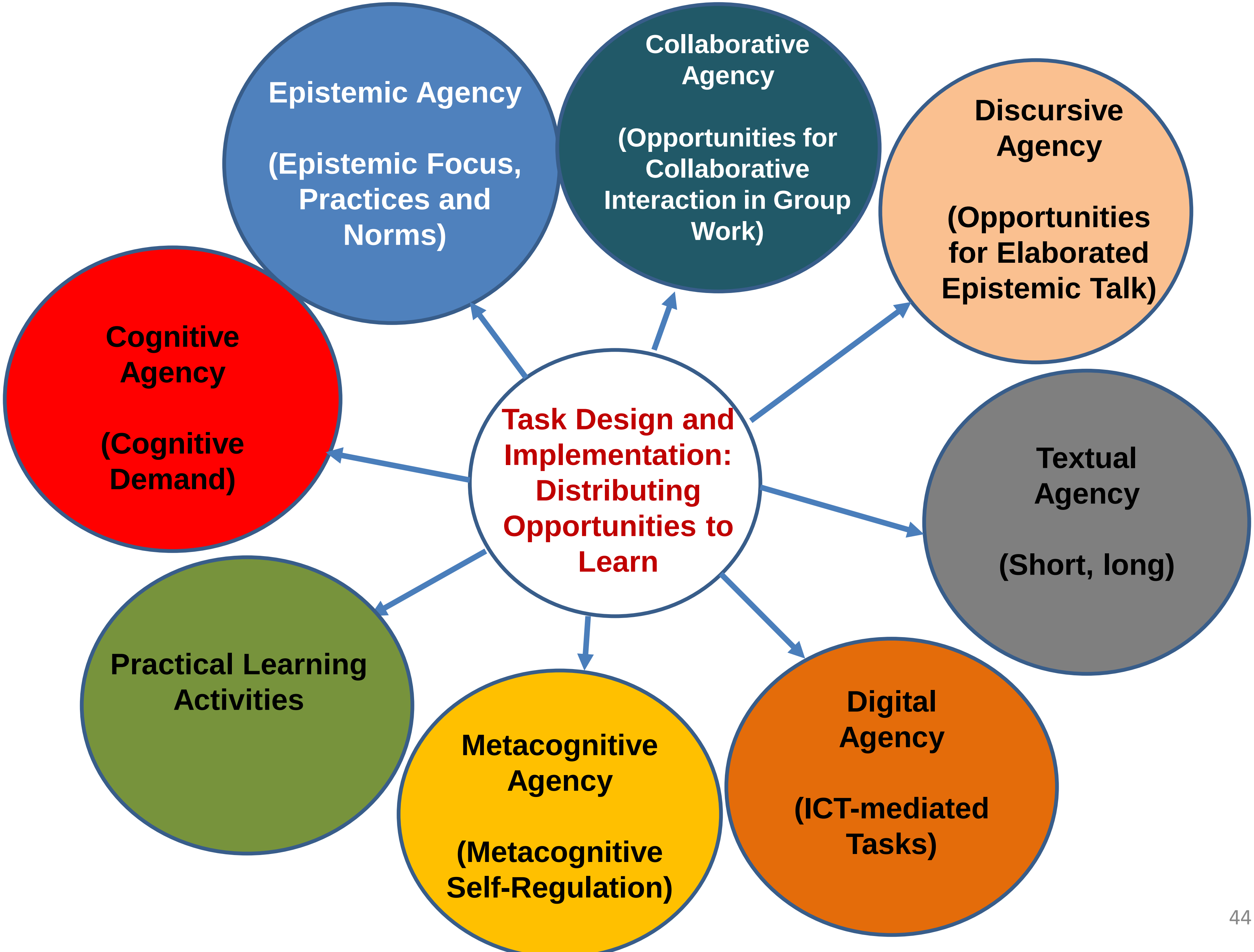
Knowledge Dimension	**Cognitive Domain**					
	Remember	Understand	Apply	Analyze	Evaluate	Create
Factual Knowledge						
Conceptual Knowledge						
Procedural Knowledge						
Meta-cognitive knowledge						



Instructional Tasks and Knowledge Building in Theoretical Context



Instructional Tasks as Multi-dimensional Opportunity Systems.



The Opportunity Structure of Instructional Tasks in Singapore Sec 3 Math and English

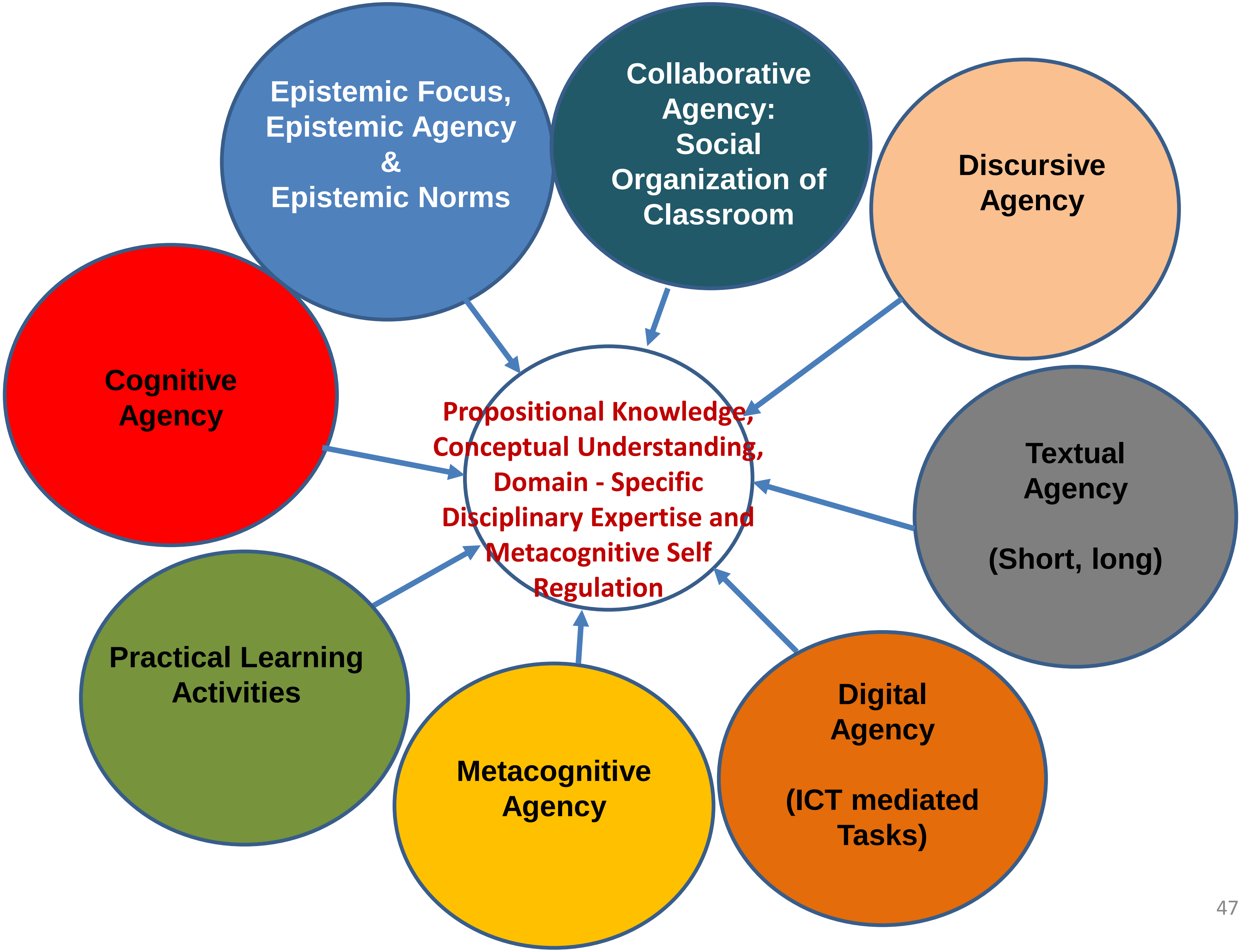
Task Feature	Findings
Practical Learning Activities	Focus on whole class activities primarily and individual work secondarily
Cognitive Agency	Focus on functional rather than complex forms of cognition
Epistemic Agency (epistemic focus, epistemic practices, epistemic norms)	Focus on factual and procedural knowledge rather than conceptual, epistemic or metacognitive knowledge; performative epistemic practices; mastery and competitive task values; very limited epistemic pluralism; hierarchical epistemic authority
Collaborative Agency	Very little collaborative group work (although some pseudo-group work)
Discursive Agency	Very limited opportunities for extended interaction, understanding talk or cumulative dialogue
Textual Agency	Short rather than elaborated text production
Digital Agency	Limited to factual inquiry and procedural fluency
Metacognitive Agency	Very little opportunity for metacognitive self regulation

Four Models of Learning

Four Models of Learning				
Name	**Conception**	**Learner's Role**	**Teacher's Role**	**Dates**
Response strengthening (Conditioning)	Strengthening or weakening of an association	Passive recipient of rewards and punishments	Dispenser of rewards and punishments	1900-1950s
Information acquisition	Adding information to memory	Passive recipient of information	Dispenser of information	1960s-1980s
Knowledge construction	Building cognitive representations	Active sense maker	Cognitive guide	1980s-1990s
Co-constructing Knowledge and skills	Knowledge building through participation in knowledge practices and building shared cognitive representations	Meaning maker and capacity builder as cognitive and epistemic apprentice	Expert	1990s - Present

Source: Adapted from Mayer, R. E. (2011). *Applying the science of learning*. Boston, MA: Pearson. p.23.

Task Design and Implementation, Student Agency and Knowledge Building.



Pellegrino, J. and Hilton, M. (2012). *Education for Life and Work: Developing Transferable Knowledge and Skills in the 21st Century*, pp. 69-20.

"The committee views the broad call for deeper learning and 21st century skills as reflecting a long-standing issue in education and training— the desire that individuals develop transferable knowledge and skills. Associated with this is the challenge of creating learning environments that support development of the cognitive, intrapersonal, and interpersonal competencies that enable learners to transfer what they have learned to new situations and new problems. These competencies include both knowledge in a domain and knowledge of how, why, and when to apply this knowledge to answer questions and solve problems—integrated forms of knowledge that we refer to as 21st century competencies and discuss further below.

If the goal of instruction is to prepare students to accomplish tasks or solve problems exactly like the ones addressed during instruction, then deeper learning is not needed. For example, if someone's job calls for adding lists of numbers accurately, that individual needs to learn to become proficient in using the addition procedure but does not need deeper learning about the nature of number and number theory that will allow transfer to new situations that involve the application of mathematical principles.

Today's technology has reduced demand for such routine skills… Success in work and life in the 21st century is associated with cognitive, intrapersonal, and interpersonal competencies that allow individuals to adapt effectively to changing situations rather than to rely solely on well-worn procedures.

When the goal is to prepare students to be able to be successful in solving new problems and adapting to new situations, then deeper learning is called for. Calls for such 21st century skills as innovation, creativity, and creative problem solving can also be seen as calls for deeper learning — helping students develop transferable knowledge that can be applied to solve new problems or respond effectively to new situations."

Today

Opportunities for

Learning Activities

Cognitive Agency

Epistemic Agency

Collaborative Agency

Discursive Agency

Learning Activities

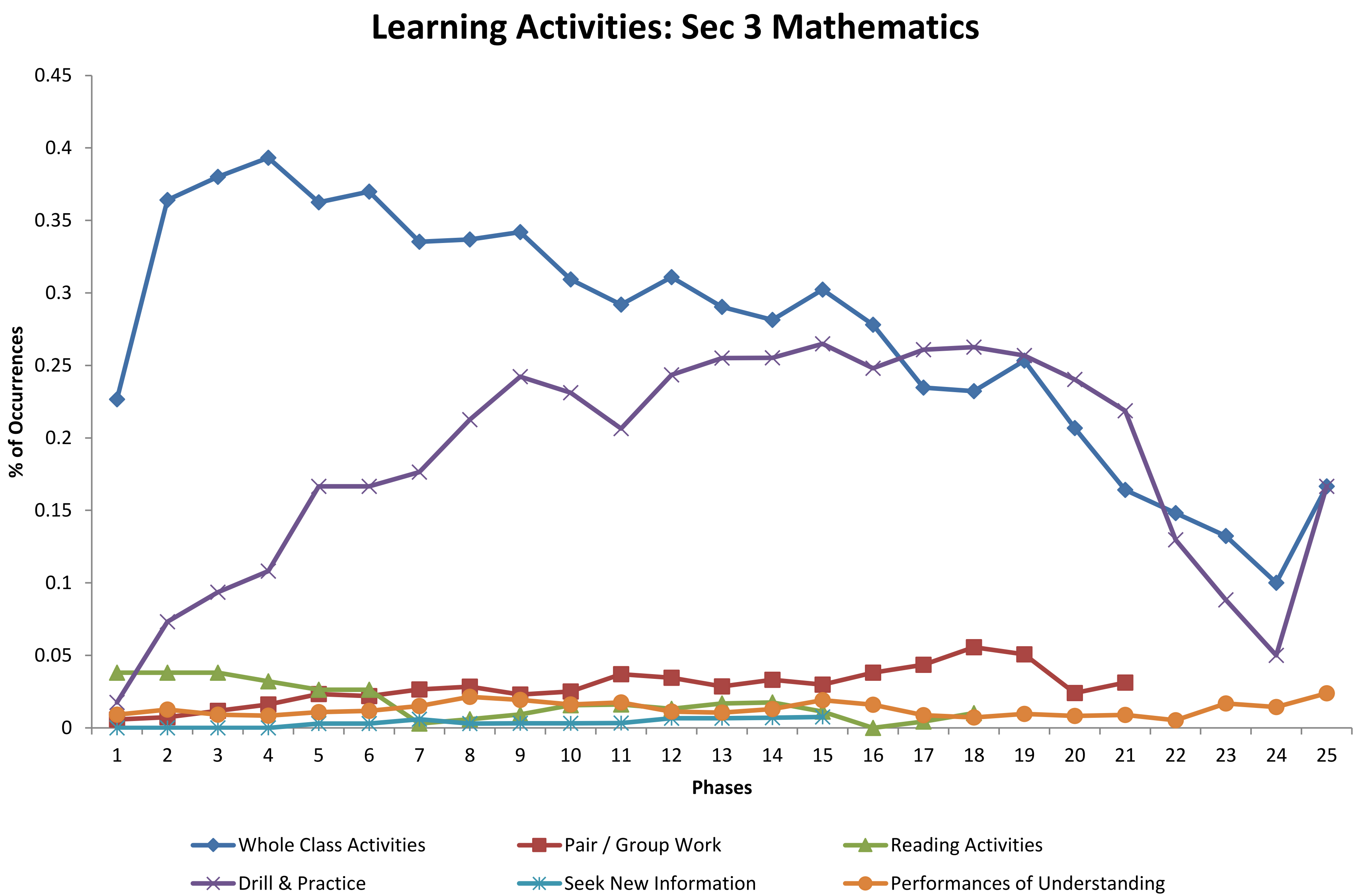
Descriptive Statistics: Learning Activities and Cognitive Activities

	Sec 3 Mathematics			Sec 3 English		
	N	%	Minutes	N	%	Minutes
No. of *Learning* Activities	4,590	100%	13,770	4,825	100%	14,475
Phases with Learning Activities	**2,944**	**98.4%**	**8,832**	**3,072**	**94.6%**	**9,216**
No. of Cognitive Activities	752			282		
No. of Phases with Cognitive Activities	**2,099**	**70.2%** (2,099/2,991)	**6,297**	**1,444**	**44.4%** (1,444/3,247)	**4,332**
No. of phases *without* cognitive activities	**892**	**29.8%** (892/2,991)		**1,803**	**55.5%** (1803/3,247)	

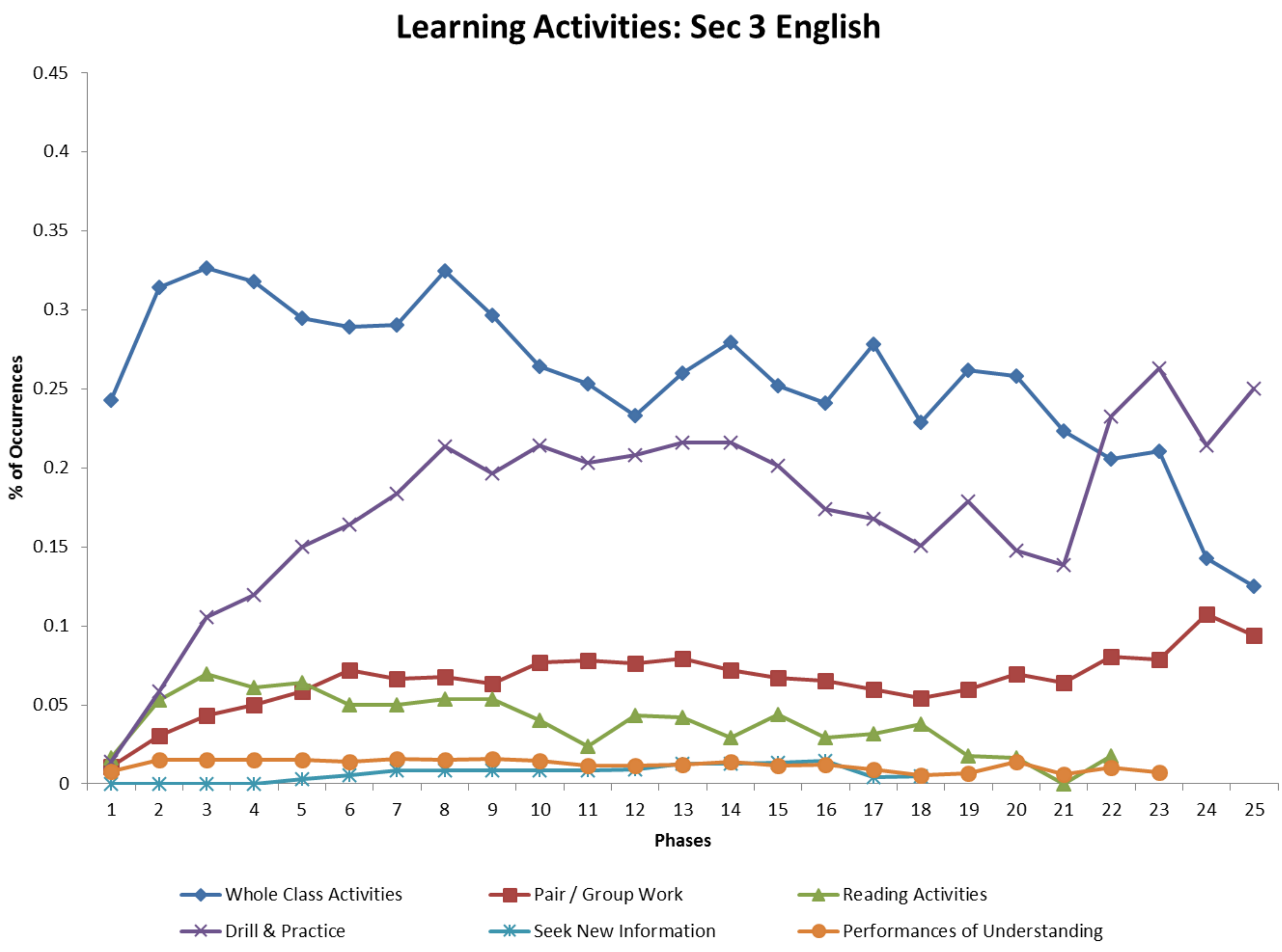
Summary of Learning Activities

	Sec 3 Mathematics		Sec 3 English		
	% lessons with at least one occurrence	% phases per lesson	% lessons with at least one occurrence	% phases per lesson	*Cohen's h % phases per lesson*
Whole Class Activities	0.51	**0.31**	0.53	**0.28**	*.14*
Pair or Group Work	0.12	**0.02**	0.18	**0.06**	*.33*
Reading Activities	0.13	**0.02**	0.22	**0.04**	*.23*
Drill and Practice	0.43	**0.19**	0.33	**0.16**	*.16*
Seeking New Information	0.01	**0.01**	0.02	**0.01**	*.00*
Performances of Understanding & Assessment Activities	0.07	**0.01**	0.05	**0.01**	*.17*

Learning Activities



Learning Activities



Breakdown Whole-Class Learning Activities

	Mathematics (N=2,991 phases, 171 lessons)		English (N=3,247 phases, 180 lessons)		Effect Size
	% lessons with at least one occurrence	**% phases per lesson**	% lessons with at least one occurrence	**% phases per lesson**	*Cohen's h* *% phases per lesson*
Whole Class Activities	0.51	**0.31**	0.53	**0.28**	*.14*
Listening to the teacher; taking notes of what teachers says, writes on whiteboard, or presents in PPT	0.99	**0.69**	0.98	**0.64**	*.11*
Listening/asking/answering questions (content IRE;'S to S questions/answers (directed/redirected by T)	0.94	**0.51**	0.91	**0.42**	*.18*
Listening /participating (commenting, asking questions) in WC discussion	0.05	**0.02**	0.06	**0.01**	*.08*
Watching or listening to multimedia (incl. video, movie, audio, flash, etc).	0.07	**0.01**	0.15	**0.04**	*.20*

Cognitive Agency

Instructional Tasks: Cognitive Demand, Sec3 Math

(After, Anderson and Krathwohl, *Taxonomy For Learning* …2001).

	Mean (1-5)	SD
To *remember* [memorize] formulae or rules	4.03	.642
To *practise* what you have learnt	3.92	.908
To *remember* or recall information you have learnt in a previous lesson	3.66	.920
To *review* what you have learnt	3.55	.900
To *check* the correctness of a solution to a problem	3.54	.909
To *apply* what you have learnt to a new problem or situation	3.53	.890
To *make the meaning* clear	3.50	.930
To *understand* a word problem, graph or table	3.47	.890
To *explain* something	3.46	.928
To *analyze* information	3.41	.910
To *discuss* a problem with one or more students	3.39	.957
To *compare* solutions to a problem	3.37	.891
To *summarize* information you have learnt or gathered	3.35	.938
To *work out* a new solution to a problem	3.35	.895

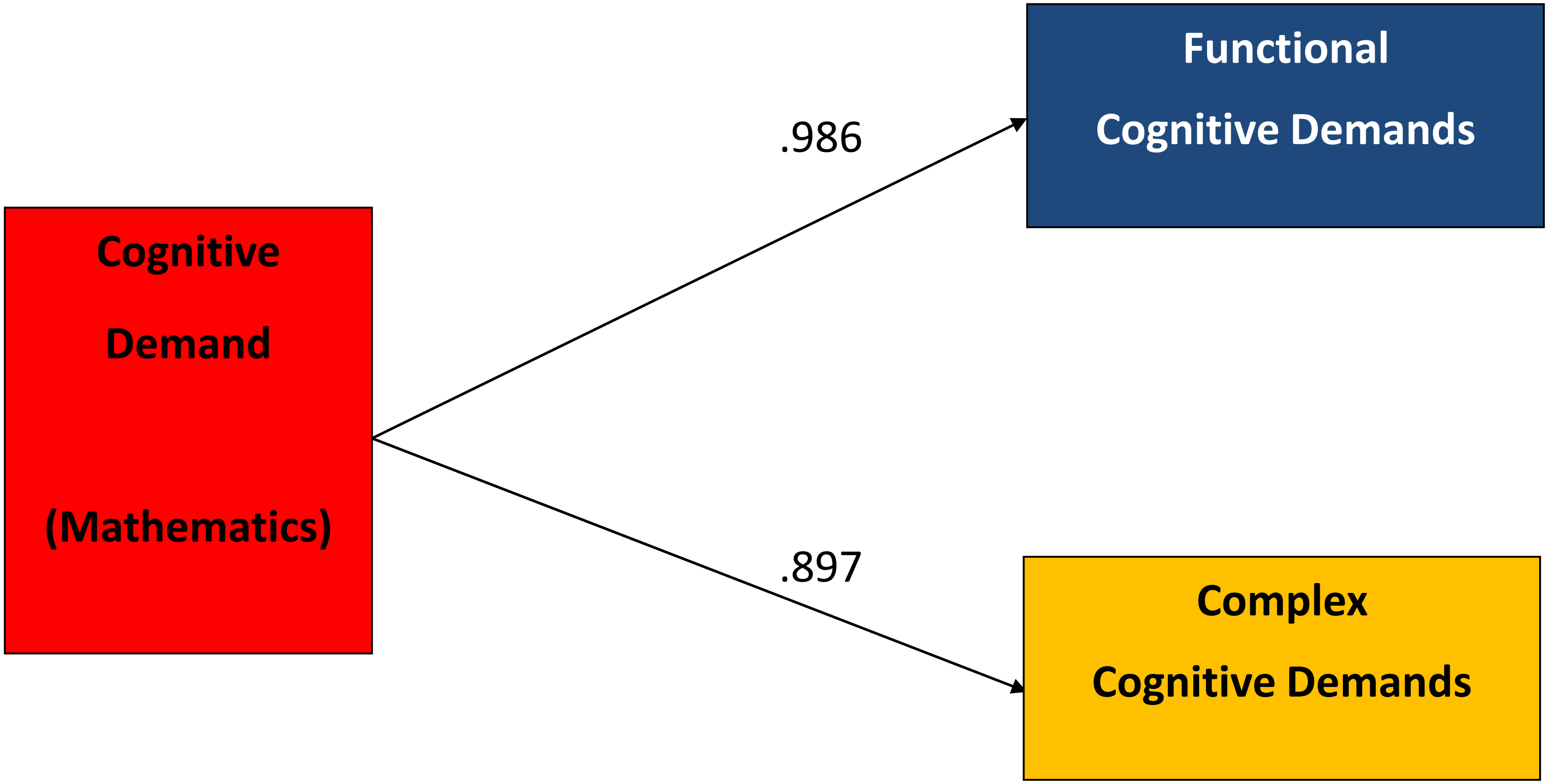
Cognitive Demand - 2

	Mean	SD
To *give reasons* for why a guess or a solution that someone has made in class is correct	3.34	.937
To *give an example* of a mathematical idea (e.g., Give an example of a four-sided figure)	3.33	.940
To *explain* the difference between two ideas (e.g., Area and Volume)	3.32	.940
To *classify* problems you have learnt	3.32	.939
To *make a connection* between what you have learnt and something else (e.g., finding area of a composite shape using regular shapes)	3.31	.937
To *investigate* a problem	3.28	.925
To *represent* or state a problem in a different way (e.g., drawing models , graphs or tables)	3.25	.912
To *represent* something differently	3.18	.903
To *write the solution* to a problem and explain it to your classmates	3.15	1.006
To *find out new information* from the textbook, the library, the internet or some other source	2.97	.996

Cognitive Agency/Demand, Secondary 3 Mathematics and English

Panel 2	Mean (1-5)	SD	Corr (r)
Mathematics			
Functional Cognition	**3.81**	.643	**.691**
Complex Cognition	**3.38**	.672	
English			
Functional Cognition	**3.43**	.748	**.340**
Complex Cognition	**3.34**	.657	

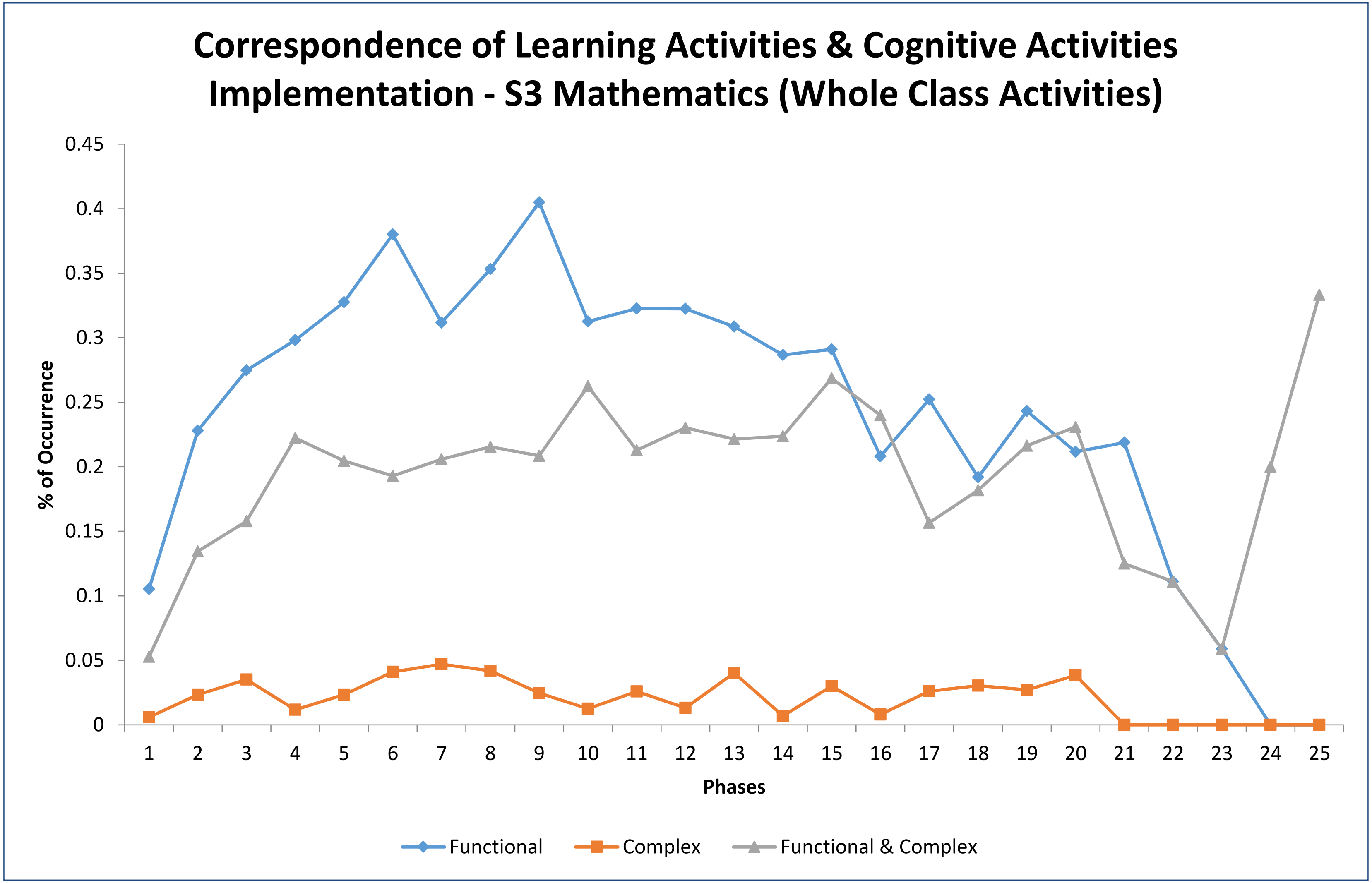
Confirmatory Factor Analysis: Cognitive Demand of Mathematical Tasks



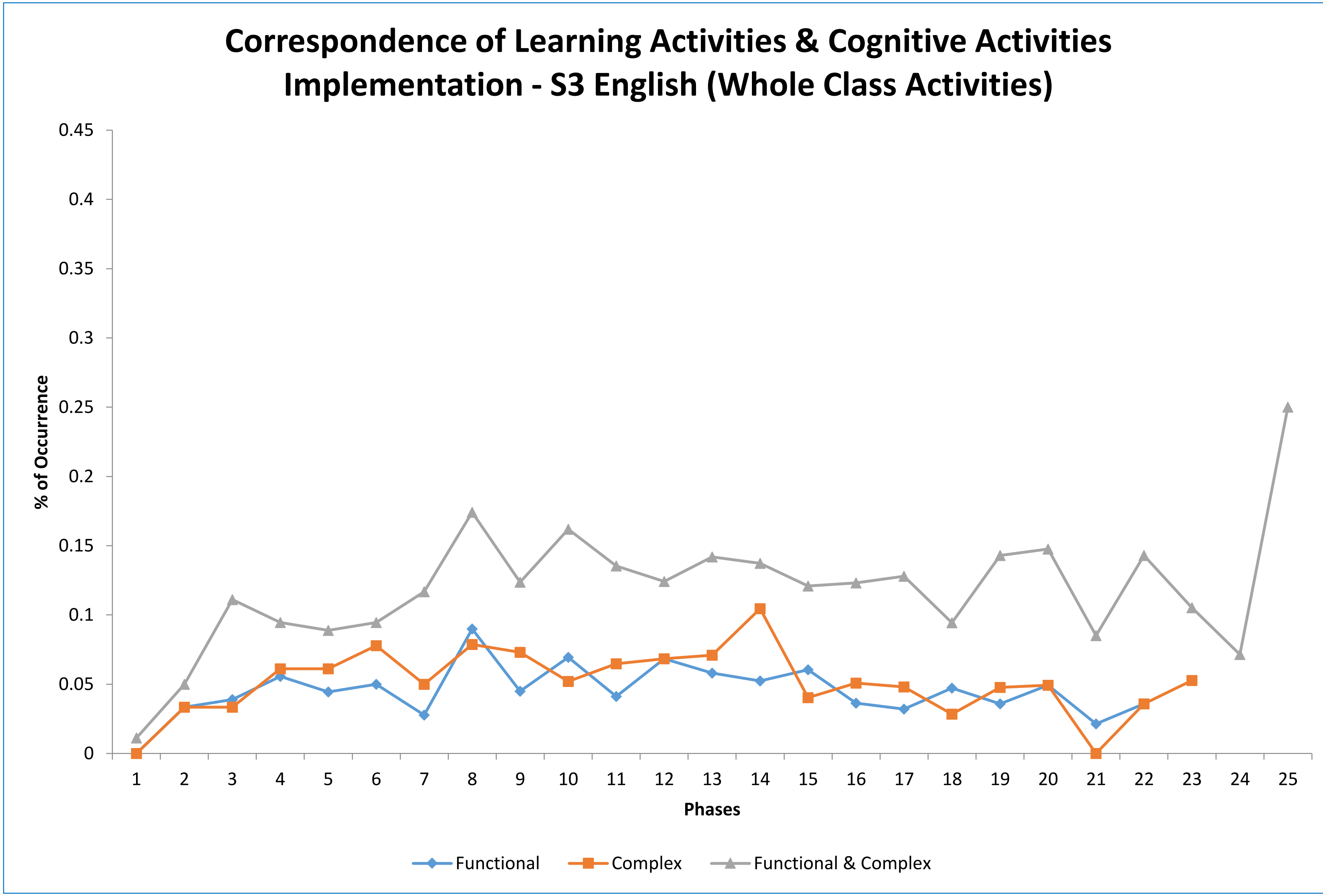
Goodness-of-fit statistics:	
Chi-Square / df / p-value	274.837 / 118 / .000
CFI / TLI	.982 / .980
RMSEA (90% C.I.)	.034 (.029-.040)
SRMR	.022

1. Cognitive Agency
(Classroom Observation Study)

	Mathematics 2010 (N=170/2099)		English 2010 (N=159/1444)		Effect Size: *Cohen's h*
	% of phases with Cognitive Activities per lesson	% of phases with Cognitive Activities per Unit	% of phases with Cognitive Activities per lesson	% of phases with Cognitive Activities per Unit	% of phases with Cognitive Activities per lesson
Functional Cognition Only	0.53	**0.50**	0.23	**0.23**	*.63*
Complex Cognition Only	0.04	**0.04**	0.25	**0.26**	*.64*
Both Functional and Complex Cognition	0.38	**0.41**	0.46	**0.46**	*.16*



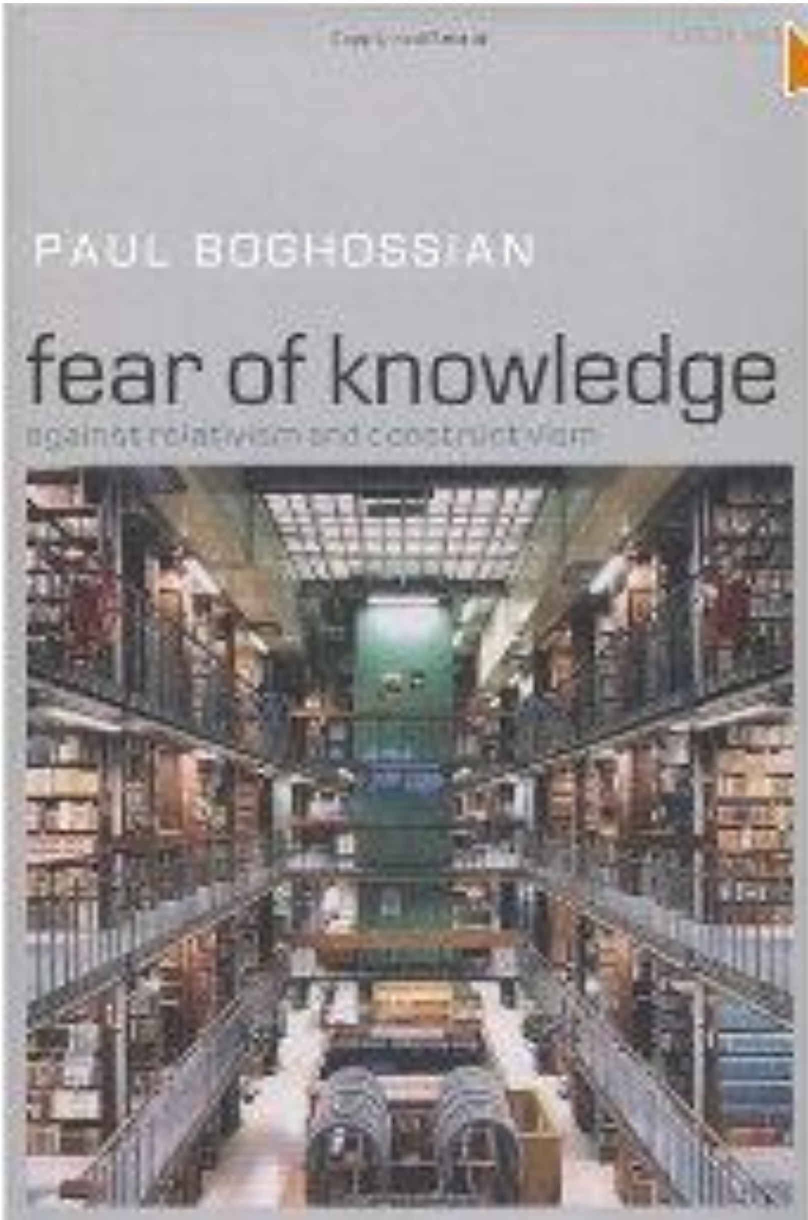
Correspondence of Learning Activities & Cognitive Activities Implementation - S3 Mathematics (Whole Class Activities)
% of Occurrence
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Phases
Functional
Complex
Functional & Complex



Correspondence of Learning Activities & Cognitive Activities Implementation - S3 English (Whole Class Activities)
% of Occurrence
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Phases
Functional
Complex
Functional & Complex

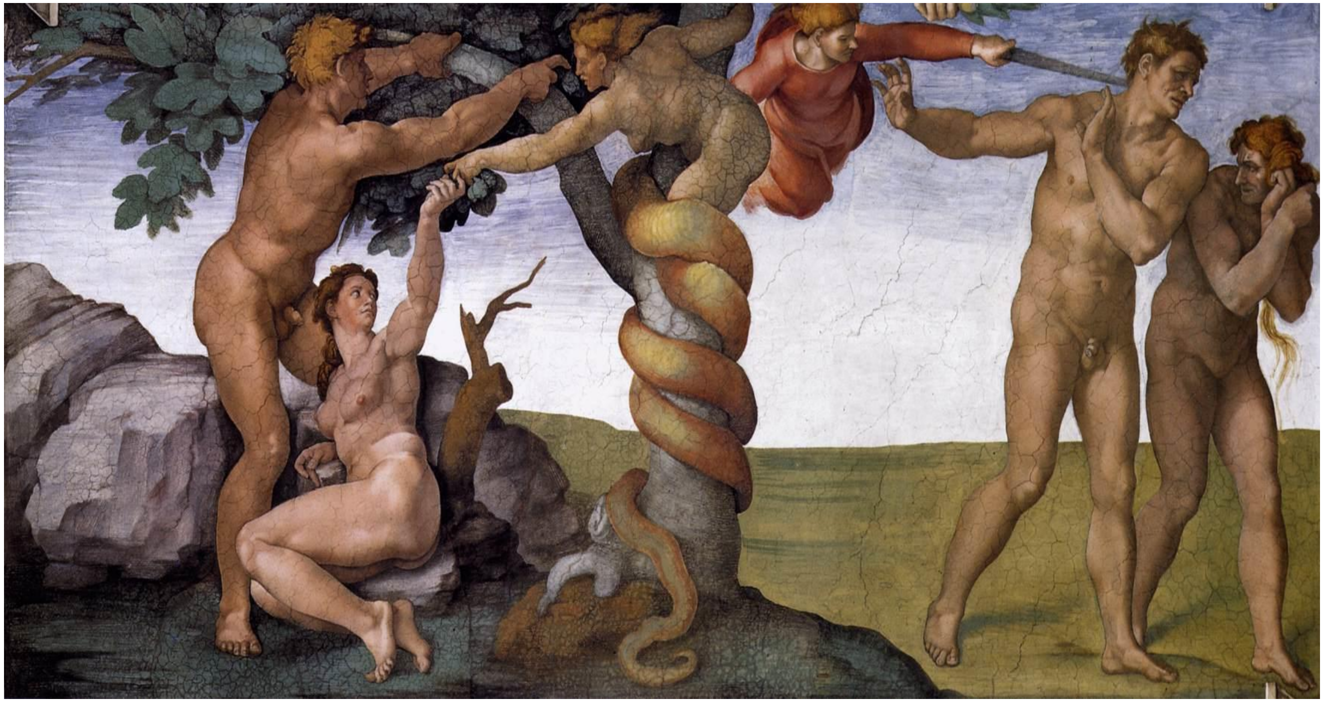
Epistemic Agency

Epistemic Focus
Epistemic Practices
Epistemic Norms


PAUL BOGHOSSIAN
fear of knowledge
against relativism and constructivism


Bringing Knowledge Back In
From social constructivism to social realism in the sociology of education.
MICHAEL F. D. YOUNG

Beware The Tree of Knowledge



17. And to Adam he said, "Because you have listened to the voice of your wife, and have eaten of the tree of which I commanded you, 'You shall not eat of it,' cursed is the ground because of you; in toil you shall eat of it all the days of your life;

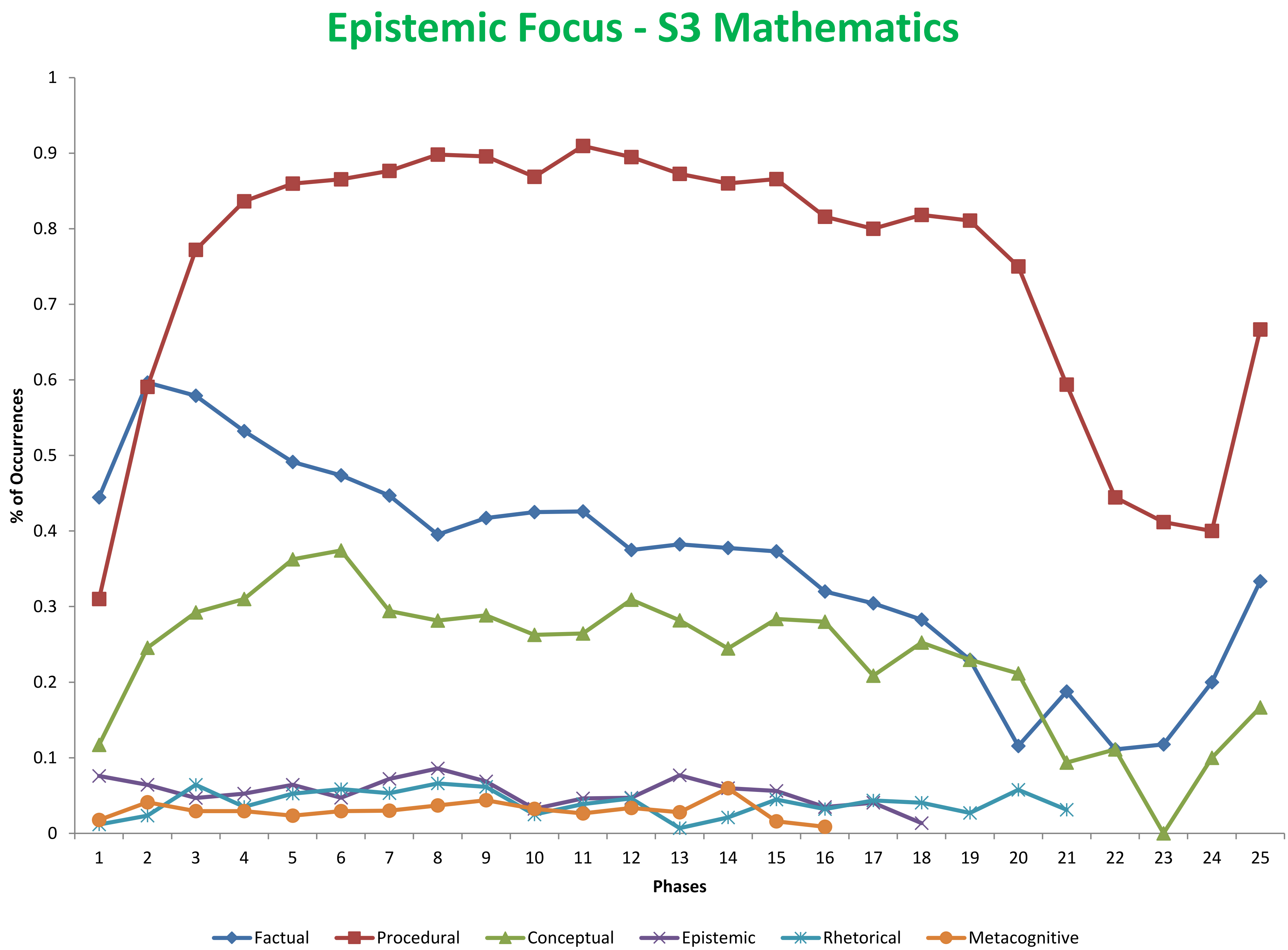
18. thorns and thistles it shall bring forth to you; and you shall eat the plants of the field.

19. In the sweat of your face you shall eat bread till you return to the ground, for out of it you were taken; you are dust, and to dust you shall return.

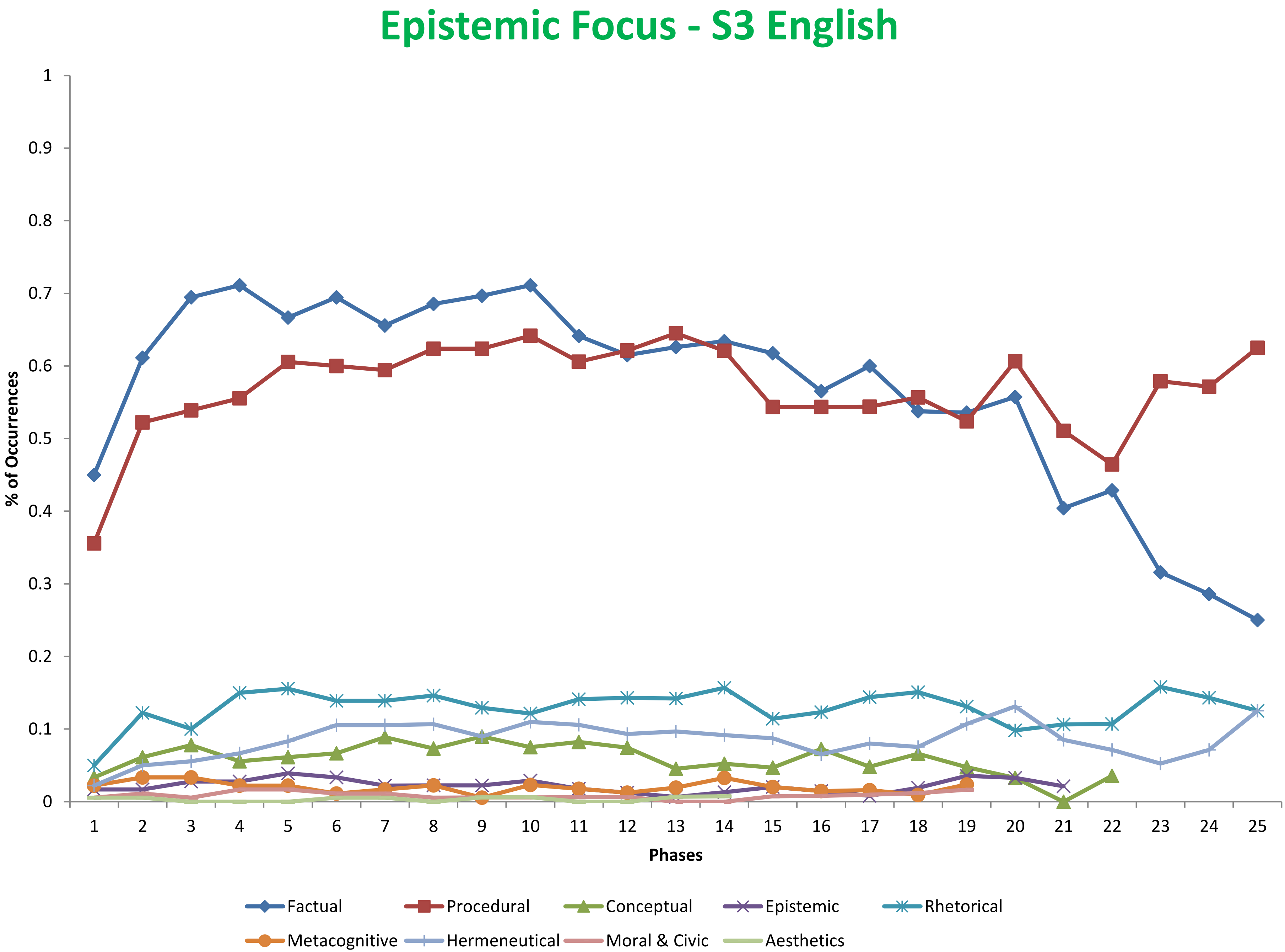
Book of Genesis, ch. 1, verses 17-19.

Epistemic (Knowledge) Focus

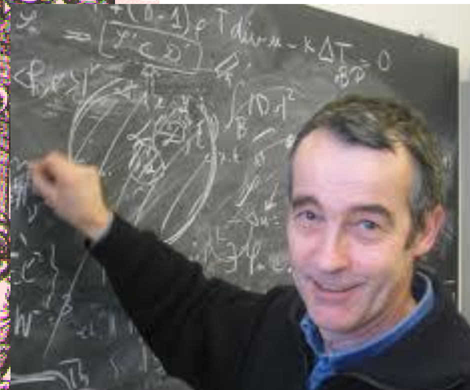
Panel 3	Mathematics 2010 (N=171/2991)		English 2010 (N=180/3247)		
N=351 (lessons) N=6238 (phases)	Fraction of lessons with at least one occurrence	Fraction of phases per lesson	Fraction of lessons with at least one occurrence	Fraction of phases per lesson	Effect Size: Cohen's h
Factual Knowledge	0.95	**0.41**	0.88	**0.63**	.44
Procedural Knowledge	0.99	**0.80**	0.87	**0.57**	.50
Conceptual Knowledge	0.85	**0.27**	0.26	**0.06**	.60
Epistemic Knowledge	0.27	**0.05**	0.09	**0.02**	.17
Rhetorical knowledge	0.35	**0.04**	0.29	**0.12**	.30
Hermeneutical Knowledge	--	**--**	0.14	**0.08**	.57
Metacognitive knowledge.	0.19	**0.03**	0.10	**0.02**	.06

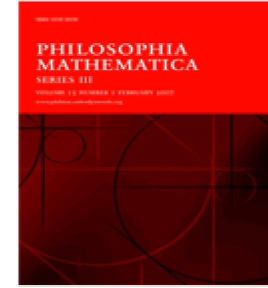


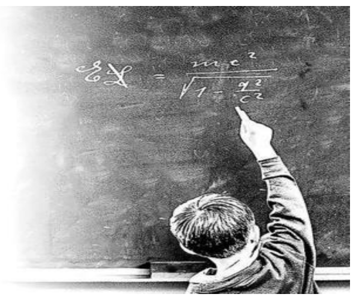
Epistemic Focus - S3 Mathematics
% of Occurrences
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Phases
Factual
Procedural
Conceptual
Epistemic
Rhetorical
Metacognitive


Epistemic Focus - S3 English
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
% of Occurrences
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Phases
Factual
Procedural
Conceptual
Epistemic
Rhetorical
Metacognitive
Hermeneutical
Moral & Civic
Aesthetics

Epistemic Practices: Mathematics

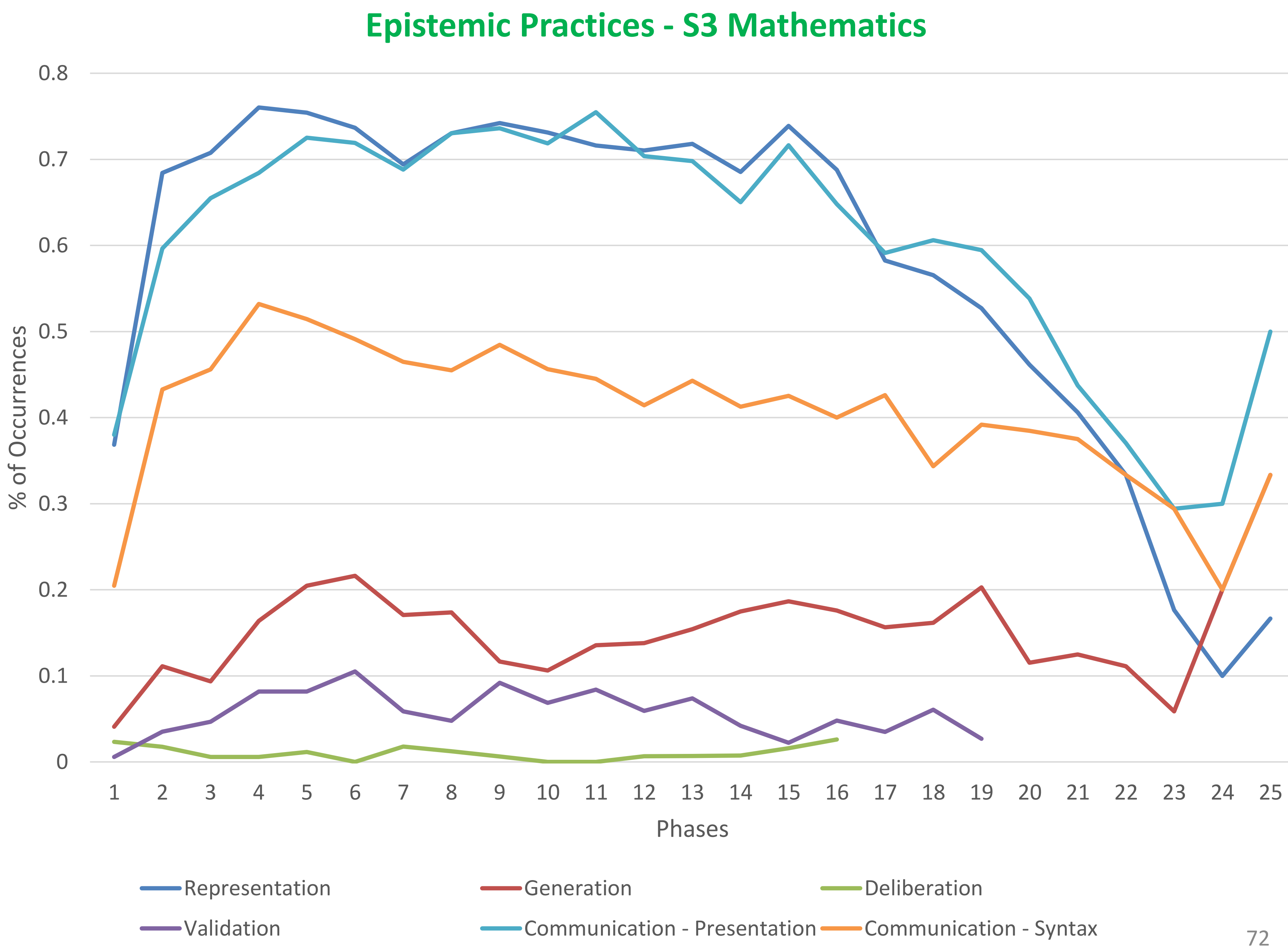




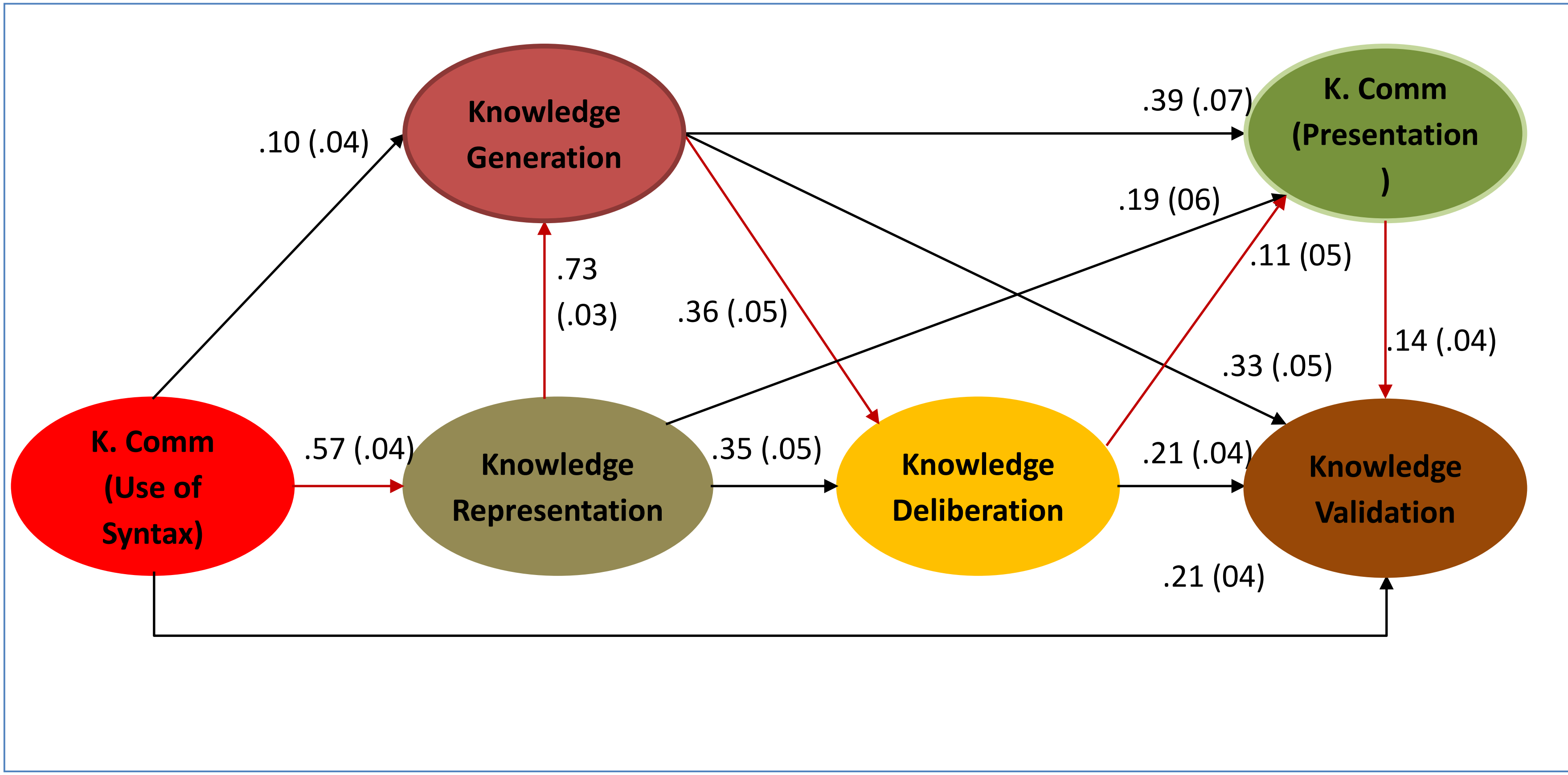


2.2. Epistemic Agency: Knowledge Practices, Sec 3 Mathematics

Panel 3	Sec 3 Mathematics 2010 (N=171/2991)	
N=351 (lessons) N=6238 (phases)	% lessons with at least one occurrence	% phases per lesson
Knowledge Communication (Syntax)	0.85	**0.42**
Knowledge Representation	0.94	**0.66**
Knowledge Generation	0.58	0.14
Knowledge Deliberation	0.10	0.01
Knowledge Justification	0.39	0.06
Knowledge Communication (Presentation)	0.96	**0.65**


Epistemic Practices - S3 Mathematics
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
% of Occurrences
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Phases
Representation
Generation
Deliberation
Validation
Communication - Presentation
Communication - Syntax

L1 Path Model of Disciplinary Knowledge Practices: Secondary 3 Mathematics

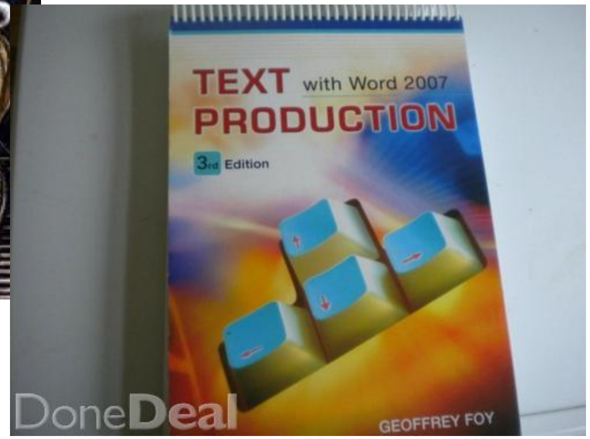


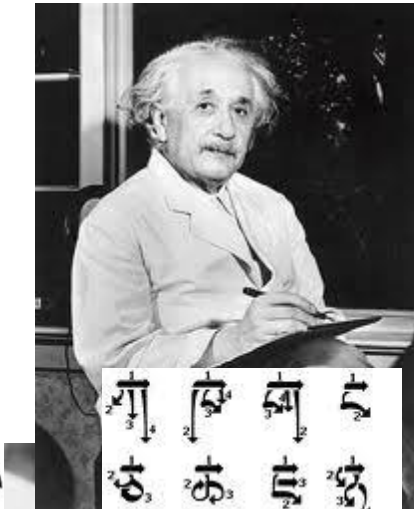
Note 1: This SEM model was constructed using composite unstandardized latent construct values rather than measurement values

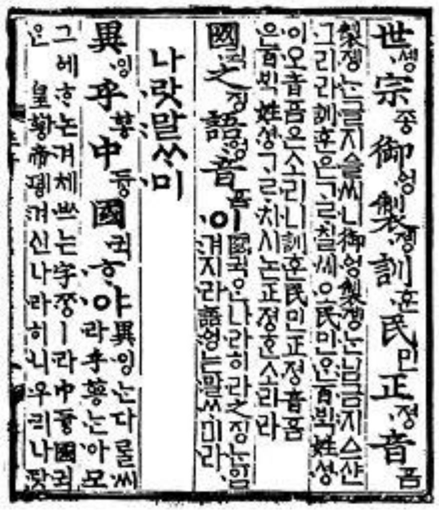
Goodness-of-fit statistics:	Scale	Mean	SD	
(N=1166)		K. Com (Syntax)	3.66	.806
Chi-Square / df / p-value	3.392 / 3 / .3350	K. Representation	3.12	.756
CFI / TLI	.997 / .988	K. Generation	3.10	.710
RMSEA (90% CI) / SRMR	.011 (.000-.052) / .006	K. Deliberation	3.14	.840
		K. Com (Presentation)	2.87	.791
		K. Validation	3.16	.846

Note 2: Values on the left represent unstandardized estimates significant at *p*<.01. Values on the right are standard errors.

Epistemic Practices: English

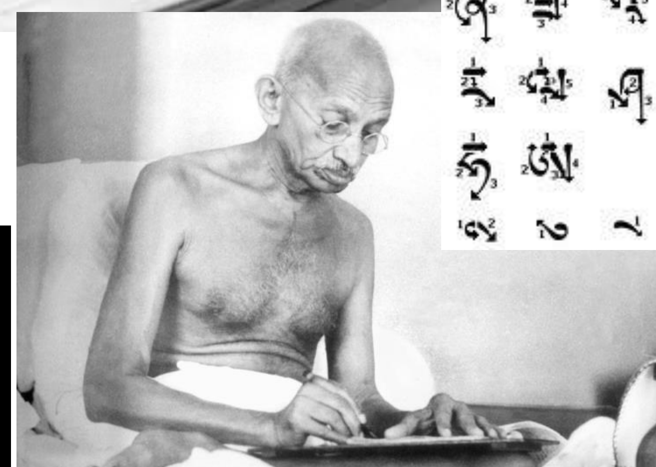





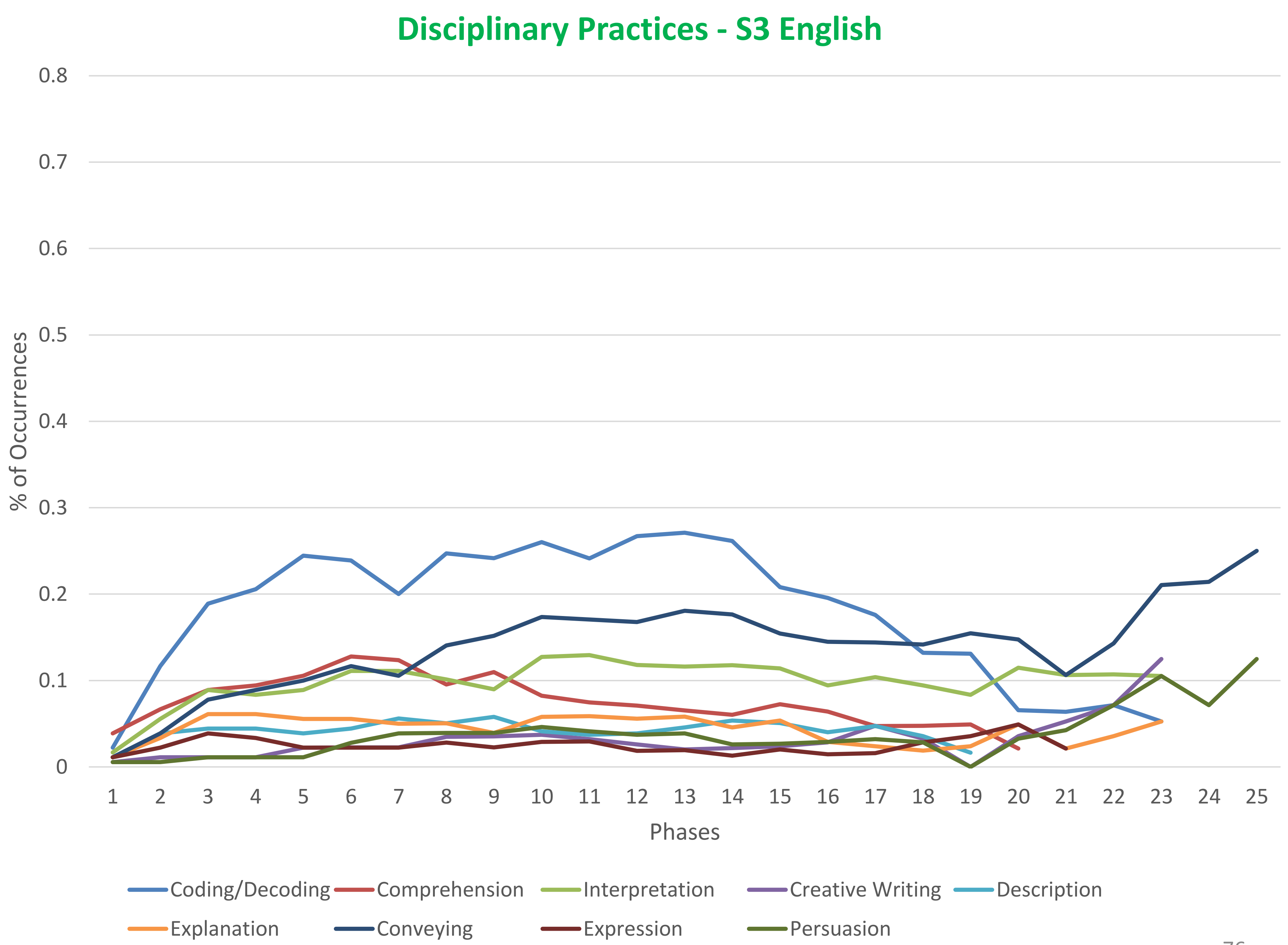






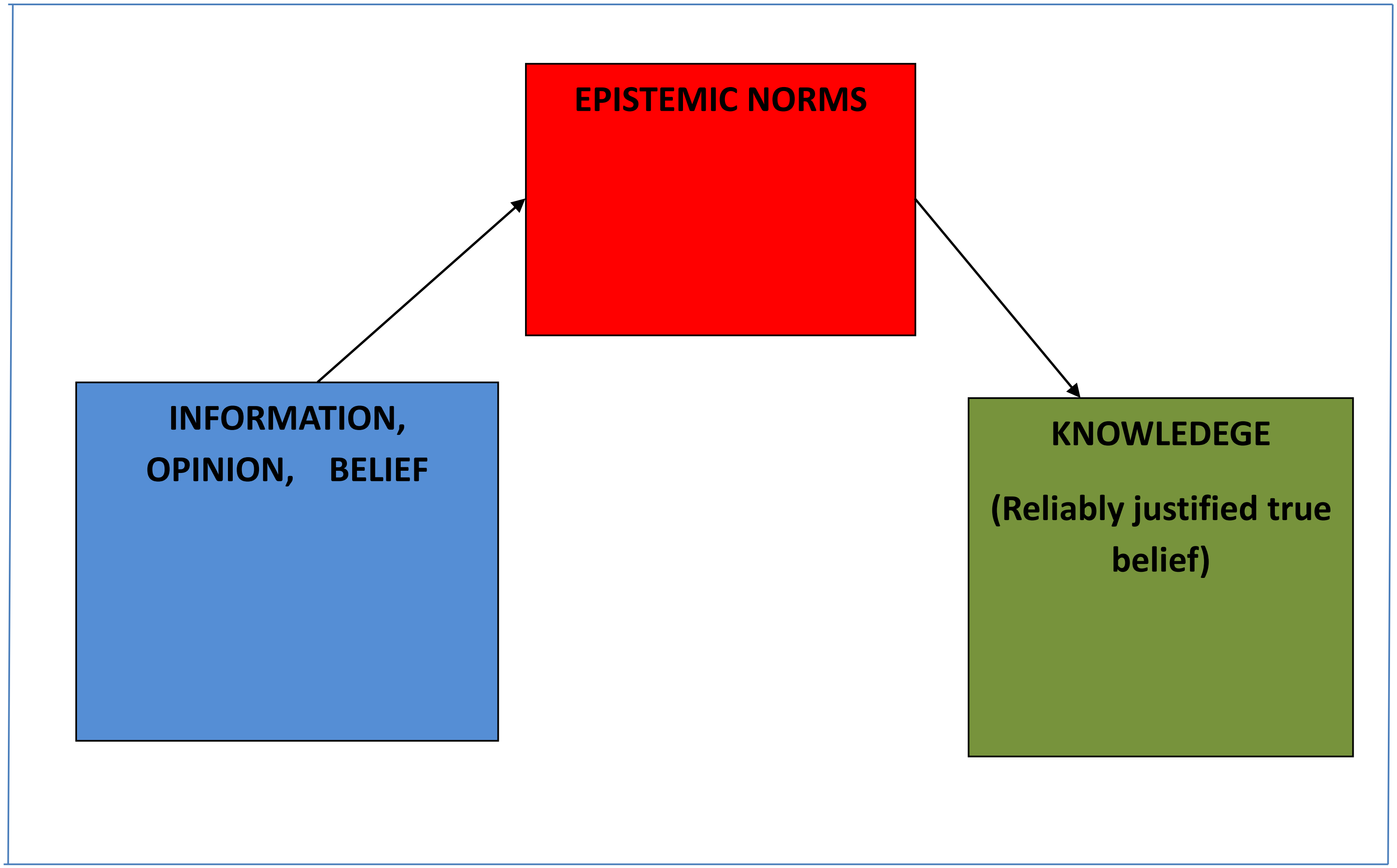
English Knowledge Practices (PANEL 3)	% lessons with at least one occurrence	% phases per lesson
Hermeneutical Practices	**.33**	**.12**
Coding/Decoding Activity	0.51	0.19
Comprehension Activity	0.20	0.08
Interpretation and Meaning Making Activity	0.27	0.10
Text Production Practices	**.11**	**.05**
Creative Writing Activity	0.06	0.02
Description Activity	0.08	0.04
Explanation Activity	0.09	0.05
Conveying Activity	0.28	0.13
Expression Activity	0.06	0.03
Persuasion Activity	.006	0.03


Disciplinary Practices - S3 English
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
% of Occurrences
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Phases
Coding/Decoding
Comprehension
Interpretation
Creative Writing
Description
Explanation
Conveying
Expression
Persuasion

Epistemic Norms: Locus of Epistemic Authority

	Secondary 3 Mathematics		Secondary 3 English		Effect Size
Locus of Epistemic Authority	% units with at least one occurrence	% Phases per unit of work	% units with at least one occurrence	% Phases per unit of work	*Cohen's h*: *% phases per unit*
Textbook	0.19	0.01	0.09	0.01	*.00*
Other printed materials	0.10	0.01	0.09	0.00	*.20*
Digital Tool	0.32	0.03	0.12	0.01	*.15*
Teacher's word	**1.00**	**0.93**	**1.00**	**0.90**	***.11***
Appeal to secular or religious authority	0.00	0.00	0.12	0.01	*.20*
Appeal to evidence	0.03	0.00	0.12	0.01	*.20*
Appeal to domain-specific knowledge	**0.48**	**0.08**	**0.18**	**0.01**	***.37***
Opinion by student, group or class	0.16	0.00	0.09	0.01	*.20*
Judgment by student, group or class	0.06	0.00	0.09	0.00	*.00*

Epistemic Norms:
Mediation of Information and Knowledge



Epistemic Norms: Epistemic Pluralism

	Mathematics 2010 (N=171/2991)		English 2010 (N=180/3247)		Effect Size: *Cohen's h*
N=351 (lessons) N=6238 (phases)	% lessons with at least one occurrence	% phases per lesson	% lessons with at least one occurrence	% phases per lesson	*% phases per lesson*
Knowledge as Truth	**0.98**	**0.88**	**0.98**	**0.89**	***.03***
Knowledge as a Contestable Claim.	.02	**.12**	.02	**.11**	***.00***
Knowledge Claim Supported by Reasons	0.17	**0.03**	0.04	**0.01**	*.15*
Knowledge Critique	0.04	**0.00**	0.03	**0.01**	*.20*
Comparing and Contrasting Information / Knowledge.	0.01	**0.00**	0.01	**0.01**	*.20*
Collective Deliberation	0.01	**0.00**	0.01	**0.00**	*.00*

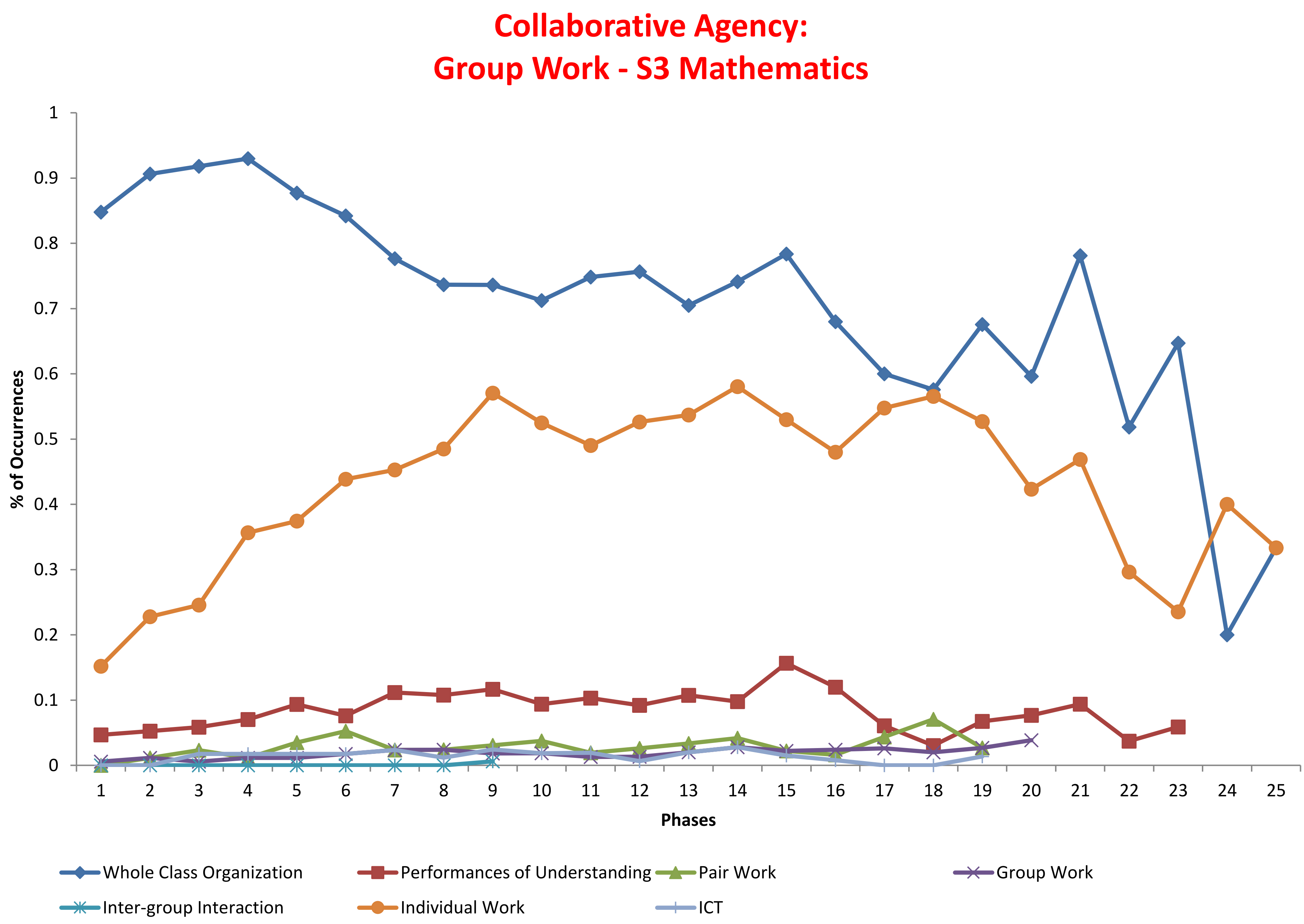
Collaborative Agency

Mean Occurrence per Lesson of Pair/Group Work Activities By Subject/Level

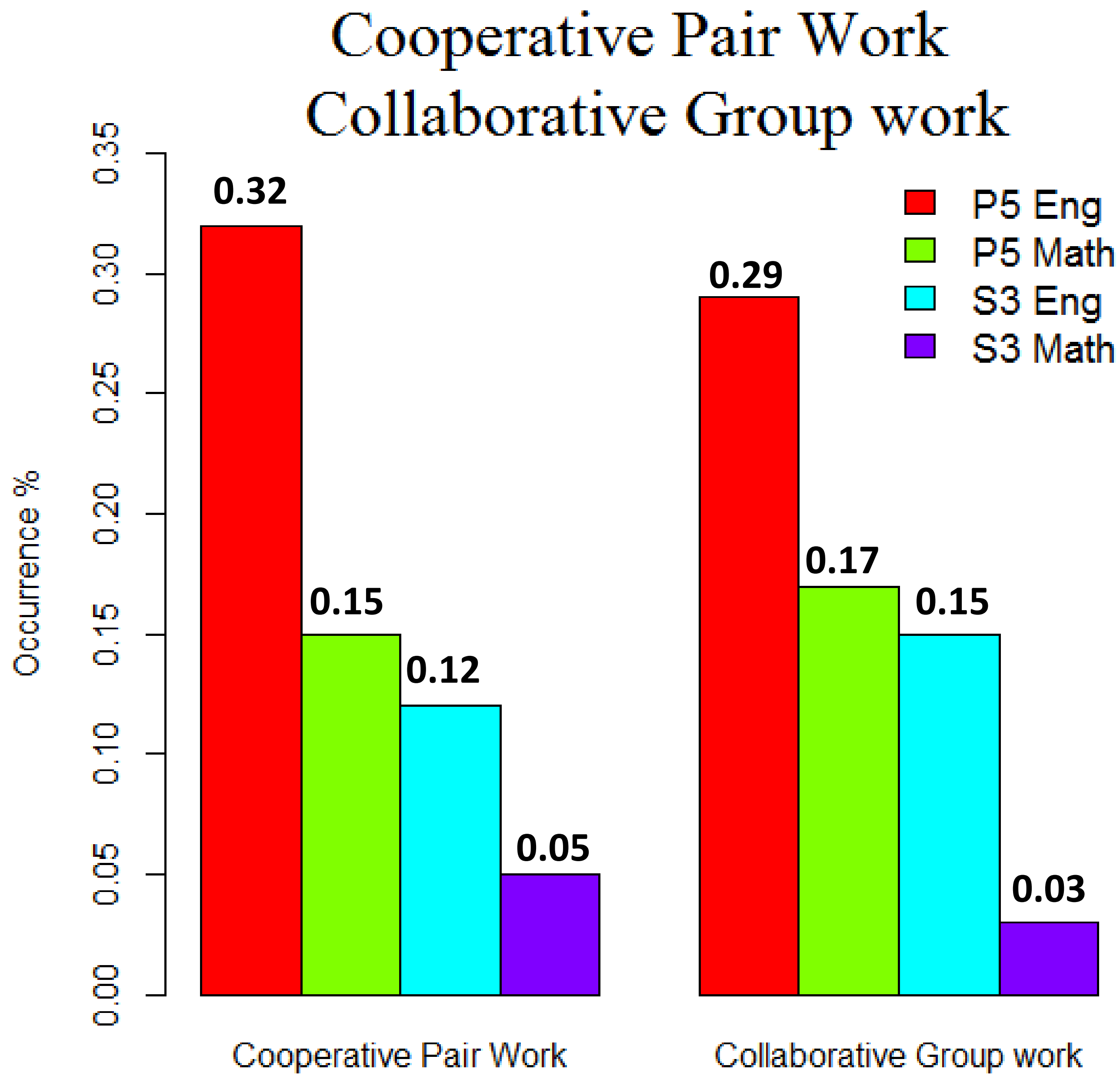
Pair/Group Work	P5 English % of phases per lesson	P5 Math % of phases per lesson	S3 English % of phases per lesson	S3 Math % of phases per lesson
Independent Pair Work	0.8	1.7	1.5	0.5
Cooperative Pair Work	6.7	2.9	2.6	1.3
Student Self-Initiated Pair/Group Work	2.0	0.6	0.5	0.8
Pseudo Group/Pair Work	1.4	0.9	1.9	0.8
Unstructured Group Work	7.2	4.1	8.5	0.6
Collaborative Group Work	5.3 (1 phase per lesson)	3.7 (< 1 phase per lesson)	5.0 (1 phase per lesson)	0.4 (1 every 25 lessons)

Summary of Learning Activities

	Sec 3 Mathematics		Sec 3 English		
	% lessons with at least one occurrence	% phases per lesson	% lessons with at least one occurrence	% phases per lesson	*Cohen's h % phases per lesson*
Whole Class Activities	0.51	**0.31**	0.53	**0.28**	*.14*
Pair or Group Work	0.12	**0.02**	0.18	**0.06**	*.33*
Reading Activities	0.13	**0.02**	0.22	**0.04**	*.23*
Drill and Practice	0.43	**0.19**	0.33	**0.16**	*.16*
Seeking New Information	0.01	**0.01**	0.02	**0.01**	*.00*
Performances of Understanding & Assessment Activities	0.07	**0.01**	0.05	**0.01**	*.17*



Collaborative Agency:
Group Work - S3 Mathematics
% of Occurrences
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Phases
Whole Class Organization
Performances of Understanding
Pair Work
Group Work
Inter-group Interaction
Individual Work
ICT



Cooperative pair work: Students work together on a task to achieve a shared, common solution or outcome.
Collaborative group work: Students work together in a stepped and role-differentiated way towards the achievement of a common goal in a shared task.

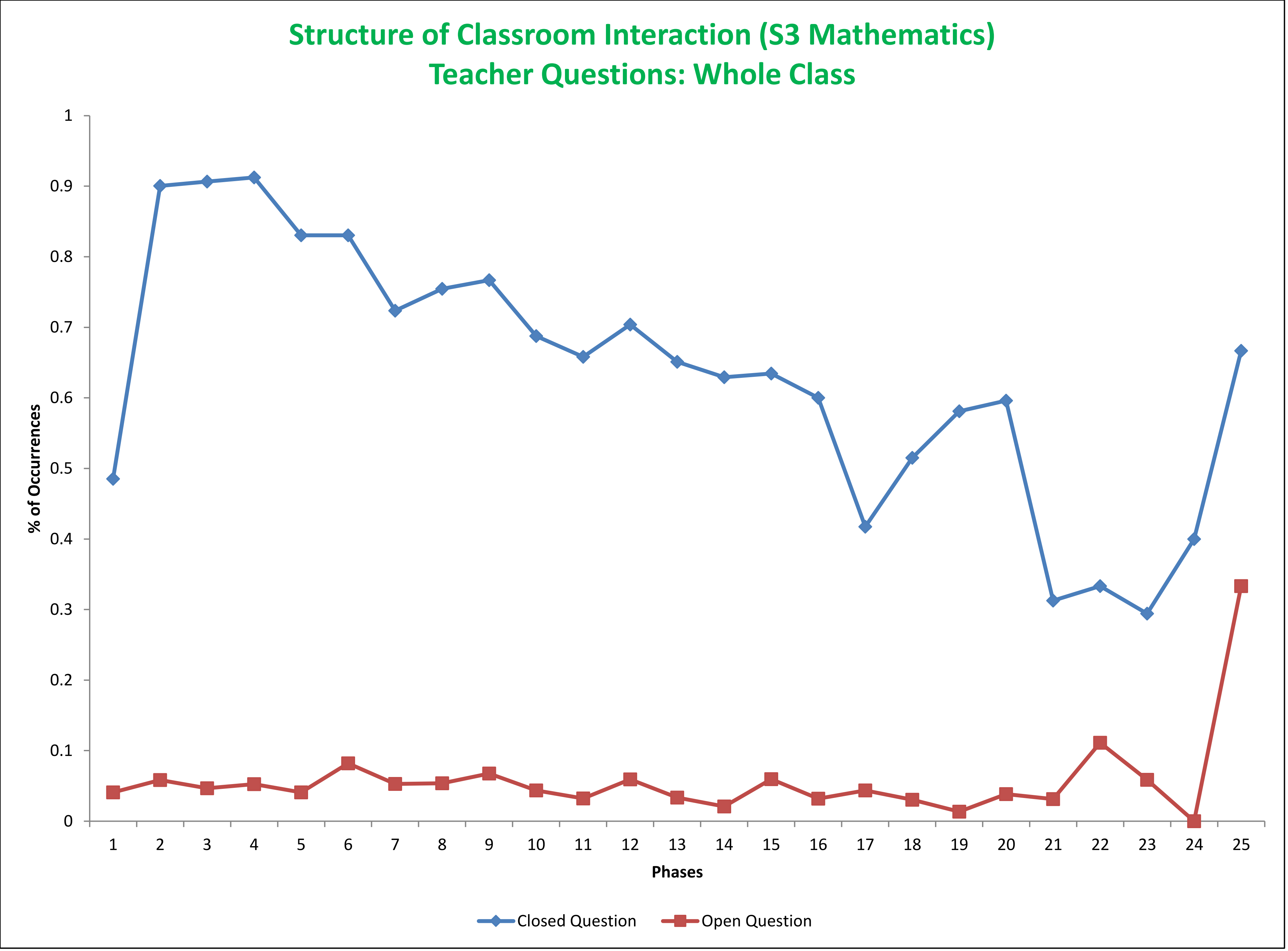
Discursive Agency:

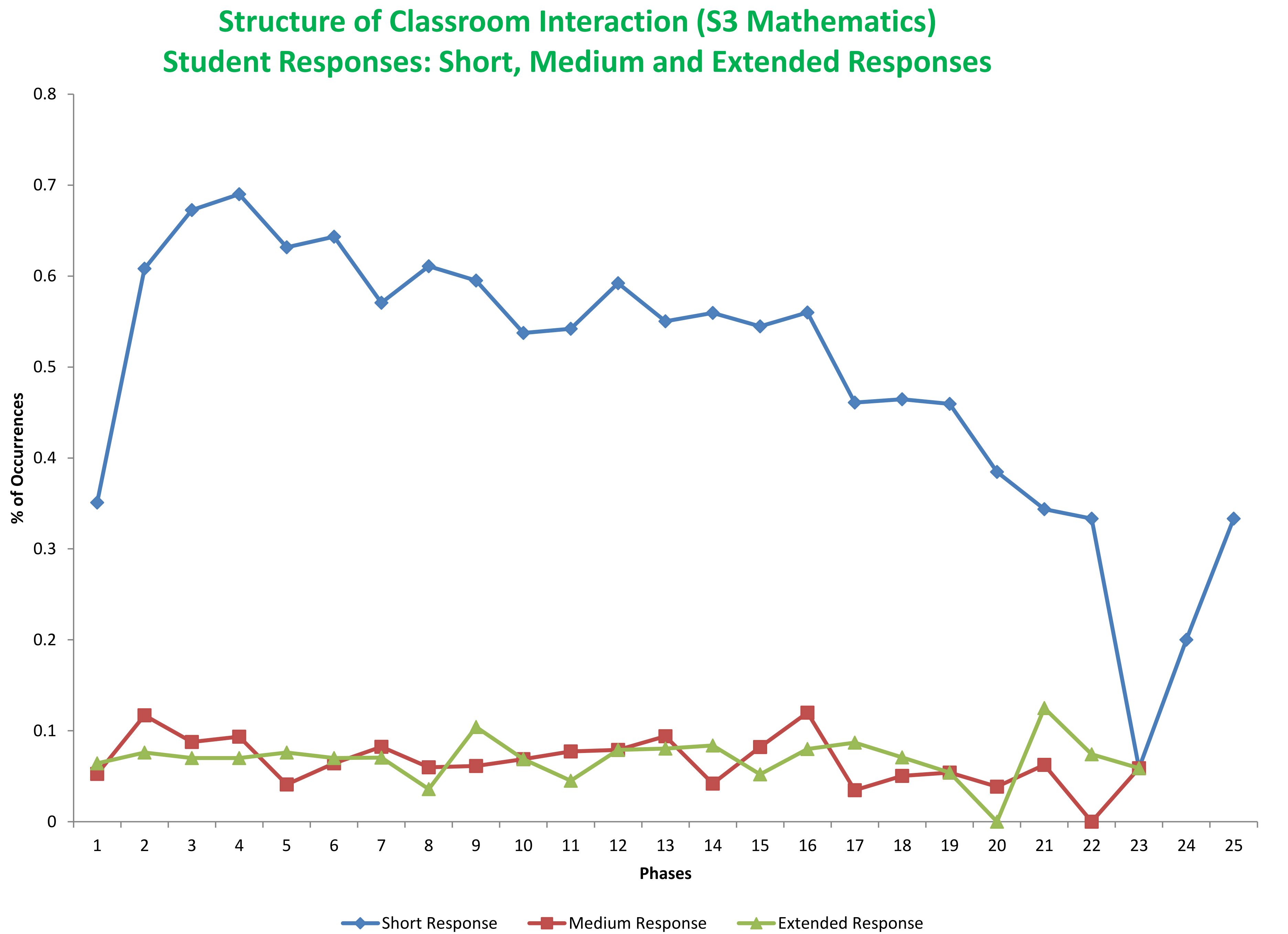
The Structure of Classroom Interaction
Epistemic Talk
Epistemic Pluralism

Michel Montaigne

"Our tutors never stop bawling into our ears, as though they were pouring water into a funnel; and our task is only to repeat what has been told us I should like the tutor to correct this practice, and right from the start, according to the capacity of the mind he has in hand, to begin putting it through its paces, making it tastes things, choose them, and discern them by itself; sometimes clearing the way for him, sometimes letting him clear his own way. I don't want him to think and talk alone, I want him to listen to his pupil speaking in his turn. Socrates, and later Arcesilaus, first had their disciples speak, and then they spoke to them. *'The authority of those who teach is often an obstacle to those who want to learn'* [Cicero].

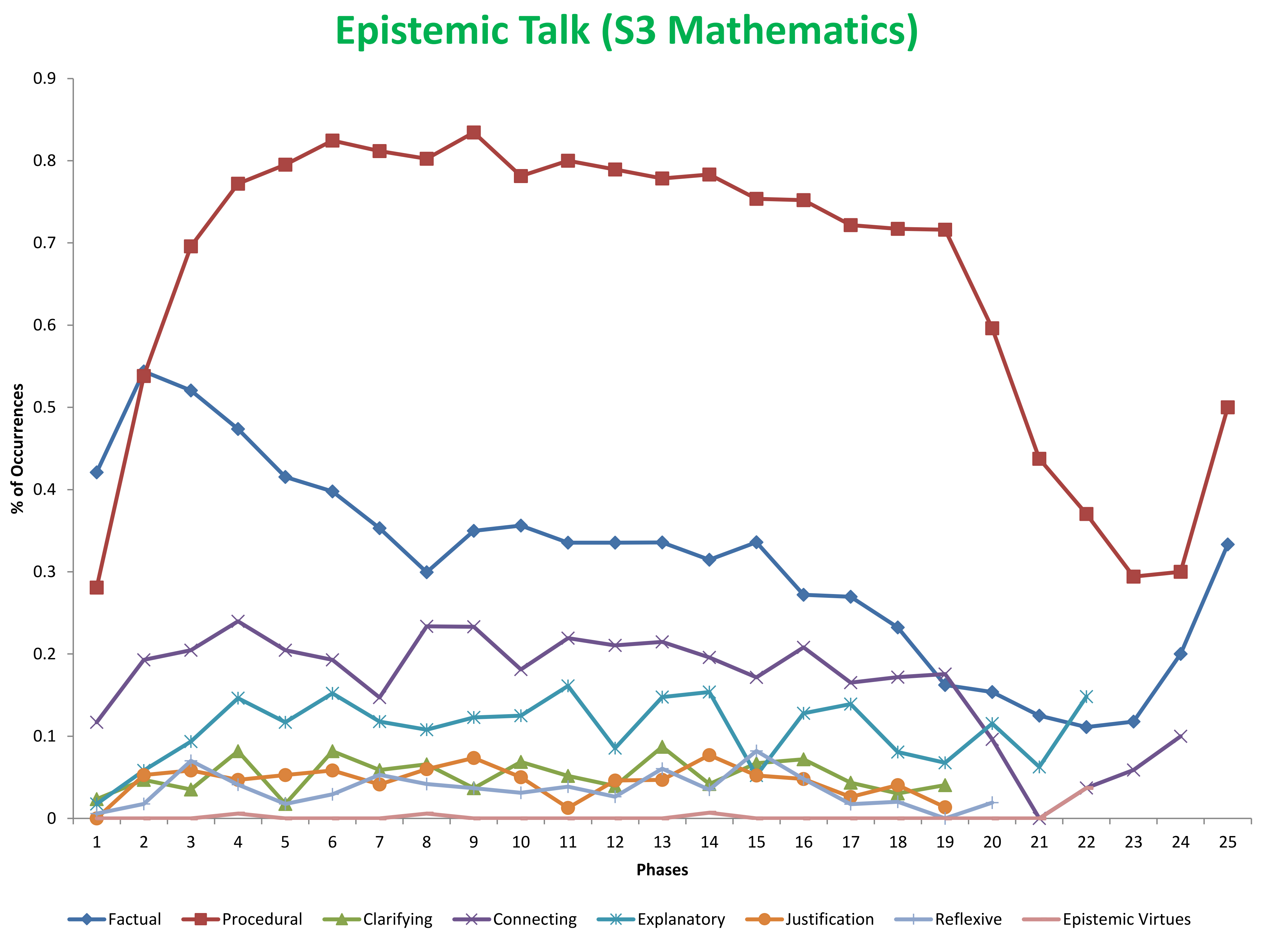
M. Montaigne, *Of the Education of Children* (1579). In *the Complete Essays of Montaigne*. Translated by D. Frame. Stanford: Stanford University Press, 1976, p. 110.


Structure of Classroom Interaction (S3 Mathematics)
Teacher Questions: Whole Class
% of Occurrences
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Phases
Closed Question
Open Question


Structure of Classroom Interaction (S3 Mathematics)
Student Responses: Short, Medium and Extended Responses
% of Occurrences
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Phases
Short Response
Medium Response
Extended Response

Mean and SD: Classroom Epistemic Talk (Panel 3)

	Secondary 3 Mathematics		Secondary 3 English		*Effect Size Cohen's h:*
	% lessons with at least one occurrence	% phases per lesson	% lessons with at least one occurrence	% phases per lesson	*% phases per lesson*
Epistemic Talk					
Factual Talk	0.96	**0.35**	0.87	**0.56**	*.42*
Procedural Talk	0.99	**0.72**	0.86	**0.51**	*.44*
Clarifying Talk	0.38	**0.05**	0.31	**0.04**	*.05*
Connecting Talk	0.61	**0.16**	0.51	**0.11**	*.15*
Temporal Connections	0.43	**0.08**	0.31	**0.03**	*.23*
Conceptual Connections	0.47	**0.07**	0.35	**0.07**	*.00*
Framing Talk	0.17	**0.02**	0.13	**0.01**	*.08*
Reframing Talk	0.12	**0.01**	0.06	**0.01**	*.00*
Explanatory Talk	0.12	**0.01**	0.06	**0.01**	*.00*
Epistemic Justification Talk	0.52	**0.11**	0.27	**0.07**	*.14*
Reflexive Talk	0.24	**0.04**	0.03	**0.00**	*.40*
Epistemic Virtues Talk	0.02	**0.00**	0.01	**0.00**	*.00*



Epistemic Talk (S3 Mathematics)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
% of Occurrences
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Phases
Factual
Procedural
Clarifying
Connecting
Explanatory
Justification
Reflexive
Epistemic Virtues

Instructional Strategies

Key Finding 3.

The instructional strategies that teachers employ in Singapore draw on multiple theoretical and cultural traditions

Found evidence of four “**generic” instructional strategies**

- traditional instruction
- direct instruction
- teaching for understanding
- co-regulated learning strategies

Correlations between the four sets of strategies very high in the aggregate and at the classroom level. Underscores the non-sectarian **hybridity** of instructional practice in Singapore

- complementary rather than completive a
- employed on a fit-for-purpose basis.

In addition, teachers employ a range of specific “**high leverage**” instructional practices, but these generally support a knowledge transmission pedagogy rather than a knowledge building pedagogy

Generic Instructional Strategies: Mean Scores/SD

Panel 2 Student Survey	Secondary 3 Mathematics			Secondary 3 English		*Effect Size*
	Mean (1-5)	SD		Mean (1-5)	SD	*Cohen's d*
Traditional Instruction (Exam Prep, textbooks, worksheets, memorization, drill)	**3.69**	.642		**3.45**	.669	*.37*
Direct Instruction (practice, revision, structure and clarity, maximum learning time, frequency of questioning)	**3.67**	.670		**3.61**	.655	*.09*
Teaching for Understanding (monitoring, feedback, flexible teaching, focus on understanding, engaging students)	**3.38**	.602		**3.43**	.564	*.09*
Co-regulated Learning Strategies	**3.01**	.770		**3.28**	.688	*.37*

Instructional Hybridity: Correlations of Instructional Strategies (Secondary 3, 2010)

	TI	DI	TfU	CRLS
Mathematics				
Traditional Instruction	1			
Direct Instruction	.72**	1		
Teaching for Understanding	.58**	.70**	1	
Co-regulated Learning Strategies	.28**	.35**	.73**	1
English				
Traditional Instruction	1			
Direct Instruction	.75**	1		
Teaching for Understanding	.63**	.68**	1	
Co-regulated Learning Strategies	.41**	.39**	.77**	1

Evidence of Teaching for Understanding / Knowledge Building

	Sec 3 Mathematics 2010		Sec 3 English 2010		
	Mean (1-5)	Std. Deviation	Mean (1-5)	Std. Deviation	*d*
N	1166		1027		
Teaching for Understanding Scale	***3.38***	***.602***	***3.43***	***.564***	***.09***
Collective Feedback	3.59	.805	3.58	.766	*.01*
Communicating Learning Goals and Performance Standards	3.57	.771	3.55	.681	*.03*
Flexible Teaching	3.57	.873	3.47	.829	*.12*
Monitoring student learning	3.46	.801	3.48	.724	*.03*
Personal Feedback	3.43	.829	3.47	.838	*.05*
Focus on Learning	3.36	.710	3.43	.704	*.10*
Quality of Questioning	3.34	.790	3.41	.733	*.09*
Engaging Students: Curiosity and Interest	3.25	.898	3.33	.894	*.09*
Whole Class Discussion	2.97	1.040	3.21	.929	*.24*
Collaborative Group Work	2.87	.962	3.28	.831	*.46*

High Leverage Instructional Strategies in Singapore

Criteria	Measured Standard
Checking for Prior Relevant Knowledge	Low
Communicating Learning Goals	Low
Communicating Performance Standards	Low
Providing Exemplars of successful performance	Low
Monitoring student learning	
Summative	High
Formative	Low
Feedback	
Evaluative	High
Detailed descriptive	Low
Formative	Very Low
Learning Support (Scaffolding)	
Procedural	High
Logistical	Low
Strategic	Low
Extended, cumulative epistemic talk	Low

High Leverage Instructional Practices:
Checking for Prior Knowledge: Sec 3 Mathematics

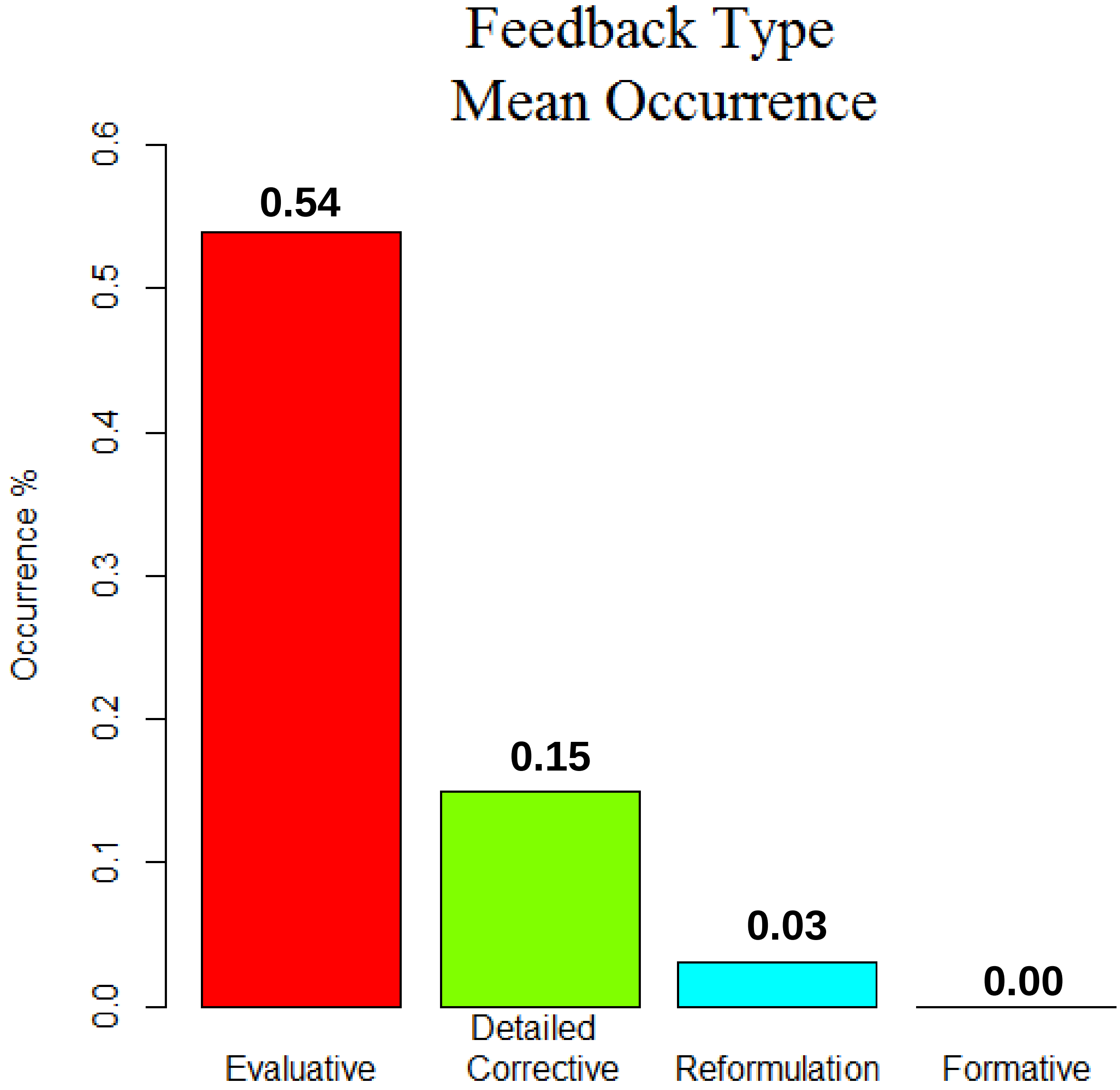
	Secondary 3 Mathematics			
	% lessons with at least one occurrence	% phases per lesson	% units with at least one occurrence	% phases per unit of work
Checking for Background Knowledge				
Checking for prior activities	0.58	**0.06**	0.90	0.06
Checking for prior specific content knowledge	0.67	**0.13**	0.94	0.13
Checking for prior relevant knowledge	0.12	**0.01**	0.48	0.01

Communicating Learning Goals and Performance Standards

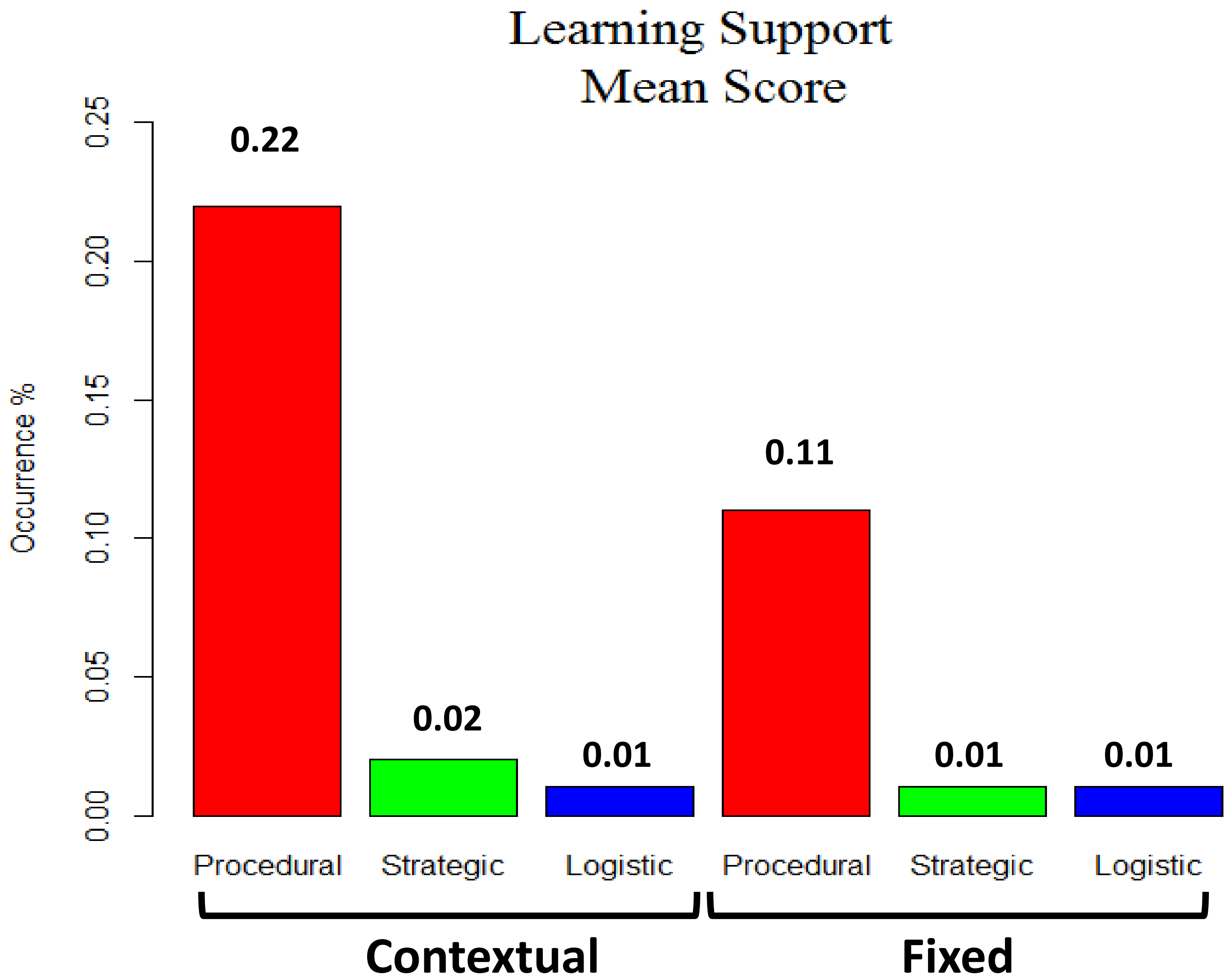
N=351 (lessons) N=6238 (phases)	Sec 3 Mathematics 2010 (N=171/2991)		Sec 3 English 2010 (N=180/3247)		
	Fraction of lessons with at least one occurrence	Fraction of phases per lesson	Fraction of lessons with at least one occurrence	Fraction of phases per lesson	*Effect Size: Cohen's h*
Communicating Learning Objectives	**0.14**	**0.02**	**0.12**	**0.01**	***.08***
Mention without detail	0.09	0.01	0.07	0.00	*.20*
Mention with minimal detail	0.11	0.01	0.11	0.01	*.00*
Mention with some detail	0.04	0.00	0.01	0.00	*.00*
Mention with substantial detail	0.00	0.00	0.01	0.00	*.00*
Communicating Performance Standards					
Explicit performance Standards	**0.42**	**0.08**	**0.16**	**0.03**	***.23***
Exemplars of Successful Performance (with degree of explanation)	0.76	0.28	0.17	0.02	*.83*
Whole Class Performances of Understanding (#3.6)	0.03	0.00	0.01	0.00	*0.00*

Co-regulated Learning Strategies

	Secondary 3 Mathematics		Secondary 3 English		
	Mean (1-5)	**Std. Deviation**	**Mean (1-5)**	**Std. Deviation**	***d***
Co-Regulated Learning Strategies (Alpha=.918, .920)	**3.01**	**.770**	**3.28**	**.688**	***.37***
Self-Directed Learning	3.41	.794	3.45	.747	*.05*
Self-Assessment*	2.92	.907	3.20	.782	*.33*
Peer Assessment*	2.80	.945	3.23	.802	*.49*

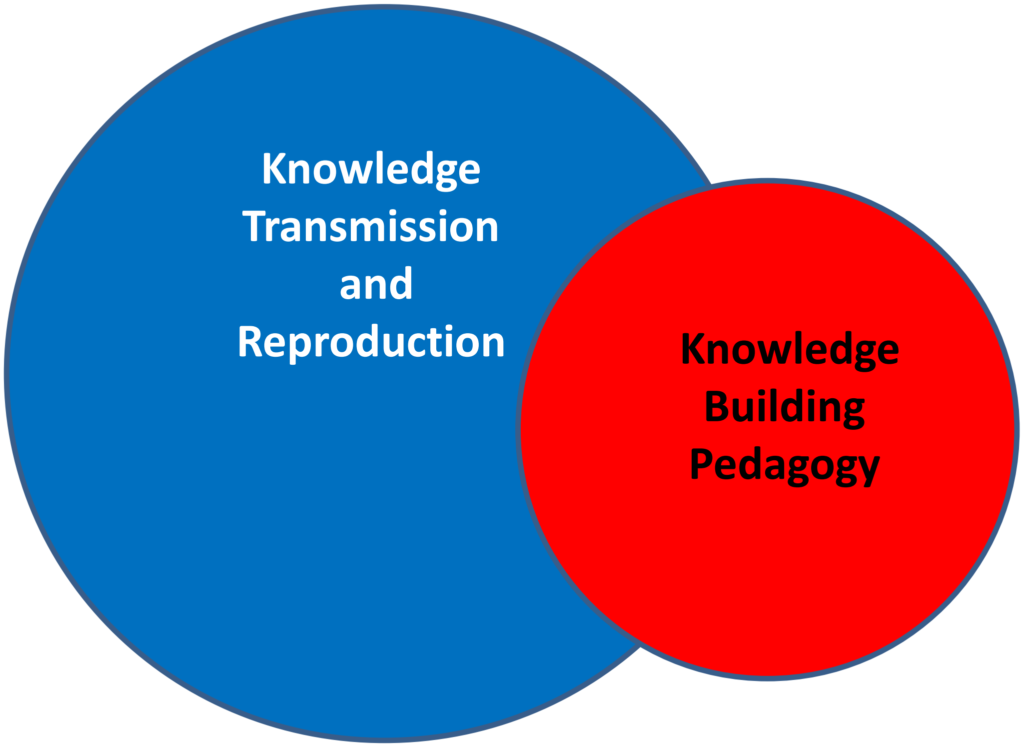

Feedback Type
Mean Occurrence
Occurrence %
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.54
0.15
0.03
0.00
Evaluative
Detailed Corrective
Reformulation
Formative

High Leverage Instructional Practices: Learning Support (S3/P4)



In Sum

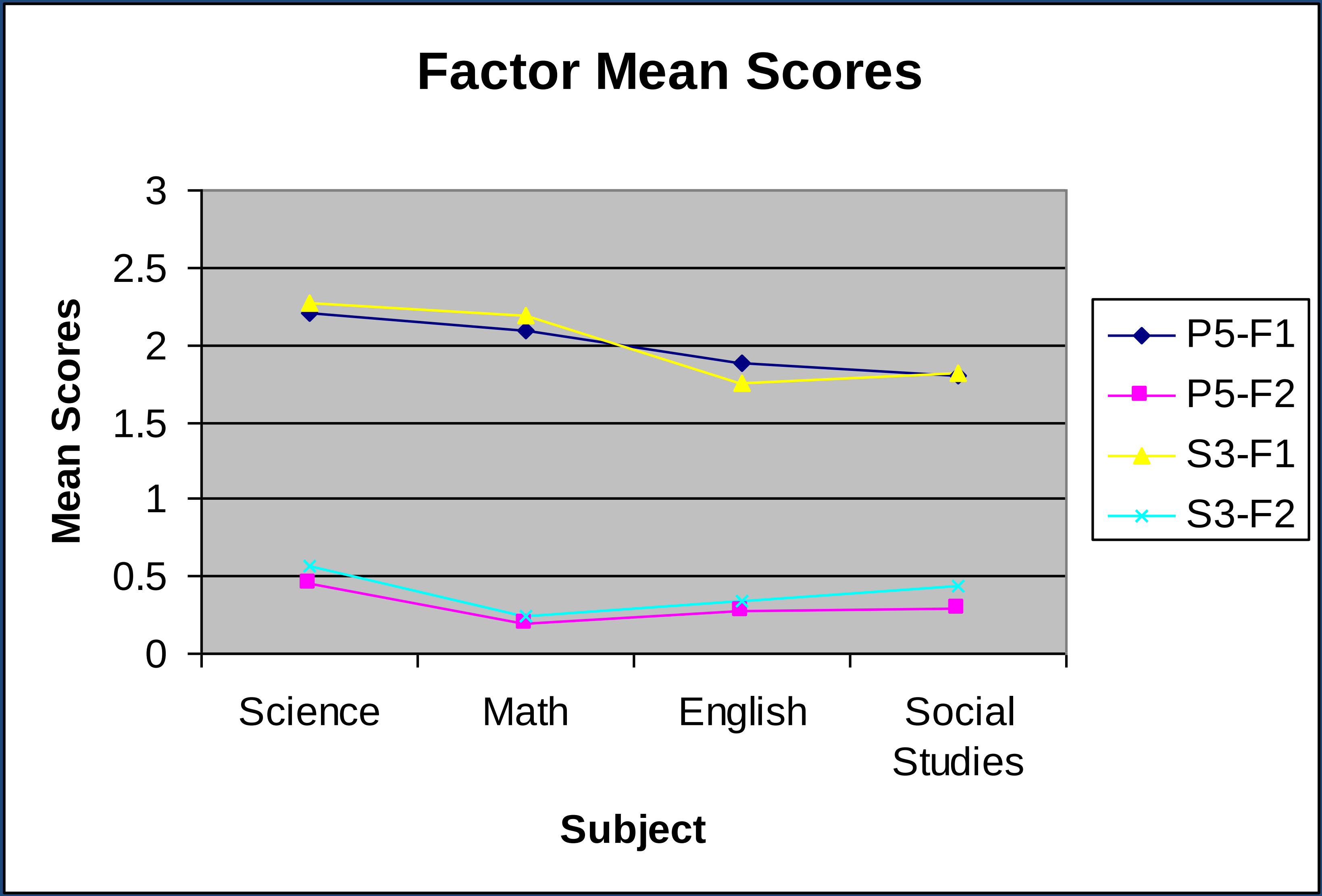
In sum: Singapore delivers a performative pedagogy that is pragmatic, fit-for-purpose, instrumental, hybridic and sharply focused on preparing students for local and international assessments



Percentage of Performative and Knowledge Building Tasks in Sec 3 Mathematics (Panel 3 Classroom Observation Data)

	N	%
Knowledge Transmission Tasks	**2,305**	**77.3%**
Remembering Tasks	409	13.7
Routine Procedural Practice Activities	1,044	35.0
Repetition	55	1.9
Review	767	25.7
Revision	30	1.0
Knowledge Building Tasks	**676**	**22.7%**
Comprehension/Knowledge Manipulation Tasks	**423**	**14.9**
Procedural Activities with Connections	**227**	**7.6**
Doing Mathematics	**26**	**0.9**
Total	**2,981**	**100%**

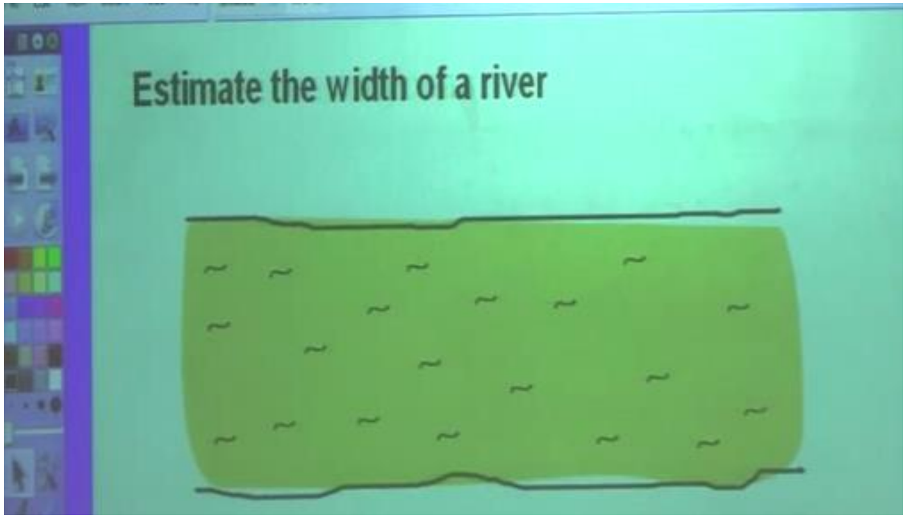
Core 1:
Subject and level differences in enacted curriculum

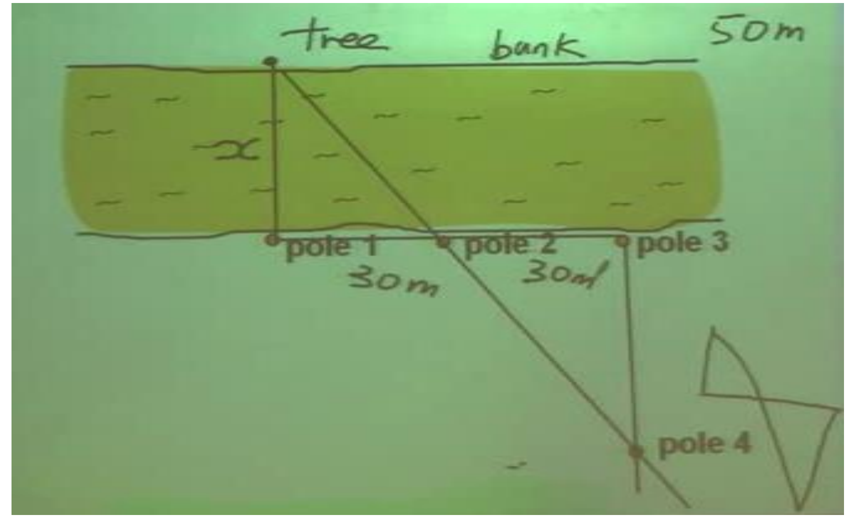


F1: Basic Knowledge Transmission

F2: Complex Knowledge Construction

Example of a 'Doing Mathematics' Activity





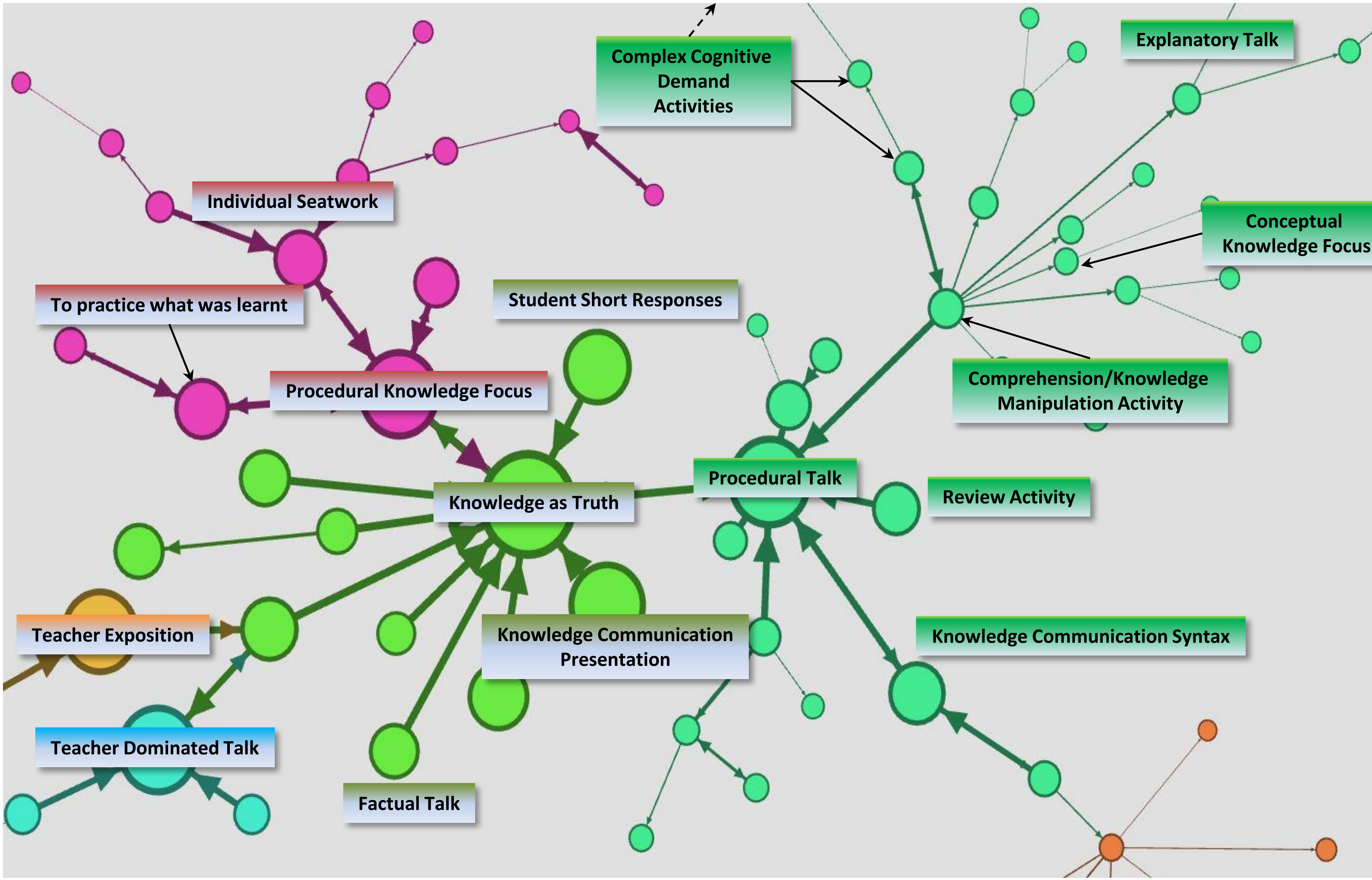
- Prior Knowledge: Students had just learned the concepts of congruent and similar triangles
- Task for students is to estimate the width of a river without swimming across the river as they are on one side of the river. They are given four poles (but not to be extended across the river)
- Requires students to apply knowledge of congruency/similarity to a 'real'life' context, use complex non-algorithmic thinking to solve the task
- There is no predictable, well-rehearsed approach or pathway explicitly suggested by the task
- Opportunity to engage students in discussion about possible approaches
- Although teacher wanted to use the idea of similar triangles, a student suggested using congruent triangles as depicted in the diagram on the right

Mathematics KB Task

"*Teaching and learning in the disciplines, then, involves students in doing the work of the discipline.* In ... mathematics, for example, ... students in DL classrooms ... are engaged in solving a cognitively challenging problem to understand the benefits of different cell phone calling plans by using mathematical habits of thinking such as drawing on prior knowledge, looking for patterns, conjecturing, and creating different representations of their solution paths – tables and equations, for instance – in purposeful ways. They propose and test ideas, tinker with calculations, try easier problems or known problems before trying the harder problem, and talk with others about their ideas, calculations, solutions, and misunderstandings. In order for this kind of disciplinary learning to occur, teachers structure and arrange students' participation through cognitively challenging tasks, carefully designed and sequenced, that reach across days and weeks of class time. Students' talk with each other to test their thinking, to share their analyses and explanations of data and sources, as well as each other's perspectives, conjectures, and interpretations, is at the heart of DL teaching and learning."

McConachie and Petrosky, *Content Matters*, 2010, p. x.

Secondary 3 Mathematics Graph: Performative Pedagogy



Network Analysis: Analytics

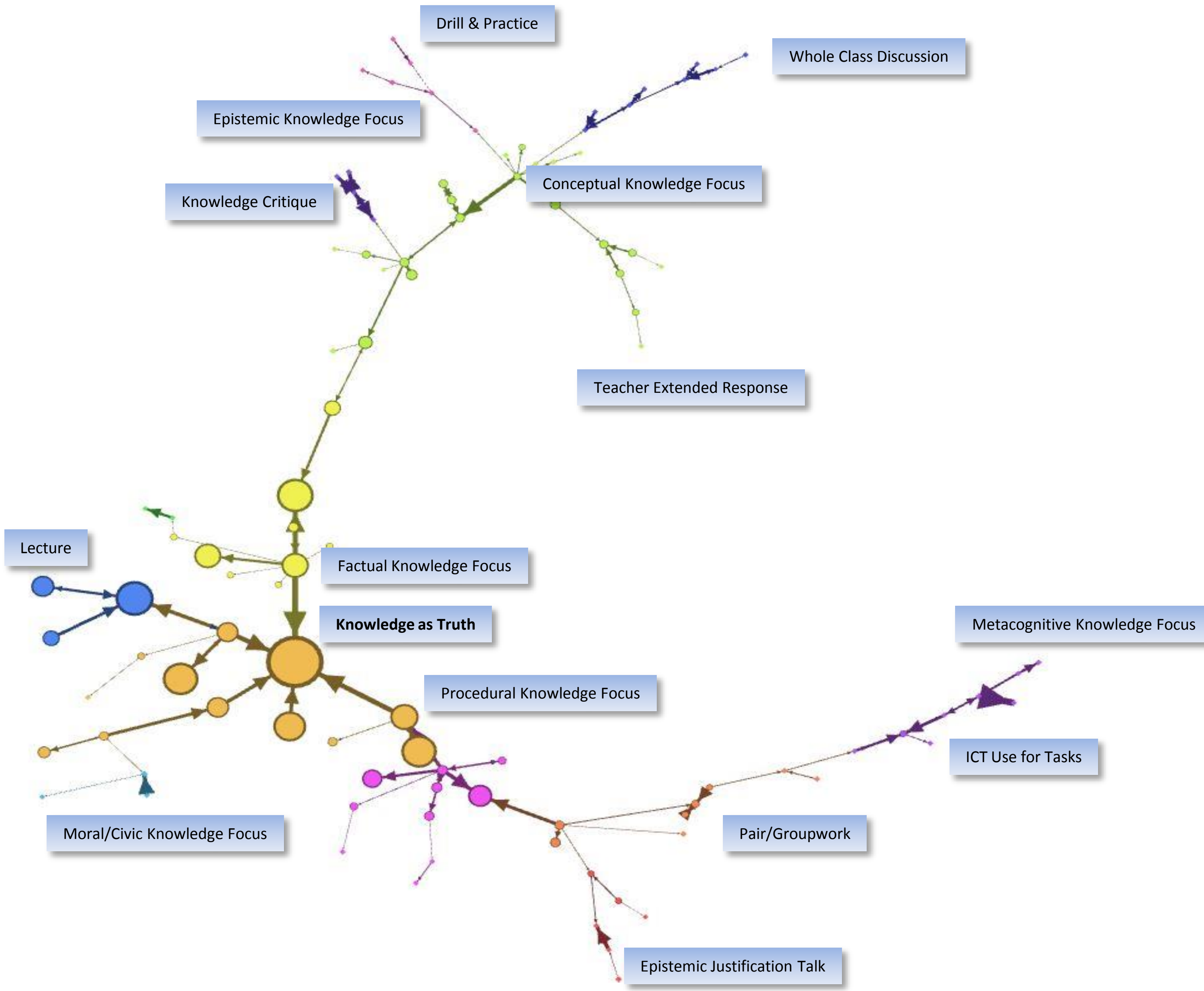
- The graphs are **transition networks** from a phase (t1) to t2…..tn.
- **Node sizes** are the relative occurrence frequency of the variable.
- **Thickness** indicates conditional probability of the target node occurring given that the source node occurs.
- **Distance** between nodes gives a rough idea of the causal relation between variables.
    - The further from the central node, the less likely that the ‘far reaches’ nodes have a strong causal relation to the central nodes.
- **Arrows** indicate the probability that if node A occurs, then node B (arrow pointed towards it) is likely to occur next.

Overview Graphs (Full Size)

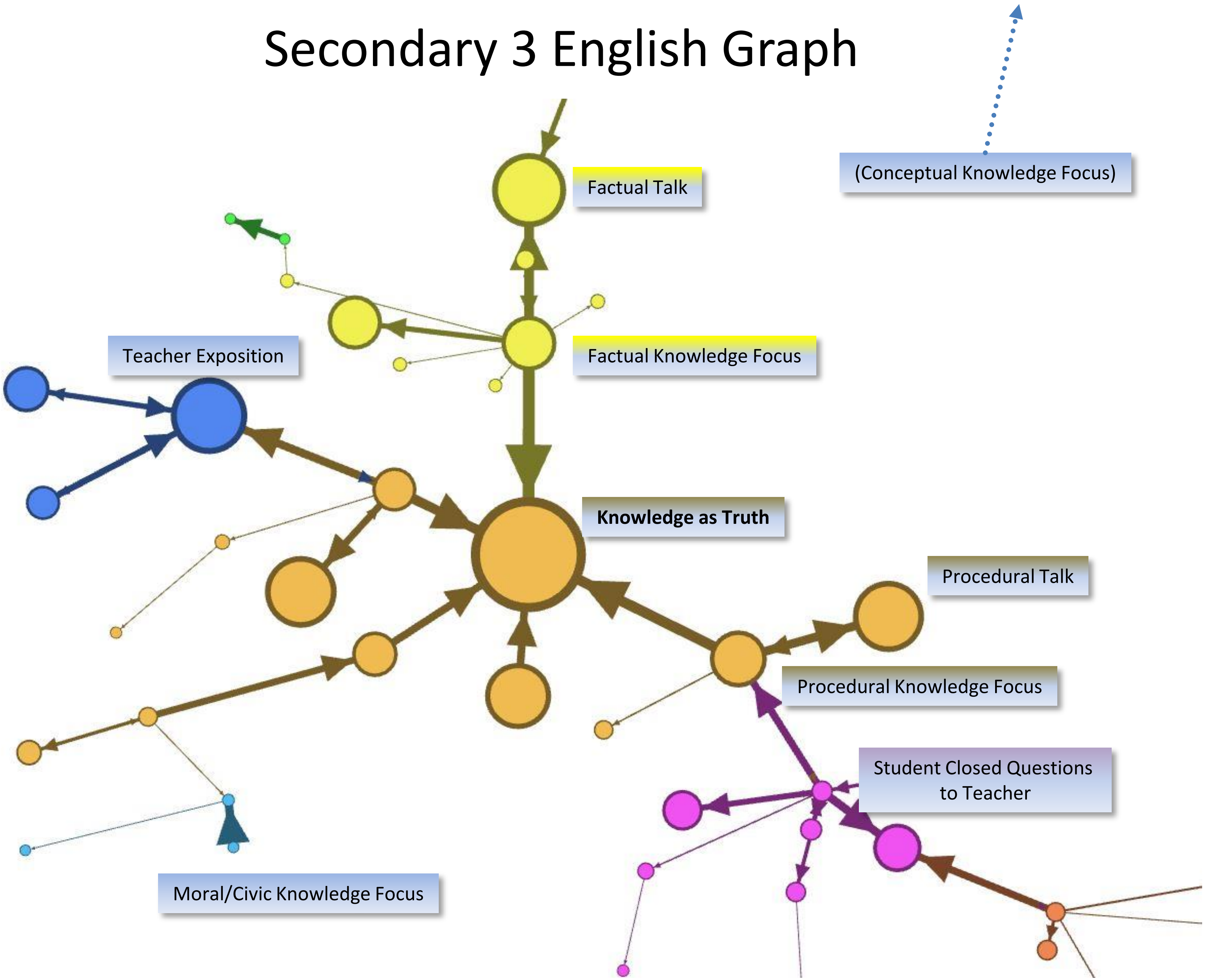
- Secondary 3 Overview Graph

S3 Graph

Secondary 3 English Graph: PP Tasks > KBP Tasks



Secondary 3 English Graph



4. Why Singaporean Teachers Teach This Way?

The (Institutional) Logic of Instructional Practice in Singapore.

Panel 2 Main Teacher Survey, Sept.-Oct 2010.

		Total	
Rank Order	*How important are the following influences on how you teach?*	Mean (1-5)	SD
1	The ability of students	4.02	.675
2	Your skills as a teacher	4.00	.651
3	Coverage of the curriculum/your department scheme of work	3.90	.710
4	National high stakes assessments	3.86	.835
5	Your views about the most effective way to teach in current circumstances	3.86	.700
6	The amount of effort students make	3.79	.775
7	Your views on how you would really like to teach	3.78	.714
8	Changes in the syllabus at the subject level	3.74	.752
9	Your professional development experiences	3.74	.708
10	The expectations of your school leaders	3.69	.780
11	Students' expectations	3.68	.709

Teaching to the Test

There's the syllabus and there's the exam. I feel a lot of the curriculum is controlled by the exam. I'm building the kids up to a last final outcome, with lots of practice and drill … Ultimately on paper, you have to have your exams and your tests. Making the link between school and real life? I think for our students that's not a salient incentive. You need to link it to the exams, right? That's the carrot that dangles. 'You learn this because exams are gonna have that.' For lots of our teenagers exams have become life. You can't draw the line, not in the Asian context, because it's very very obvious, you know.

Secondary 3 English Teacher, Singapore.

Why Do Teachers Teach This Way.

There's the syllabus and there's the exam. I feel a lot of the curriculum is controlled by the exam. I'm building the kids up to a last final outcome, with lots of practice and drill … Ultimately on paper, you have to have your exams and your tests. Making the link between school and real life? I think for our students that's not a salient incentive. You need to link it to the exams, right? That's the carrot that dangles. 'You learn this because exams are gonna have that.' For lots of our teenagers exams have become life. You can't draw the line, not in the Asian context, because it's very very obvious, you know.

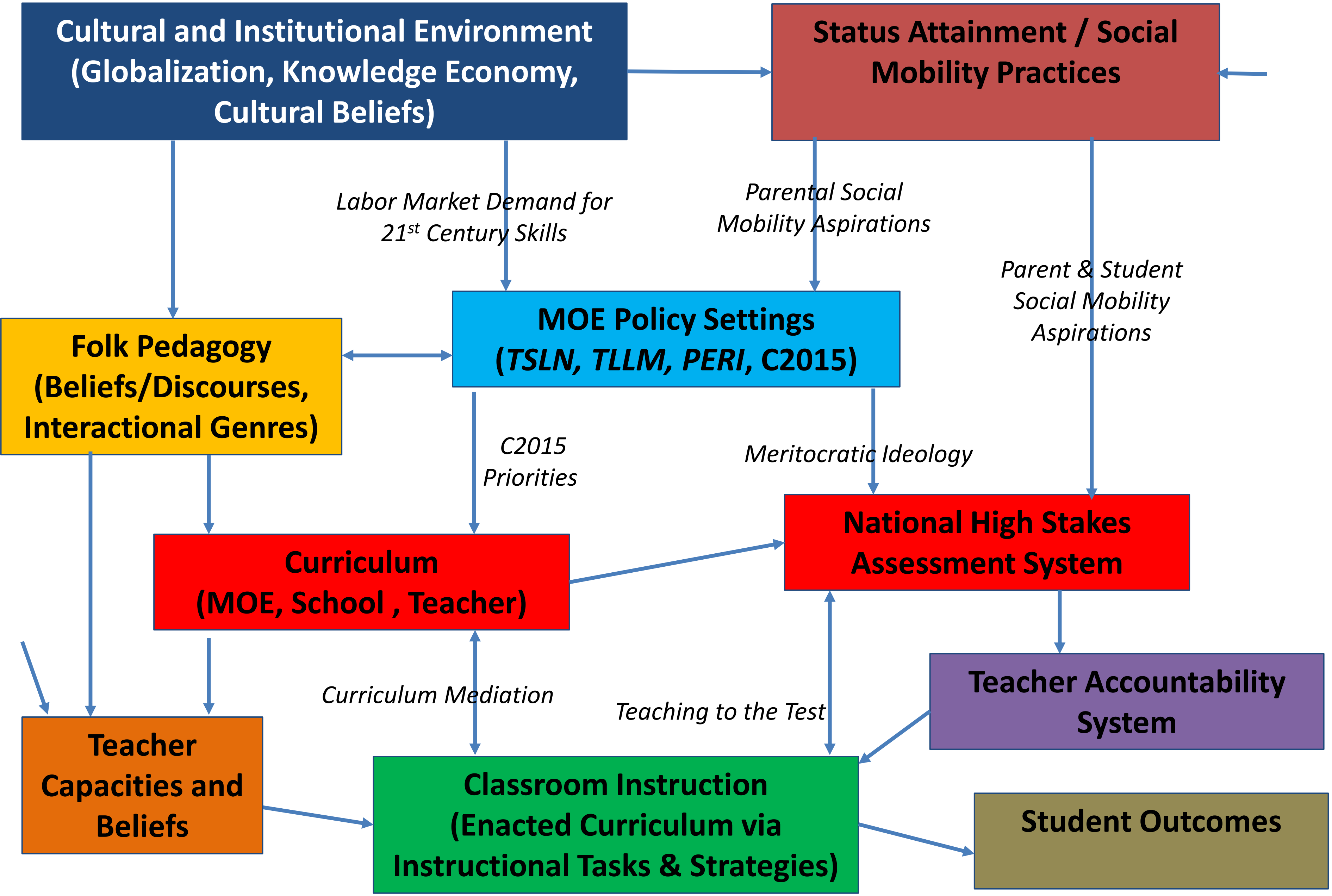
Secondary 3 English Teacher, Singapore.

Why Do Teachers Teach This Way: Institutional Drivers.

Key Drivers:

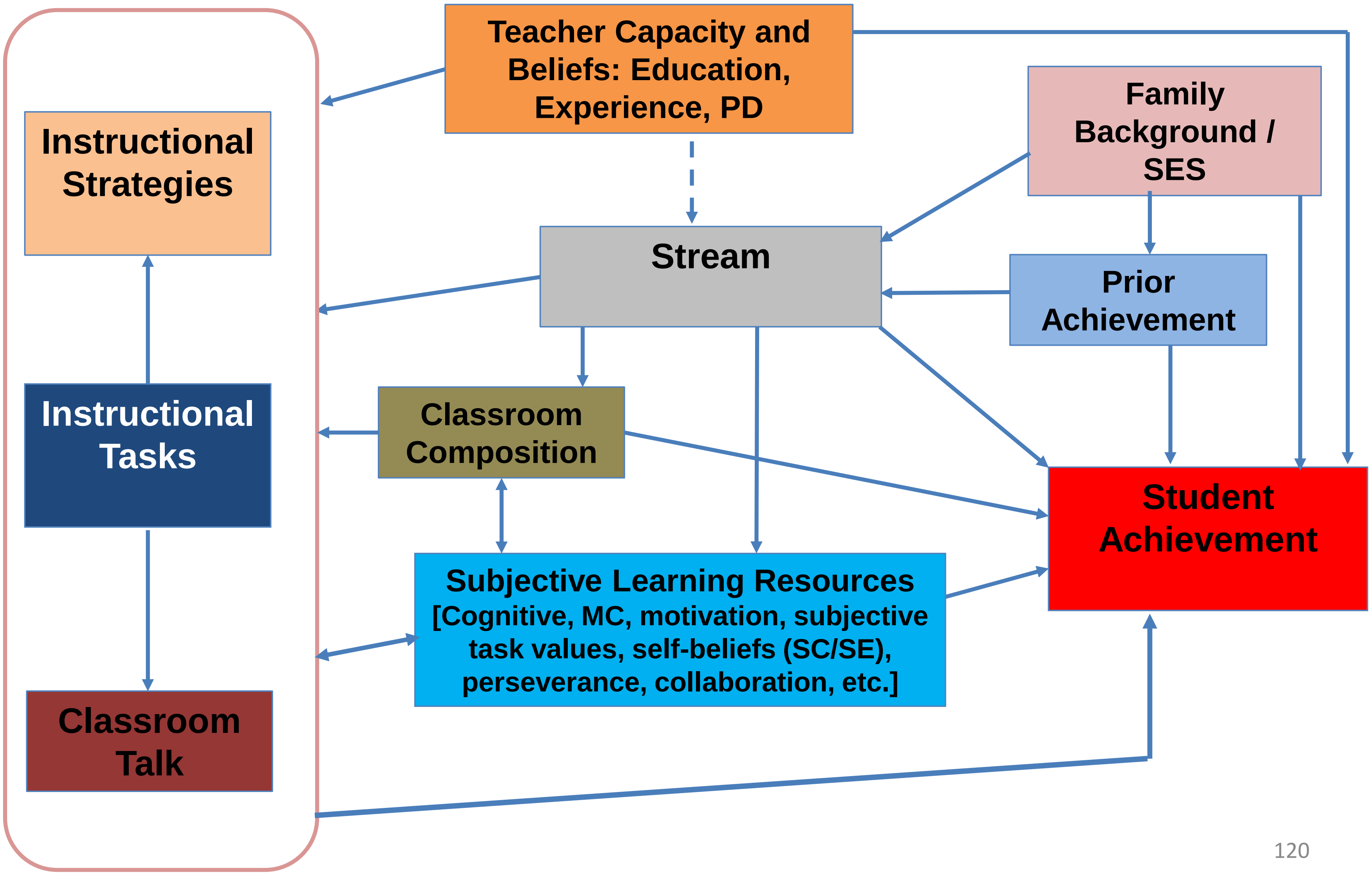
- Prescribed curriculum: *coverage of the curriculum*
- National high stakes assessment: *teaching to the test*
- Folk pedagogy, e.g.,
    - *teaching is talking and learning is listening;*
    - *effort and hard work, not ability, explains differences in student achievement*
    - *Knowledge is objective*
    - *Pedagogical authority is bureaucratic, hierarchical and indistinguishable from epistemic authority*
- Meritocratic norms: *streaming* is both fair and efficient
- Parent and student expectations: very high *instrumental* value of education
- Performative teacher *accountabilities*: student achievement levels
- Commitment to *collective wellbeing*: education as key nation-building project

The Logic of Instruction in Singapore: An Institutionalist Model



5. Instructional Practice and Student Achievement in Singapore.

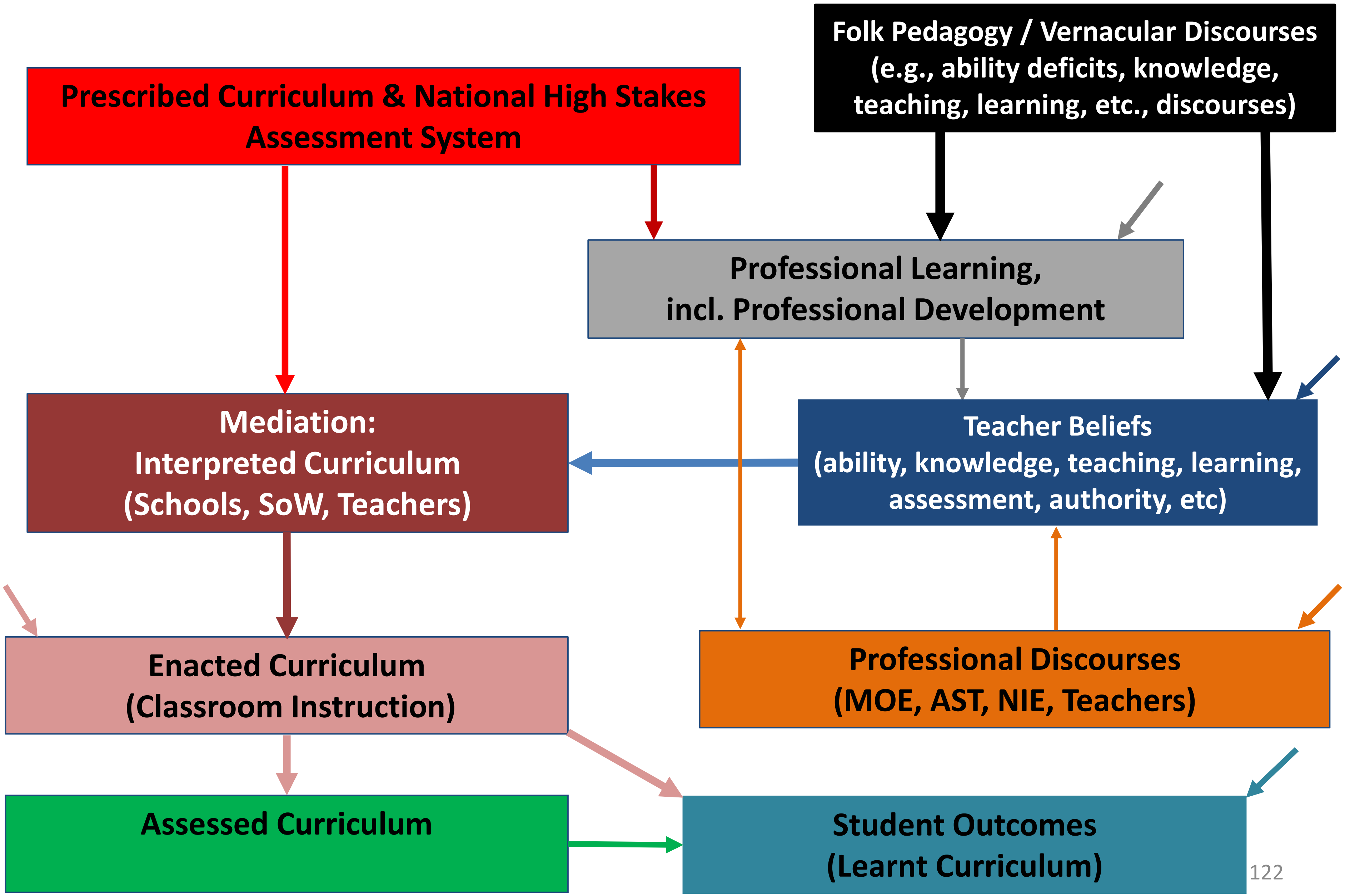
Expanded Conceptual Model of Teacher and Instructional Effects on Student Achievement Controlling for Prior Achievement, Stream and SES



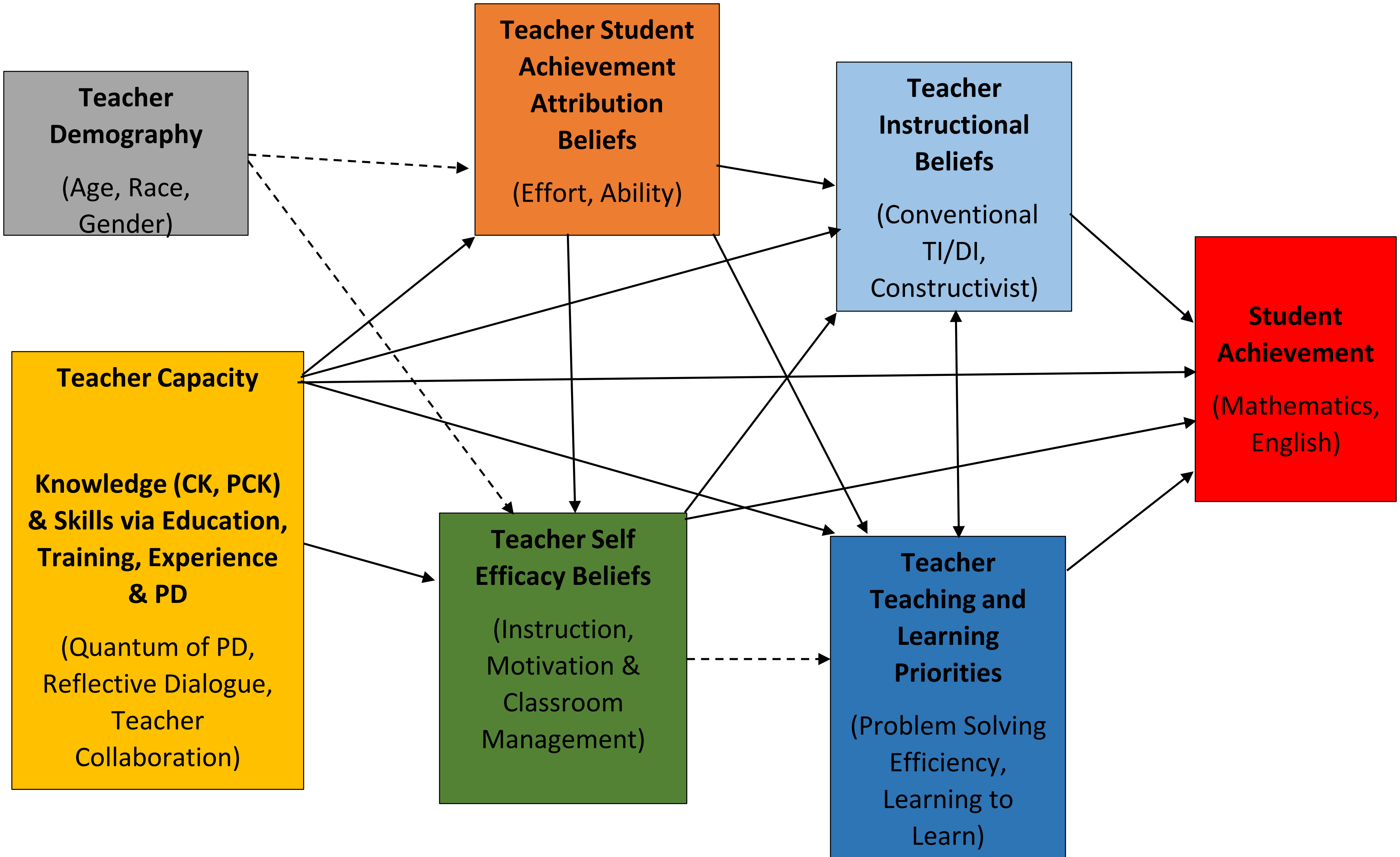
Teacher Effects

(As opposed to *teaching* effects)

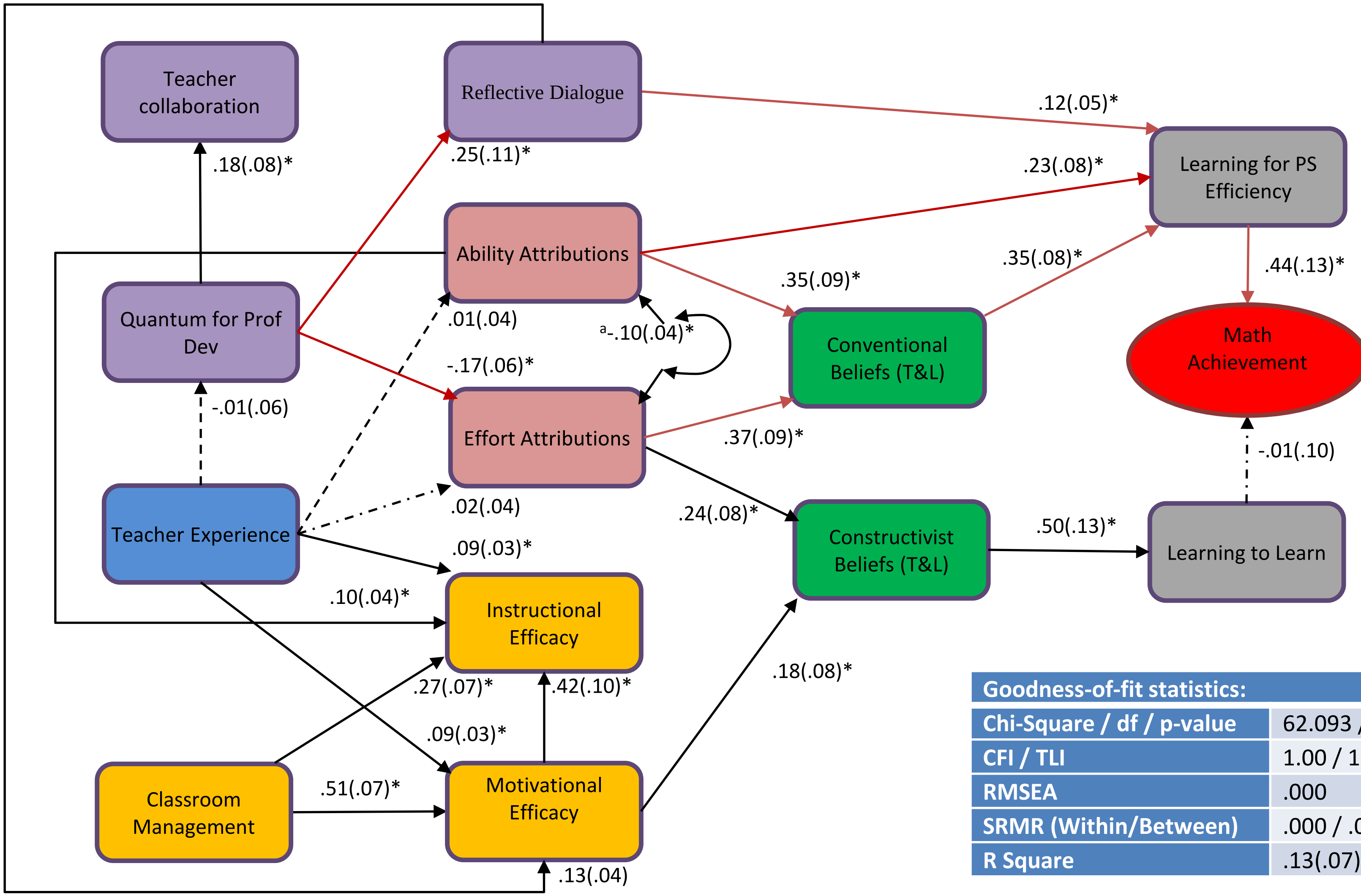
Teacher Beliefs, PD and Curriculum Mediation



A Conceptual Model of Teacher Effects



ML_SEM: Teacher Effects (Mathematics) (L2 Only)



Goodness-of-fit statistics:	
Chi-Square / df / p-value	62.093 / 63 / .509
CFI / TLI	1.00 / 1.00
RMSEA	.000
SRMR (Within/Between)	.000 / .075
R Square	.13(.07)

Note: **p*<.05. All parameter estimates are unstandardized. Dashed arrows denote non-significant paths. Double-headed curved arrows represent estimated error covariances [a]Standardized=-.27(*SE*=.10).

Findings:
Some, but not all, teacher characteristics & beliefs matter

- Teacher beliefs matter, but only those that complement existing pedagogical arrangements
- Teacher learning priorities matter, but which ones matter depends on the nature of the assessment tasks: enhancing problem solving efficacy matters, but learning to learn doesn't
- Teacher self efficacy beliefs have a direct impact on constructivist beliefs about T&L, but have no direct or indirect influence on student achievement
- Constructivist beliefs about teaching and learning have no direct or indirect effect on student achievement are mediated by learning priorities and have no impact on student achievement
- Teacher effort and ability attributions about student achievement have an indirect effect on student achievement but only via conventional beliefs about T&L
- Teacher experience has a direct impact on self efficacy beliefs but no influence on student achievement
- Teacher credentials have no direct or indirect impact on student achievement
- PD has an indirect effect on student achievement, but only via its effect on conventional T&L beliefs and learning priorities. In effect, in Singapore, PD reinforces rather than challenges existing pedagogical arrangements

Teacher Preparation, PD and TIMSS Achievement Scores

	Singapore	Australia
Teacher Education	**(% of Tchers / Av. TIMSS Score**	**(% of Tchers / Av. TIMSS Score**
Major in Math and Math Education	32/620	37/505
Major in Math Education but not Math	6/584	9/522
Major in Math but not Math Education	45/620	21/519
All others	17/585	34/500
Professional Development	**% of Teachers**	**% of Teachers**
Math Content	67	52
Math Pedagogy / Instruction	79	65
Math Curriculum	55	55
Integration ICT into Math	68	69
Improving Students Critical Thinking / Problem Solving Skills	48	48
Math Assessment	58	39

TIMSS, 2011, Mathematics, Ch. 7 (pp. 290, 300).

Whither Teacher Quality, more broadly?

- Do these findings indicate "teacher quality" is not all that it is cracked up to be?

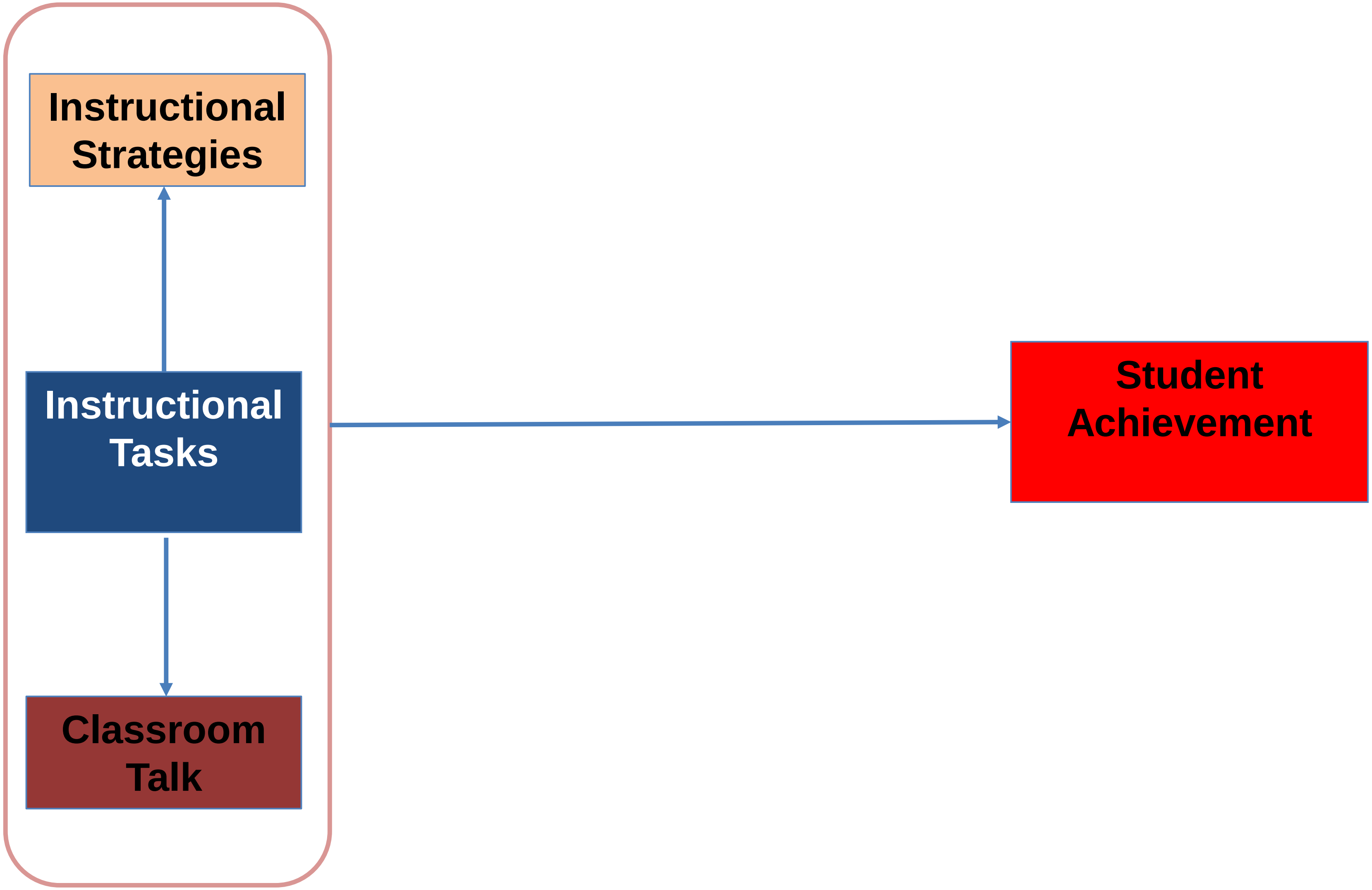
- No, but need to frame "teacher quality" not just in terms of teacher experience, knowledge, skills, judgement, commitments and beliefs, let alone their training and PD, but also in terms of what they *do* in the classroom – that is to say, *how they teach*. As Mary Kennedy puts it, the issue is not so much "teacher quality as the quality of teaching" (Kennedy, 2005, 2006, 2010a, 2010b; see also Hiebert and Morris, 2012)

- But as important as this is, from the perspective of student learning, what teachers do in the classroom is even less important than what students *do* in class. This, in turn, is primarily a function of the character of the instructional tasks students engage in (Doyle 1983; Newmann et al. 1996; Newmann and Bryk, 2001; City, Elmore, Fiarman and Teitel 2009; Hattie 2009; Cohen 2011).

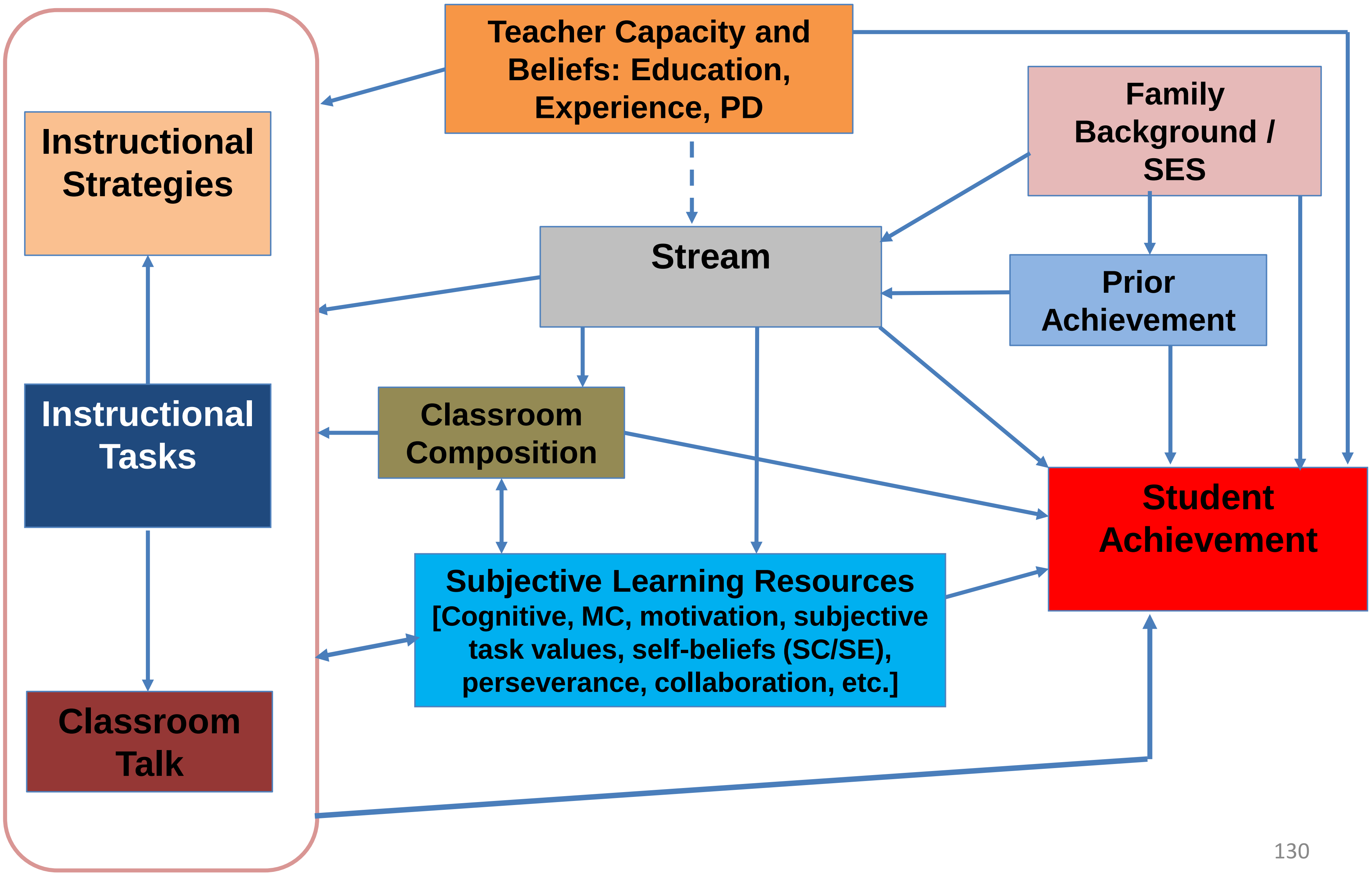
Teaching Effects

(As opposed to *teacher* effects)

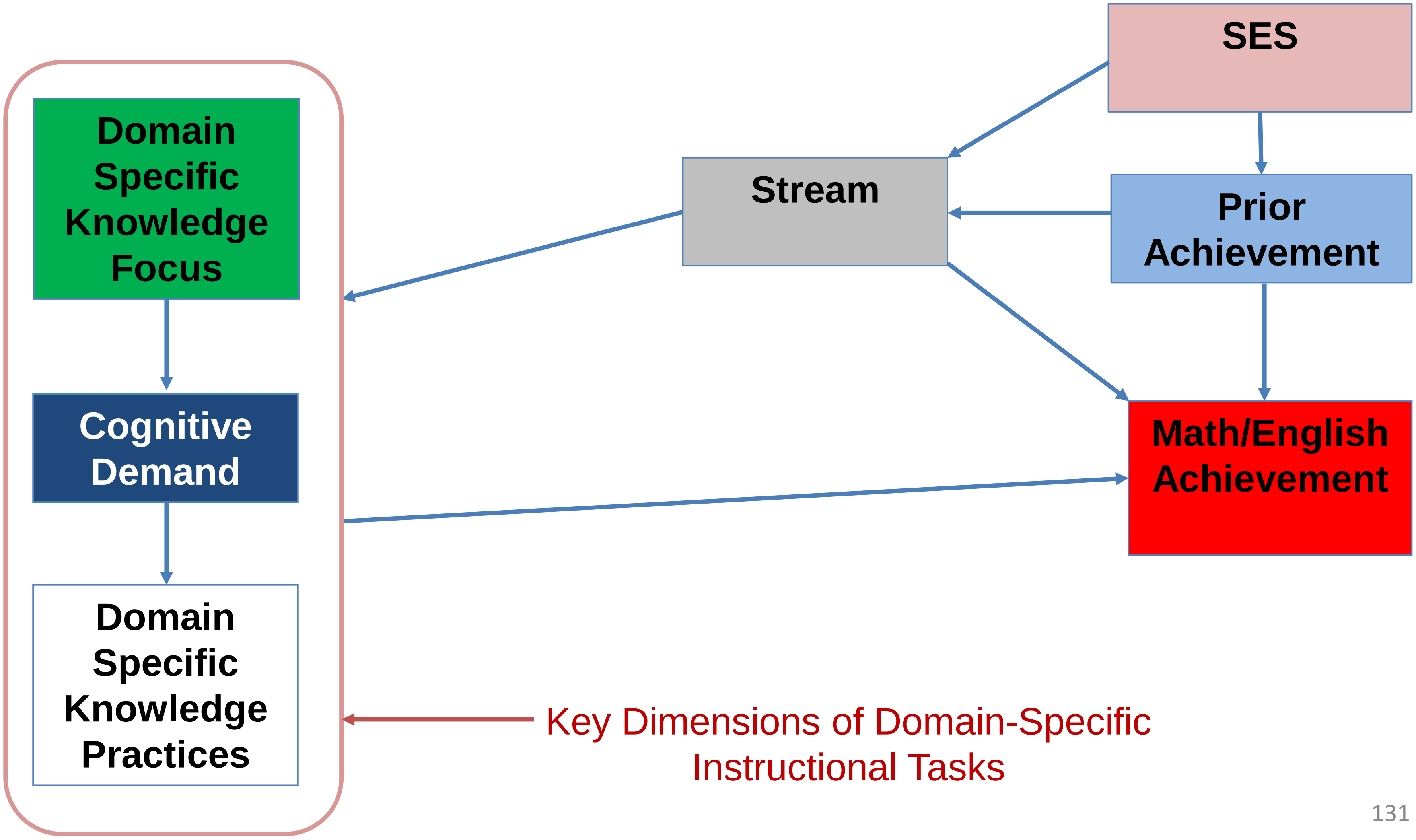
Simplified Model of Instructional Effects and Student Achievement



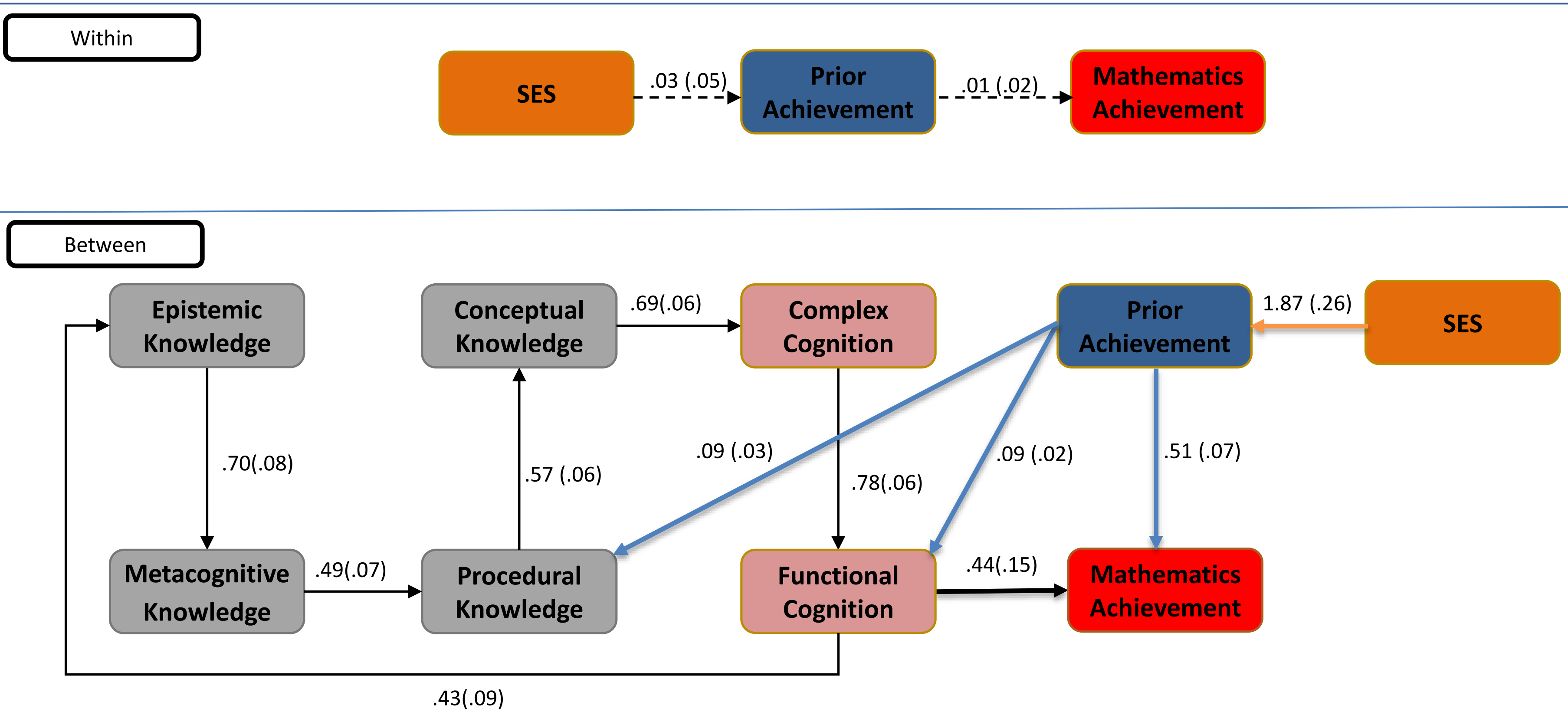
Expanded Conceptual Model of Teacher and Instructional Effects on Student Achievement Controlling for Prior Achievement, Stream and SES



Conceptual Model of Effect of Instructional Tasks on Student Achievement Controlling for Prior Achievement, Stream and SES



ML_SEM Model of Effects of Classroom Knowledge Focus and Cognitive Demand on Mathematics Achievement controlling for SES and Prior Achievement: Confirms EA Model



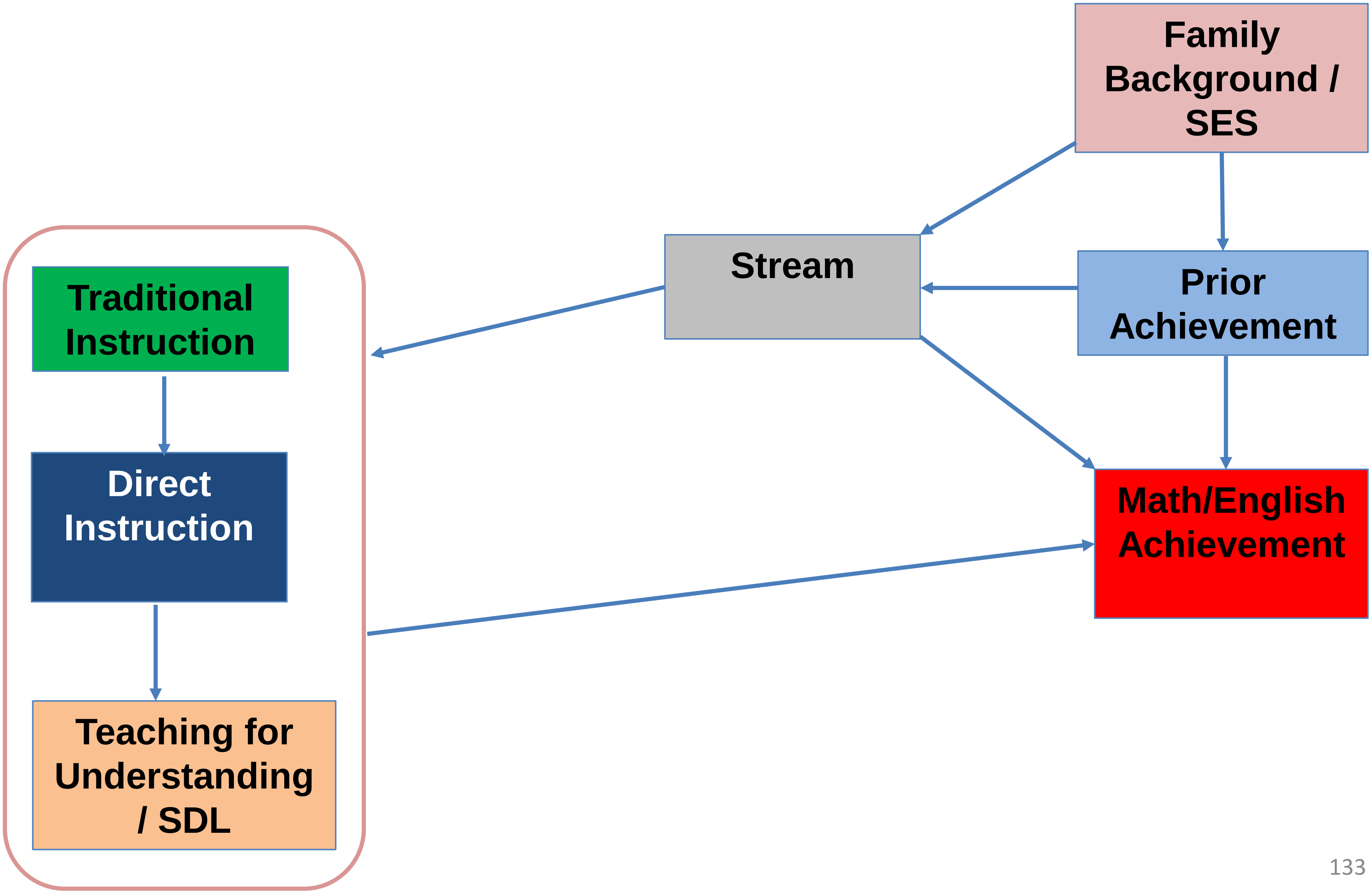
Note. Unstandardized estimates. **p<.01. *p<.05.

Goodness of Fit Statistic	Values
Chi-Square / df / p-value	28.914 / 20 / .315
CFI / TLI	.994 / .991
RMSEA	.010
SRMR (Within/Between)	.000/.052
AIC / BIC / R-square (L2)	9013.55 / 9187.18 / .56 (.09)

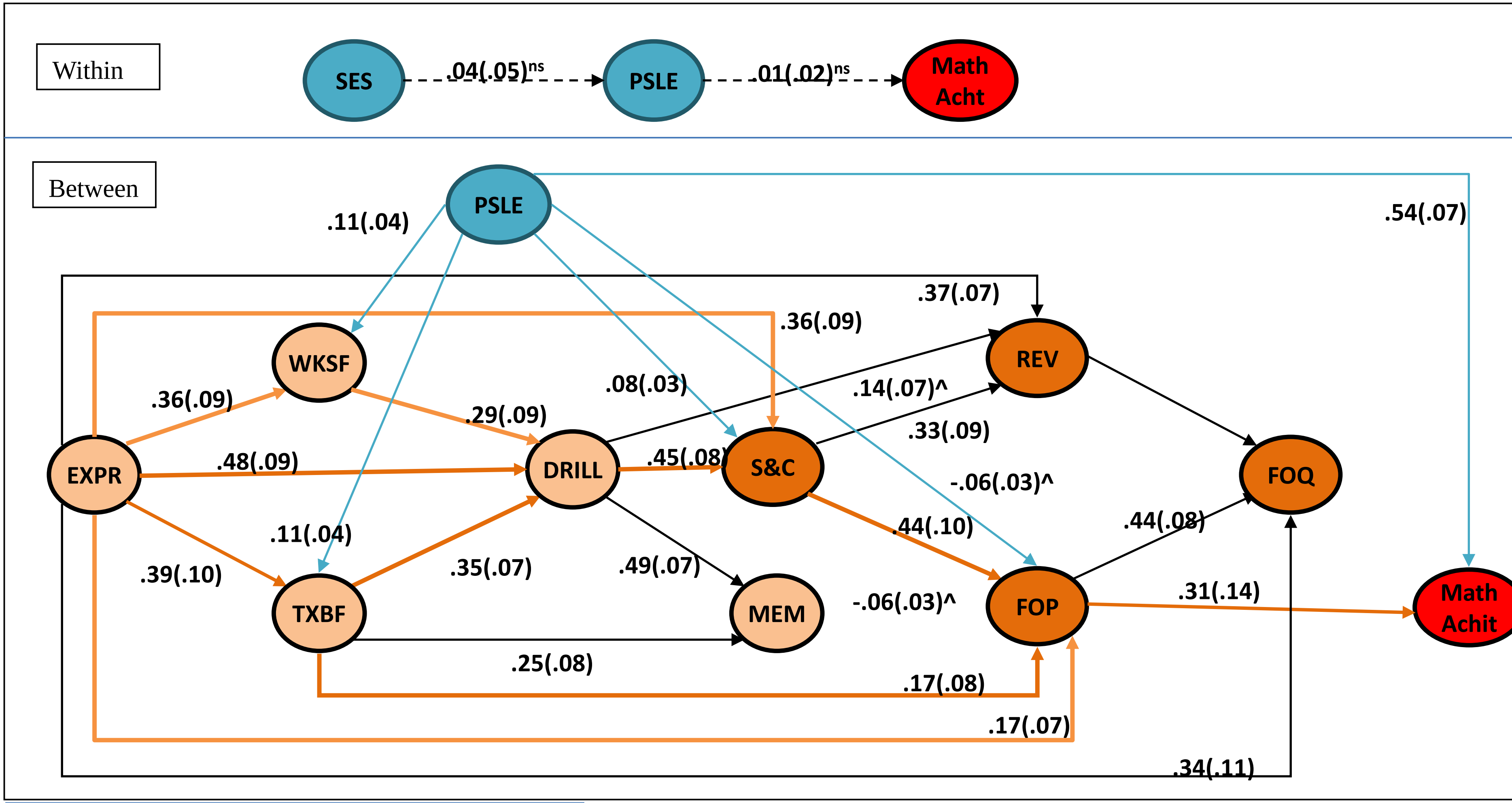
Direct instructional effects < Direct prior achievement effect: .44 < .51

Indirect plus direct effects: IE<PA+SES

Conceptual Model of Effect of Instructional Strategies on Student Achievement Controlling for Prior Achievement, Stream and SES



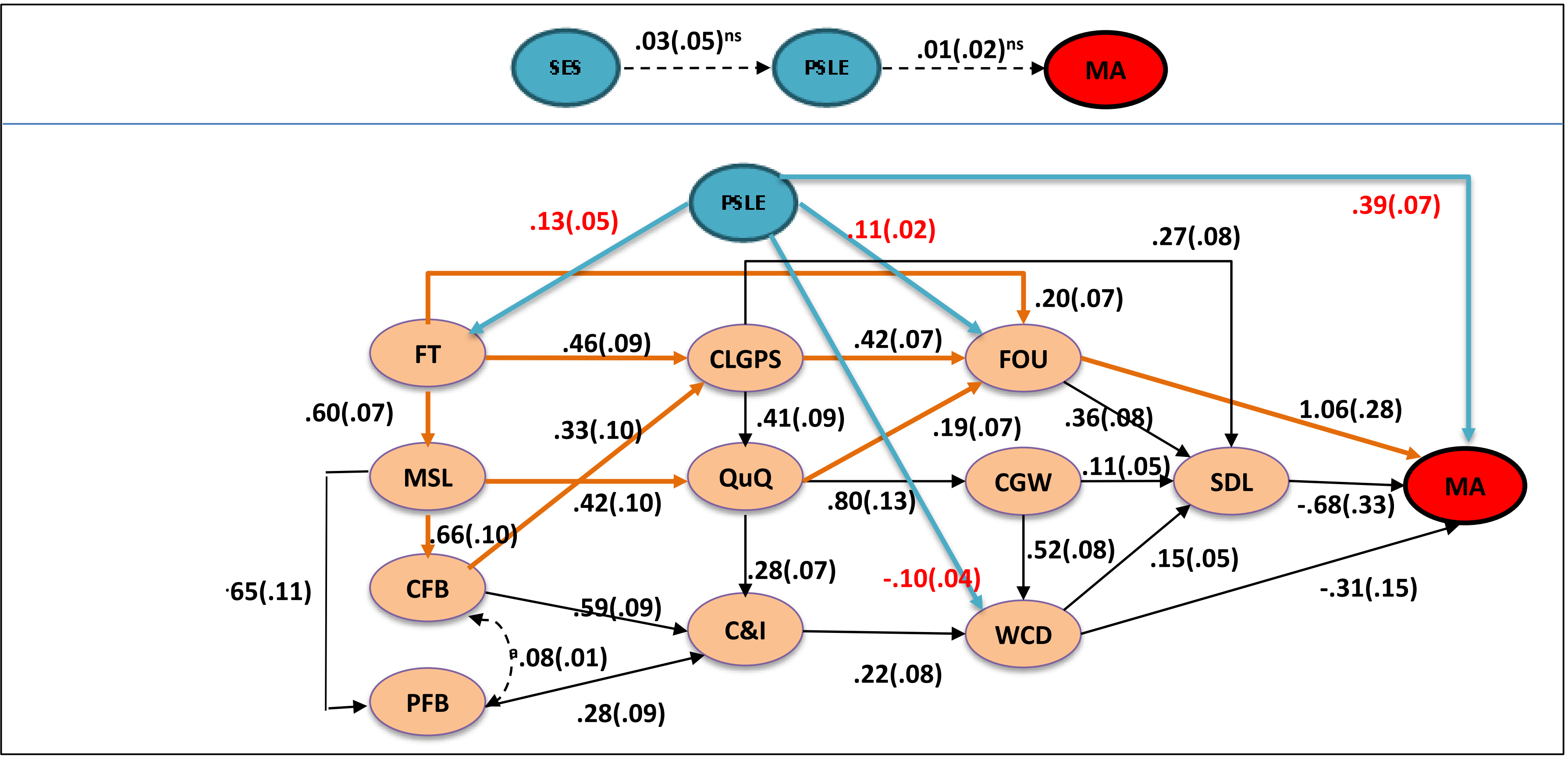
Multilevel SEM Model of Traditional and Direct Instruction with PSLE and SES at L2 in Secondary 3 Mathematics



Goodness of Fit	
Chi-Square / df / p-value	27.562 / 27 / .4338
CFI / TLI	.999 / .998
RMSEA	.004
SRMR (within/between)	.001 / .050
AIC / BIC / R-square	

Note. Unstandardized estimates. **p<.01. *p<.05.

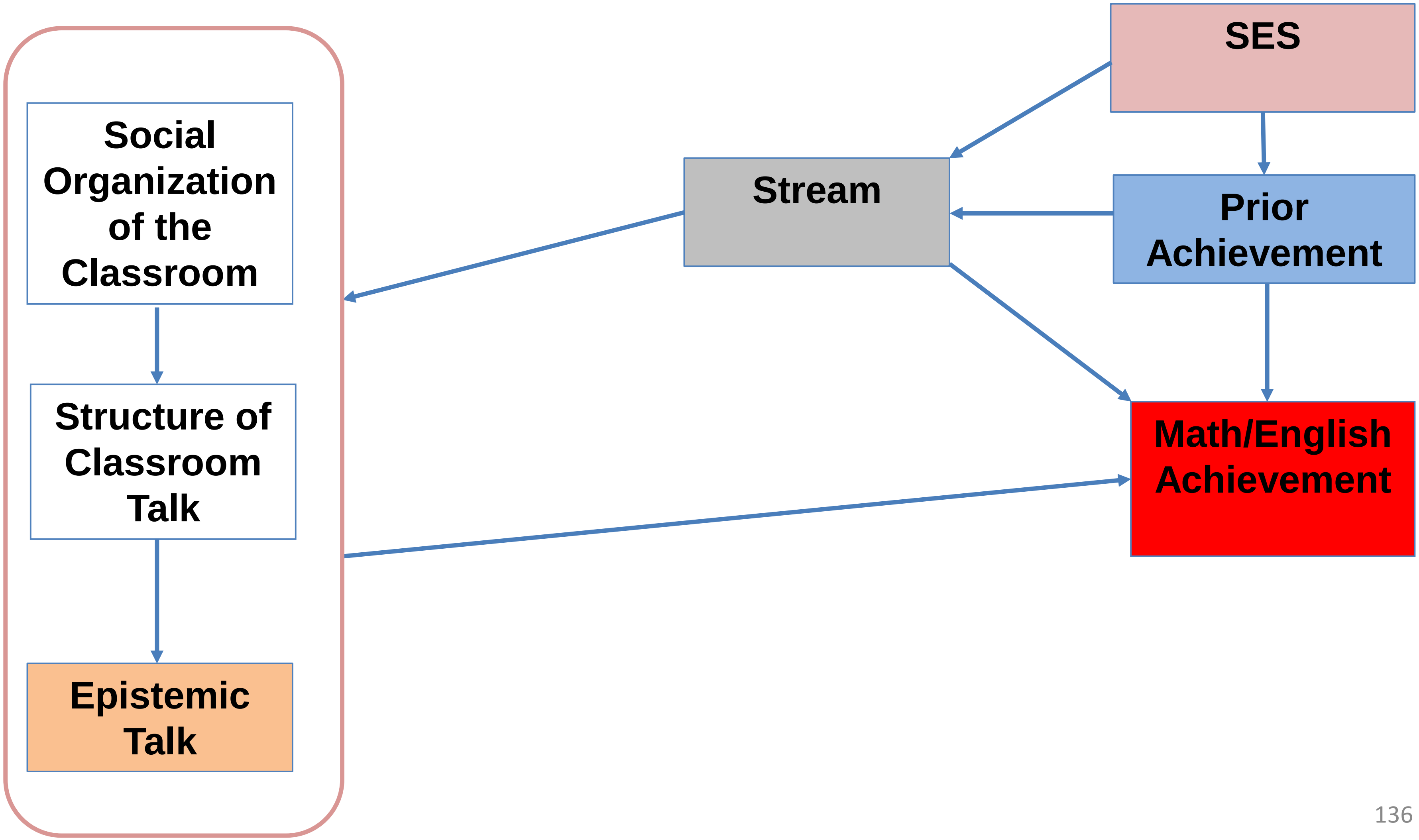
Multilevel SEM Path Model of Teaching for Understanding and Self-Directed Learning on Mathematics Achievement After Controlling for PSLE



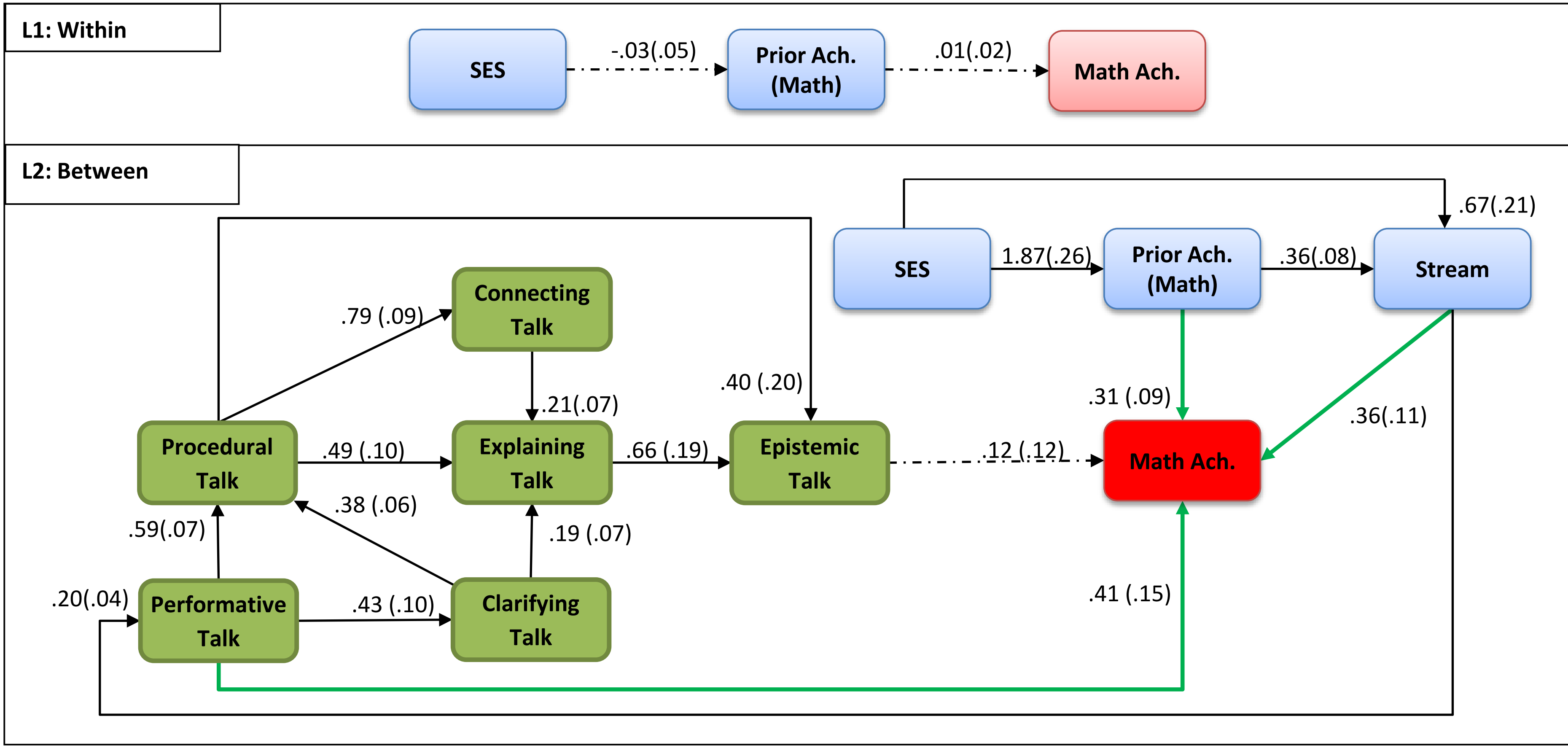
Goodness of Fit	
Chi-Square / df / p-value	72.782 / 51 / .0242
CFI / TLI	.978 / .966
RMSEA	.020
SRMR (within/between)	.001 / .055
AIC / BIC / R-square	6679.784 / 6970.955 / .598(.074)

Note. Unstandardized estimates. **p<.01. *p<.05.

Conceptual Model of Effect of Classroom Interaction on Student Achievement Controlling for Prior Achievement, Stream and SES



Multilevel SEM Model of Classroom Talk and Mathematics Achievement: Singapore Sec 3 2010



Goodness of Fit	Math
Chi-Square / df / p-value	48.625 / 29 / .013
CFI / TLI	.967/ .946
RMSEA	.025
SRMR (L1/L2)	.003/.076
R-square (L1/L2)	.01(.01)/.63(.08)

Note: All values represent unstandardized estimates significant at *p*<.05. In brackets are standard errors. Dashed arrows represent non-significant paths.

To Sum Up

So: What Does this All Add Up To?
Key Finding 4.

1. Some, but not all, **instructional practices** predict student achievement *in Singapore*.

2. **Performative instructional practices** are especially predictive of student achievement; teachers know this and teach accordingly (that is, teachers, not unreasonably, **teach to the test**).

3. Performative instructional practices support **knowledge building**, **cognitively speaking**, as predicted by the East Asian model but contrary to Western constructivist learning theory. Singapore's performative pedagogy, however, does not appear to support knowledge building, epistemically speaking.

4. However, **TfU/"visible teaching"/"high leverage"** instructional practices generally do *not* predict student achievement in Singapore.

5. At a disaggregated instructional level, instructional effects are less predictive than **prior achievement** & **composition effects** generated by prior achievement & streaming.

6. In the **aggregate**, instructional effects are larger than classroom composition effects. Instruction matters, and can moderate effects of SES/streaming/classroom composition.

7. Teacher effects (training, experience, PD, beliefs) are far less predictive than **teaching effects**. **PD effects** are moderate, selective (limited to and mediated by instructional practices that support performative instruction) indirect only and mediated (and regulated) by prior T&L beliefs and priorities and teacher accountabilities

8. **Streaming** compounds effects of SES. **De-streaming** will shift variance from L2 to L1 and require different instructional improvement strategies at classroom level

9. **Classroom composition** has some (generally small to modest) effects on instructional practices. Some pedagogically sensible, others reflect **stratification** of instructional practice.

10. **Cultural effects** at the student level (motivation, subjective task values, self-beliefs, self regulation, perseverance, aspirations, etc.) vary in their effect size from large to small. Some but not all affected ("mediated") by instructional practices.

11. **Institutional effects** (streaming, coverage of the curriculum, teaching to the test) are pervasive, constitutive and highly regulative.

12. **Instructional practices** (and instructional effects) should be framed ecologically as **hierarchically organized, interdependent, mediated, culturally embedded, institutionally regulated** ***systems*** of classroom practice rather than as an ***inventory*** or ***aggregate*** of discrete instructional practices. This has important implications for the interpretation of conventional correlational and meta-analytical studies of instructional effects. (see also Stigler and Heibert, 1999, on "teaching as a system of interacting elements."

6. Culture and Pedagogy:

But Only Two of Many Aspects…

Key Finding 5.

Culture matters, and matters a lot.

Cultural change is difficult, at least in the short run, but culture is not destiny … Some forms of cultural change are possible at the school, teacher and student level in the medium to long term.

6.1. Cultural Background and Achievement Orientation

Mathematical Performance for Non-Immigrant and Immigrant Populations, 2012

	Australia	New Zealand	Singapore	OECD Average
Non-Immigrant Score	**503**	**503**	**570**	**500**
Immigrant Score (& % of total sample)	**528** (22.7%)	**503** (26.3%)	**596** (18.3%)	**463** (11.2%)
Effect Size for Immigrant Status	.27	.00	.26	-.39
1st Generation	516	509	591	454
2nd Generation	539	492	609	478
Chinese Immigrants	**585**	**582**	-	-
New Zealand Immigrants	484	-	-	-
UK Immigrants	508	505	-	-
Vietnam Immigrants	553	-	-	-
Immigrant students who speak language of assessment at home	528	516	606	473
Immigrant students who DO NOT speak language of assessment at home	**541**	**492**	**597**	**463**

Source: PISA 2012, Vol. 2, pp. 227-228, 233-234, 252-253.

PISA Scores (Mathematics) for Native born Australians and 2nd Generation East Asians from High Performing Countries

	Native Born Australians	2nd Generation Students from High Performing East Asian Countries	Difference
2003	528	565	37
2006	518	579	61
2009	511	582	71
2012	499	605	106

Adapted from John Jerrim, *Why do East Asian children perform so well in PISA? An investigation of Western-born children of East Asian descent.* Institute of Education, London. October 2014, p. 26.

Regression Estimates for 2nd Generation East Asian Students Compared to Australian Native Born Students With Controls

	St. Beta	*SE*		*St. Beta*	*SE*
Reference Group: Native Born Australians	**[0.0]**	--			
Second Generation High Performing East Asian Countries	**1.022**	0.104			
After controlling for:			***And After Controlling for…***		
Demographic Characteristics	**0.841**	0.96	Subjective Norms Scale	**0.247**	0.068
Fixed School Effects	**0.407**	0.061	Instrumental Motivation + Attitudes Towards School Scale	**0.259**	0.066
Effort on Pisa	**0.406**	0.065			
Time Studying Outside School	**0.290**	0.067	Maths Behaviour Scale	**0.202**	0.064
Work Ethic Scale + Perceived Control Scale + Attributions to Failure Scale + Perseverance	**0.244**	0.068	Future Aspirations Scale	**0.148**	0.063
Total Explained Variance with All Controls: approx. 85% (0.148/1.022)					

Adapted from John Jerrim, *Why do East Asian children perform so well in PISA? An investigation of Western-born children of East Asian descent.* Institute of Education, London. October 2014, pp. 27-29.

Culture Matters, and its Intractable, at least in the Short Term…

"… Australian children with East Asian parents outperform their native Australian peers by an average of more than 100 PISA test points (equivalent to two and a half years of schooling). Moreover, while PISA test scores of native Australians declined substantially between 2003 and 2012, the scores of children with East Asian heritage improved rapidly.

Yet there is little evidence that one single factor (a 'silver bullet') is able to explain the exceptionally high PISA test scores obtained by this group. Rather a series of factors combine, each making their own independent contribution. This includes selection of high quality schools, the high value placed upon education, willingness to invest in out-of-school tuition, a hard work ethic and holding high aspirations for the future.

Consequently, Western policymakers should not expect there to be an easy way to replicate East Asian students' extraordinary educational success. The reality is that this may only be possible over the very long-term, requiring a cultural shift where all families instil a strong belief in the value of education amongst their children (along with the realisation that hard work and sacrifice may be needed to achieve it)."

John Jerrim, *Why do East Asian children perform so well in PISA? An investigation of Western-born children of East Asian descent.* Institute of Education, London. October 2014, p. 4.

6.2. Cultural Differences Between Singapore and Australia at the Student Level: Drive, Motivation, Self Beliefs and Dispositions

Student Drive and Motivation (Mean Index Score/(R.Square))

	Australia	Singapore	Finland	OECD Average
Perseverance	.10 (8.2%)	.29 (1.1%)	0.0 (14.3%)	0.0 (5.6%)
Openness to Problem Solving	-0.07 (18.1%)	.01 (4.3%)	-.011 (23.6%)	0.0 (11.5%)
Locus of Control: Perceived Self Responsibility for failing in Mathematics	-0.24 (4.9%)	-0.48 (4.9%)	-0.12 (4.0%)	0.0 (2.9%)
Intrinsic Motivation to Learn Mathematics	.11 (4.6%)	0.84 (0.4%)	-0.22 (11.5%)	0.0 (5.2%)
Instrumental Motivation to Learn Mathematics	.24 (4.3%)	.40 (0.1%)	-.01 (10.0%)	0.0 (4.2%)

Source: PISA 2012, vol.3 (pp. 270, 271, 273, 274, 278, 279, 283, 284, 289)

Mathematical Self-Beliefs, Dispositions (Mean Index Score / RSq)

	Australia	Singapore	Finland	OECD Average
Self-Efficacy	.06 (35.5%)	.47 (30.6%)	-.027 (31.4%)	0.0 (28.3%)
Self-Concept	.06 (19.9%)	.22 (10.6%)	.03 (32.7%)	0.0 (17.0%)
Mathematics Anxiety	.03 (14.9%)	.16 (15.9%)	-.33 (19.8%)	0.0 (14.0%)
Mathematics Behaviours	-0.18 (6.3%)	.47 (0.1%)	-.02 (2.2%)	0.0 (1.9%)
Mathematics Intentions	.02 (0.0%)	.06 (0.3%)	-.06 (7.9%)	0.0 (2.3%)
Subjective Norms in Mathematics	.31 (1.5%)	.80 (0.2%)	-.12 (1.5%)	0.0 (1.1%)

Source: PISA 2012, Vol. 3, pp. 299-300, 305-306, 315-317, 322-323, 328-329.

So culture matters, and is intractable, at least in the short run.

Culture is not destiny, but improving the quality of teaching and learning requires a long term commitment to cultural work at the classroom, community and at the state and national levels.

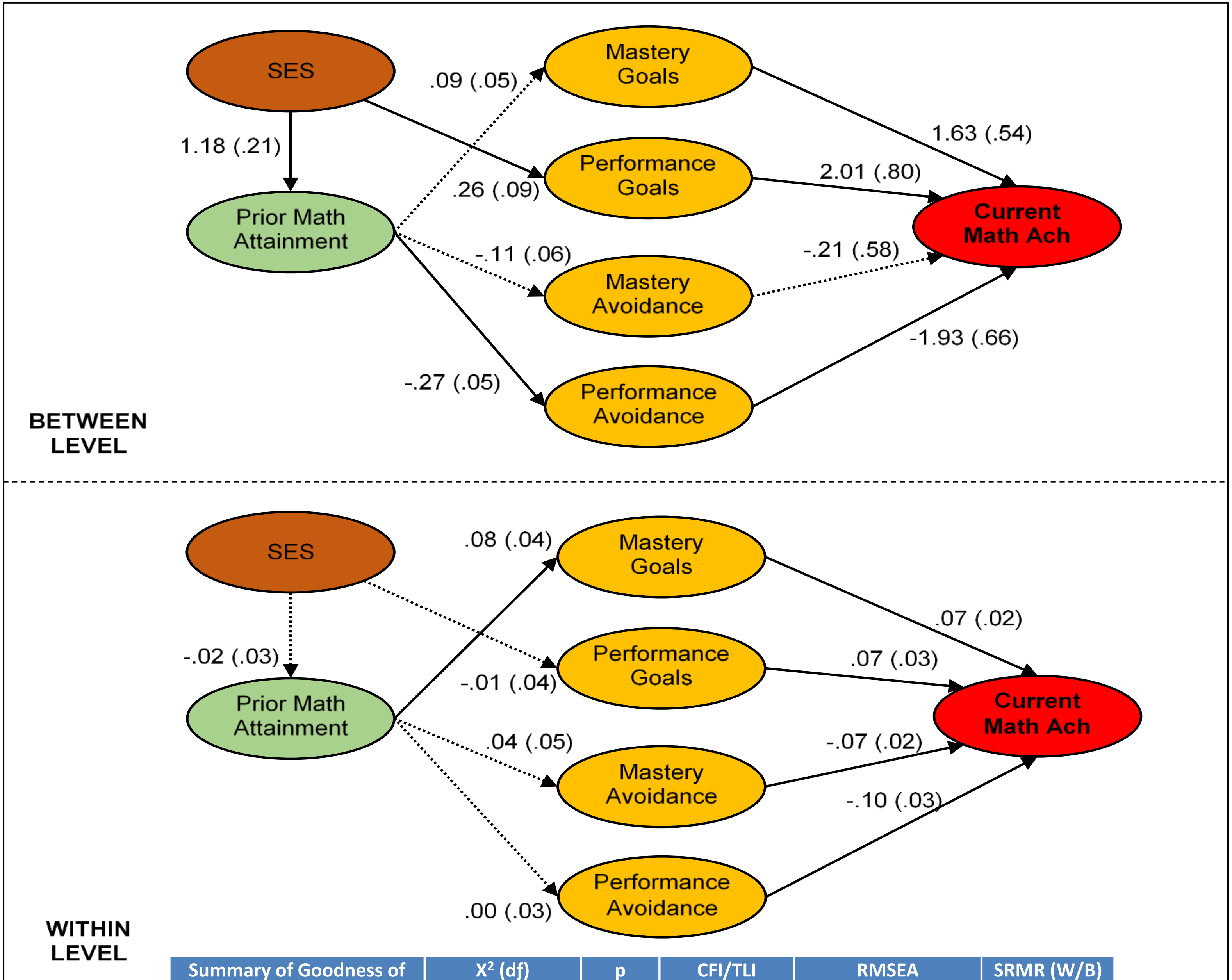
Policy settings and institution arrangements matter too and help explain the logic of instructional practice…and how it might be changed, even in the short term

6.3. Core 2 Findings on Student Motivation and Self Regulation

Descriptive Stats: Student Motivation

	Sec 3 Mathematics (n=1940)		Sec 3 English (n=992)		Effect Size
	Mean (1-5)	**SD**	**Mean (1-5)**	**SD**	***Cohen's d***
Motivation					
Mastery Approach Goals	**3.56**	.767	**3.45**	.742	*.15*
Performance Approach Goals	**3.67**	.798	**3.60**	.788	*.09*
Mastery Avoidance Goals	**3.45**	.870	**3.24**	.812	*.31*
Performance Avoidance Goals	**2.88**	.912	**2.81**	.897	*.04*
Subjective Task Values					
Interest	**3.63**	.924	**3.51**	.851	*.13*
Useful	**3.74**	.783	**3.90**	.722	*-.21*

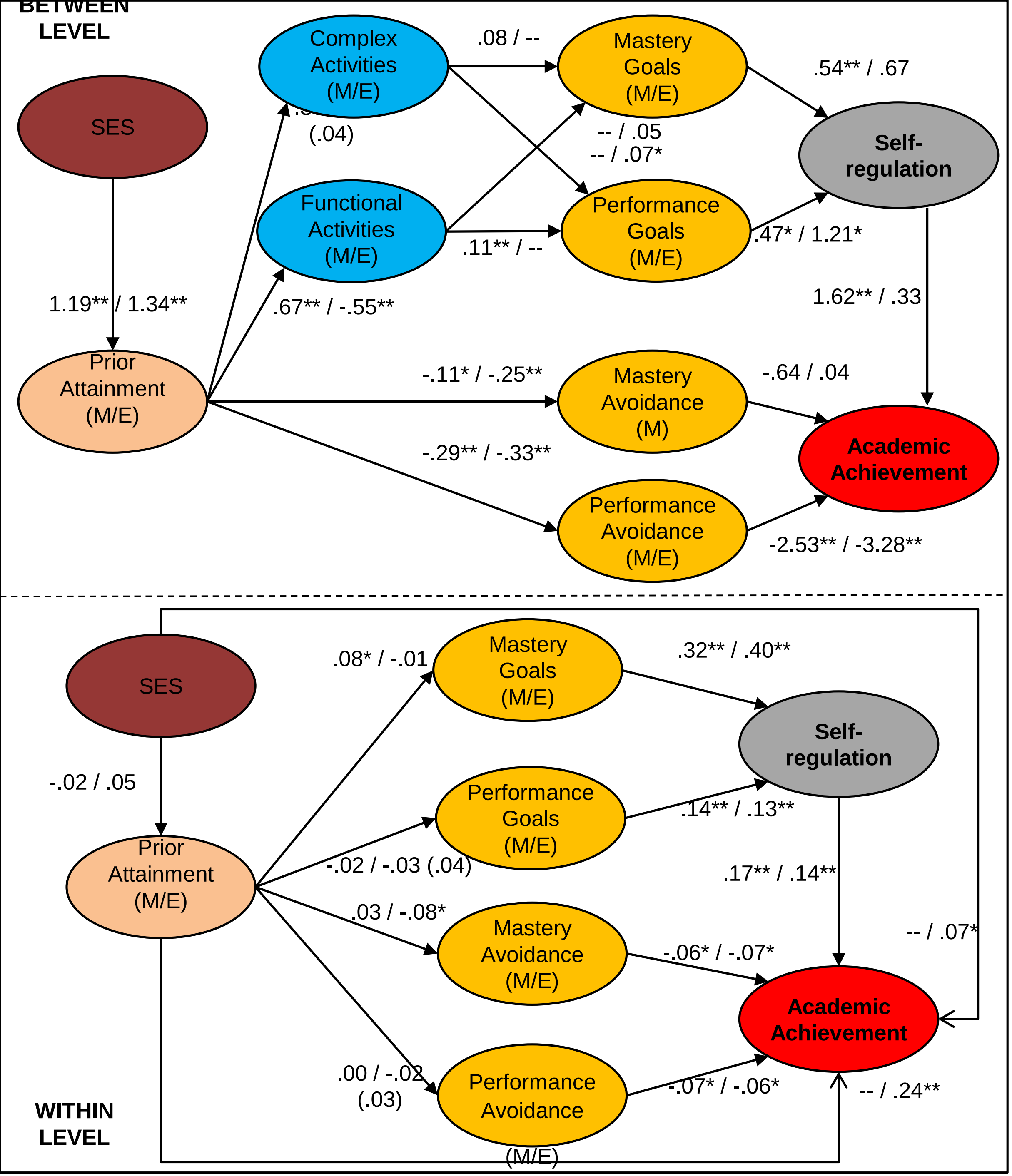
ML-SEM Model of Motivation and Student Achievement in Sec 3 MA and EL



Summary of Goodness of Fit Statistics	X^2 (df)	p	CFI/TLI	RMSEA (90% CI)	SRMR (W/B)
Mathematics	48.466 (30)	.018	.979/.960	.023	.011/.153
English	40.399 (28)	.061	.986/.971	.021	.014/.145

Descriptive Statistics: Self Regulation

	Sec 3 Mathematics (n=1940)		**Sec 3 English (n=992)**		**Effect Size**
	Mean (1-5)	**SD**	**Mean (1-5)**	**SD**	***Cohen's d***
Self-Regulation	**3.65**	.513	**3.56**	.550	*.17*
Behaviour Regulation	**3.61**	.691	**3.43**	.595	*.28*
-Time & Homework Regulation	**3.56**	.731	**3.43**	.760	*.17*
- Individual engagement	**3.66**	.747	**3.57**	.725	*.12*
Conscientiousness /perseverence	**3.77**	.569	**3.74**	.581	*.05*
Positive Affect At School	**3.56**	.760	**3.53**	.784	*.04*



ML_SEM Model of Cognition, Motivation, Self Regulation and Academic Achievement in Sec 3 Math and English

	Goodness of Fit Statistics	
	Math	**English**
X^2 (df)	148.886 (97)	209.426 (96)
p	.001	.000
CFI/TLI	.981/.975	.964/.950
RMSEA (90% CI)	.022	.035
SRMR (W/B)	.027/.138	.034/.169

7. The Limits of the Singapore Model …

Key Finding 6.
Limits /Opportunity Costs of Singapore's Performative Pedagogy

1. Generates **aversion to risk and innovation:** innovation very high transaction and opportunity costs

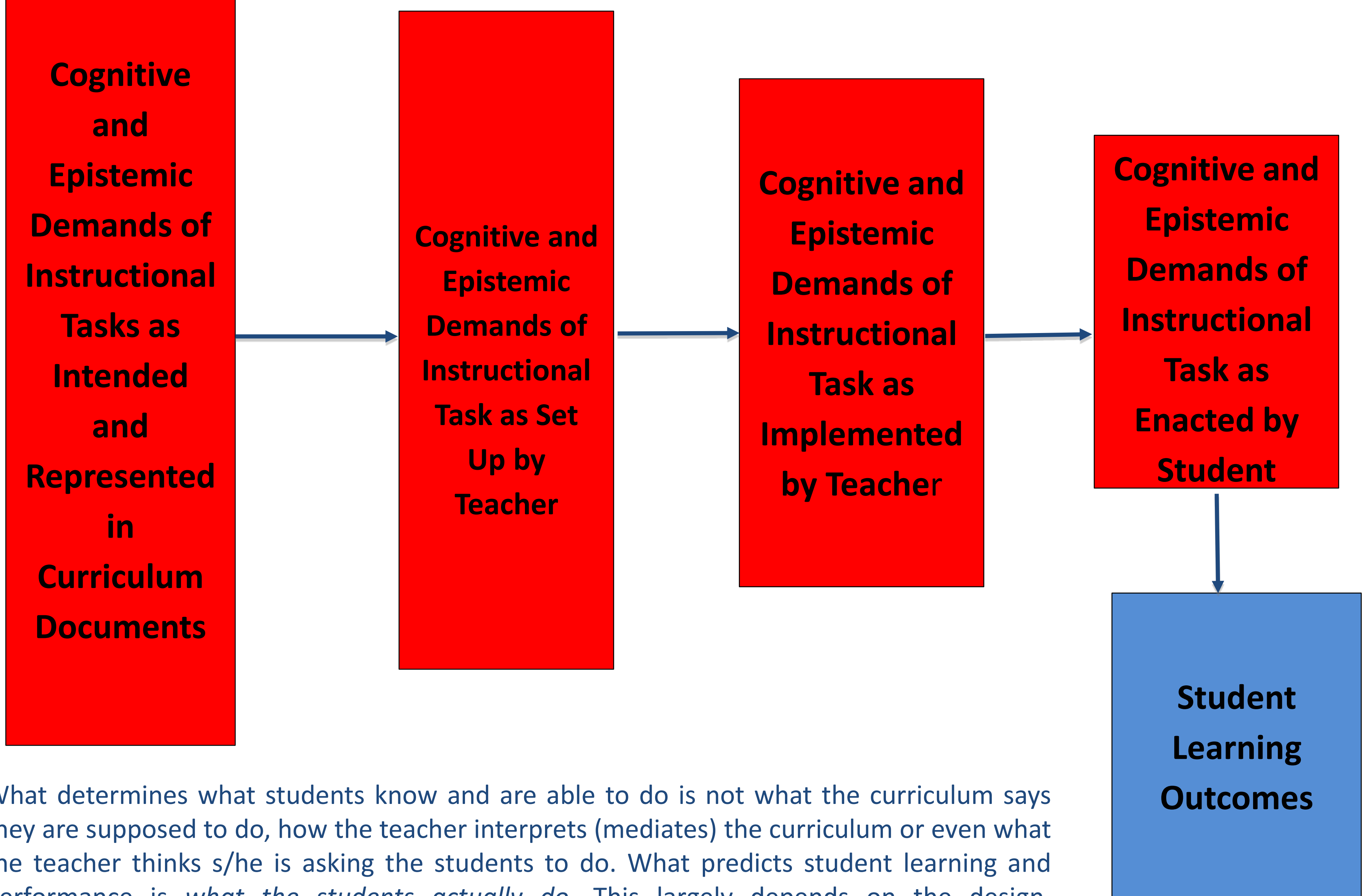
2. Press for curriculum coverage and teaching to the generates a pervasive curriculum tension between **performativity and curriculum depth**.

3. **Perverse instructional incentives.** Performative instructional practices and student achievement predict student achievement. Knowledge building instructional practices generally do not predict student achievement, contrary to MOE hopes.

4. This results in
   - restricted attention to **knowledge building / 21st century instructional tasks**
   - Limited development of **ICT mediated tasks** and the integration of technology into instruction
   - **Task Infidelity** (Task Implementation < Task Design)
   - Limited use of **high leverage** instructional strategies

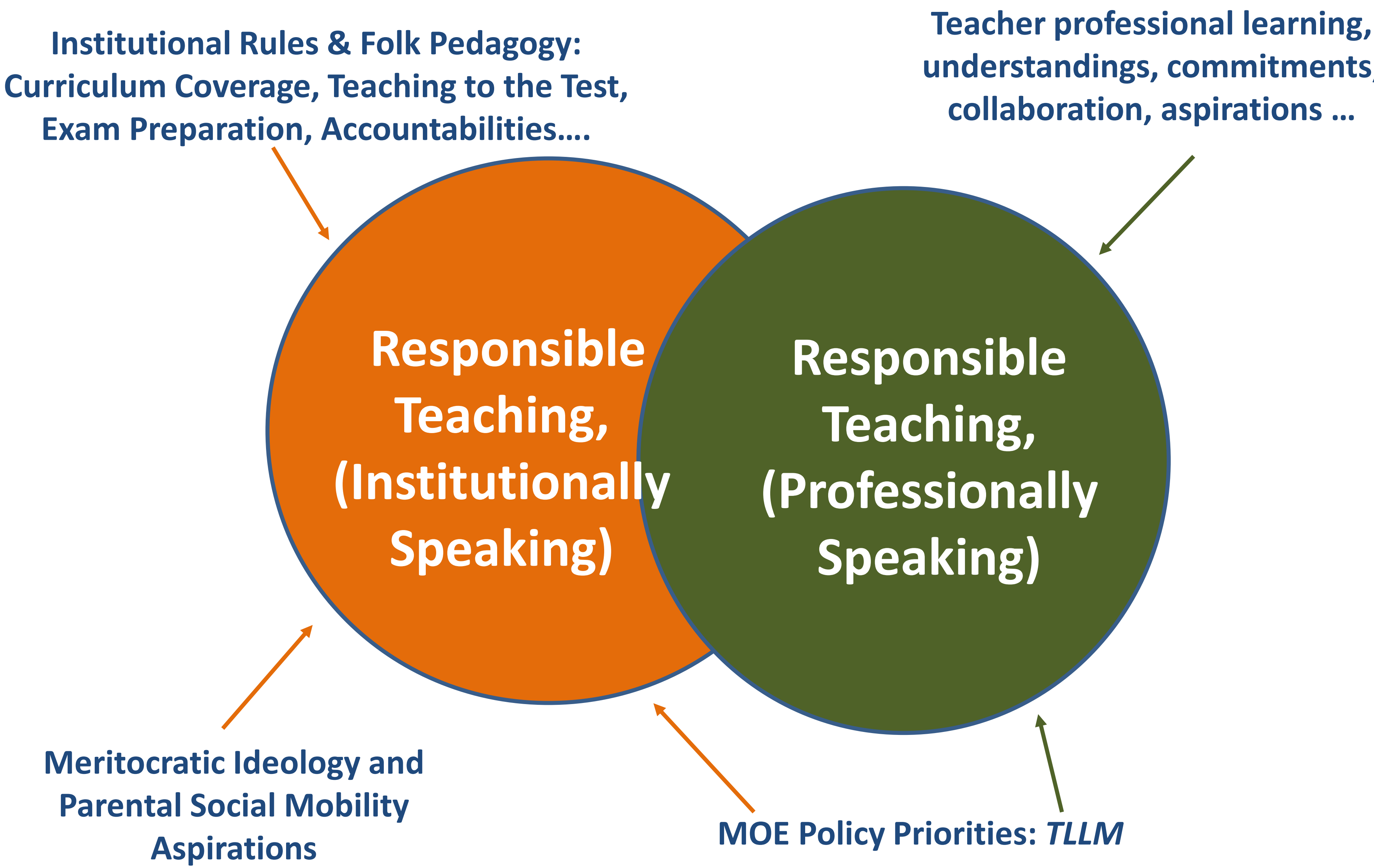
Task (In)Fidelity

Adapted from Stein, Grover & Henningsen, M. (1996).



What determines what students know and are able to do is not what the curriculum says they are supposed to do, how the teacher interprets (mediates) the curriculum or even what the teacher thinks s/he is asking the students to do. What predicts student learning and performance is *what the students actually do.* This largely depends on the design, implementation and the enactment, above all, of instructional tasks – in other words, on task fidelity. City, Elmore, Fiarman and Teitel, *Instructional Rounds*. Cambridge, MA: HUEP, 2009, pp. 23, 30-31.

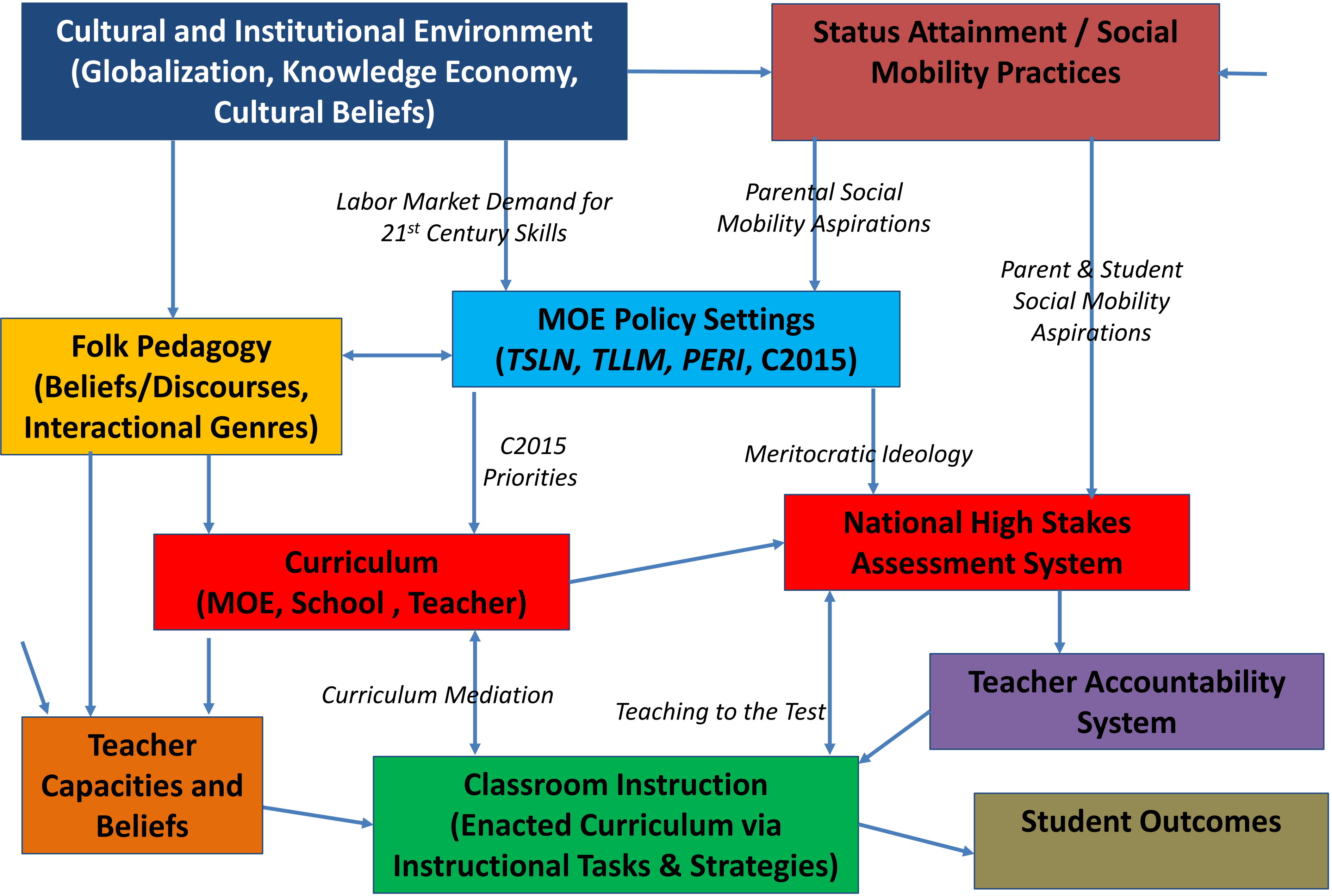
5. Tension between two normative conceptions of responsibility: institutional and professional.



Limits/Opportunity Costs of Singapore's Performativity Model

6. **Streaming** generates perverse effects
   - Institutionalizes and legitimates **deficit discourses** and low self esteem and efficacy
   - Results in some **stratification** of instructional practice
   - compounds **social class inequalities** in student achievement: **class composition effects** > instructional effects (Its not which families students come from that matters so much as which students they go to class with)

The Logic of Instruction in Singapore: An Institutionalist Model



8. Metaphysical Anxiety and Reforming the Singapore Model …

Thinking Schools, Learning Nation, 1997

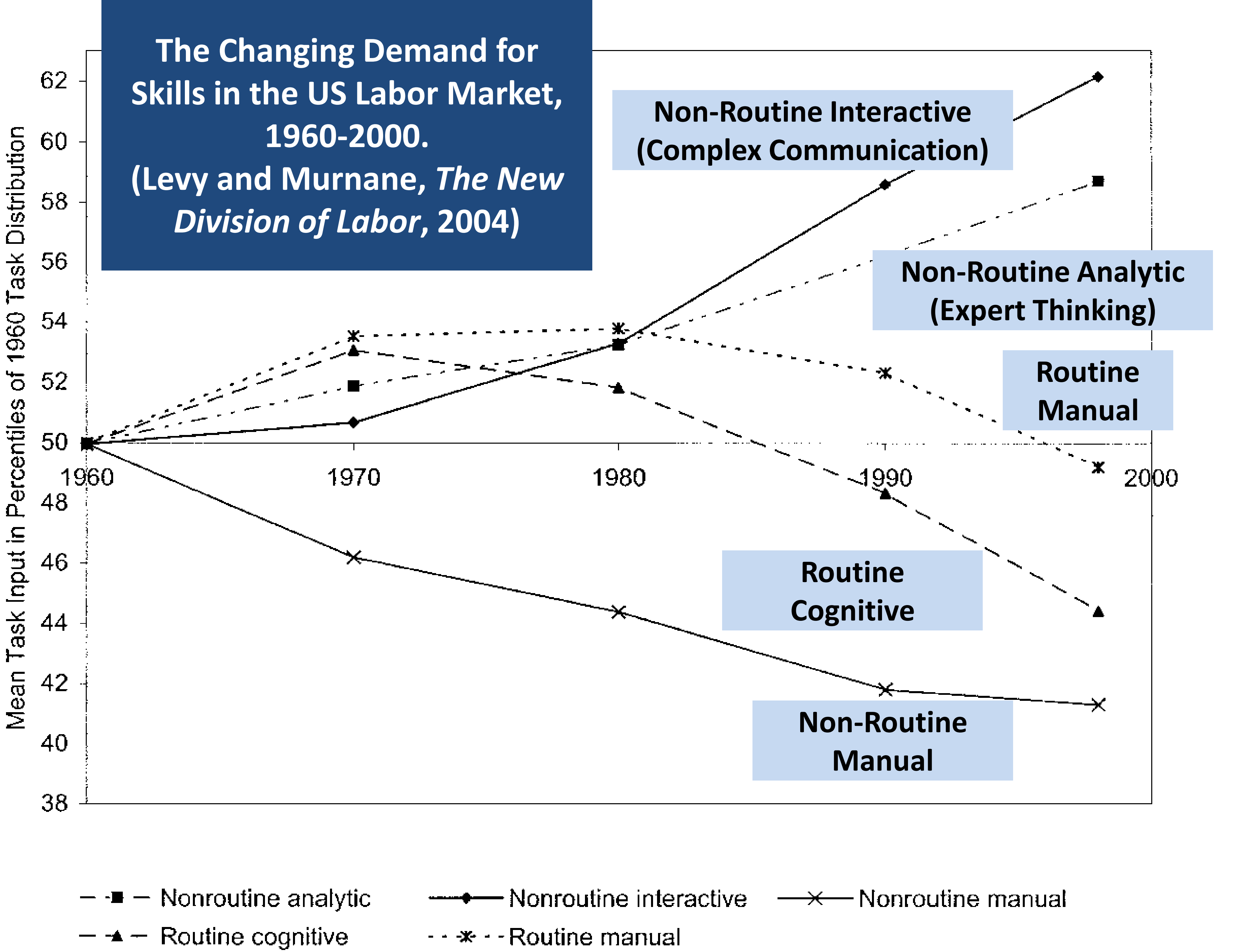
"We will bring about a mindset change among Singaporeans. We must get away from the idea that it is only the people at the top who should be thinking, and the job of everyone else is to do as told. Instead we want to bring about a *spirit of innovation*, *of learning by doing*, of everyone each at his own level all the time asking how he can do his job better..." (Italics added).

Prime Minister, Goh Chok Tong, Speech at the Opening of the 7th International Conference on Thinking in 1997, para. 31.

Teach Less, Learn More (2004-)

Reconsider How We Teach -

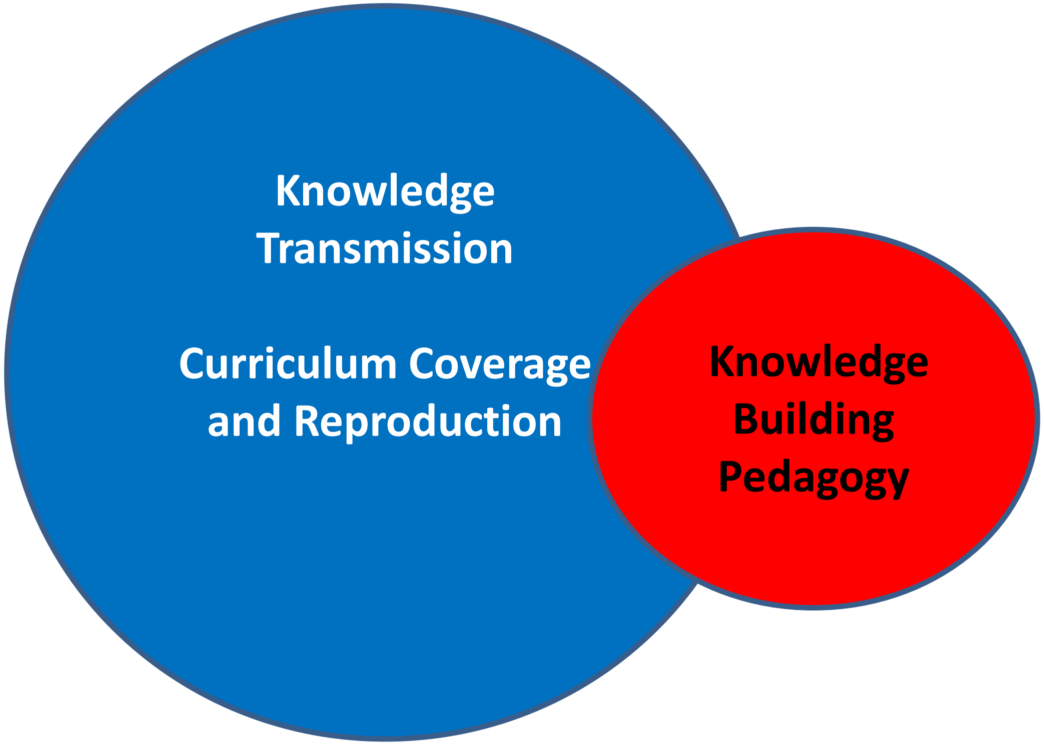
More…	Less…
Focus on Quality of learning	Focus on quantity of learning
Engaged Learning	Drill and Practice
Differentiated Teaching	'One-size-fits-all' Instruction
Guiding, Facilitating, Modelling	Telling
Formative and Qualitative Assessing	Summative and Quantitative Testing
Spirit of innovation and enterprise	Set Formulae, Standard Answers


The Changing Demand for Skills in the US Labor Market, 1960-2000.
(Levy and Murnane, *The New Division of Labor*, 2004)
Non-Routine Interactive (Complex Communication)
Non-Routine Analytic (Expert Thinking)
Routine Manual
Routine Cognitive
Non-Routine Manual
Mean Task Input in Percentiles of 1960 Task Distribution
62
60
58
56
54
52
50
48
46
44
42
40
38
1960
1970
1980
1990
2000
Nonroutine analytic
Nonroutine interactive
Nonroutine manual
Routine cognitive
Routine manual

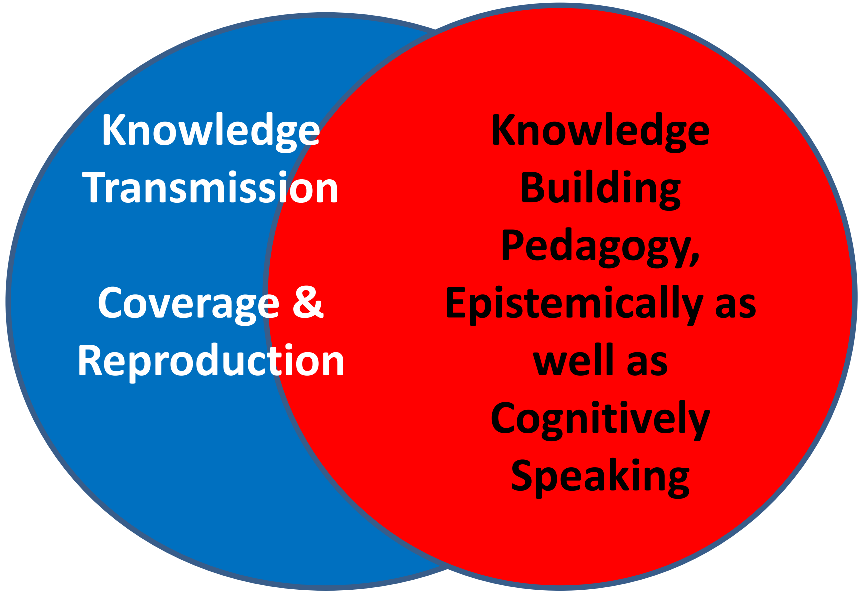
PISA 2015:
Matrix of Collaborative Problem Solving Skills: Cognitive Domain by Team Work

	(1) Establishing and maintaining shared understanding	(2) Taking appropriate action to solve the problem	(3) Establishing and maintaining team organisation
(A) Exploring and Understanding	(A1) Discovering perspectives and abilities of team members	(A2) Discovering the type of collaborative interaction to solve the problem, along with goals	(A3) Understanding roles to solve problem
(B) Representing and Formulating	(B1) Building a shared representation and negotiating the meaning of the problem (common ground)	(B2) Identifying and describing tasks to be completed	(B3) Describe roles and team organisation (communication protocol/rules of engagement)
(C) Planning and Executing	(C1) Communicating with team members about the actions to be/ being performed	(C2) Enacting plans	(C3) Following rules of engagement, (*e.g.*, prompting other team members to perform their tasks.)
(D) Monitoring and Reflecting	(D1) Monitoring and repairing the shared understanding	(D2) Monitoring results of actions and evaluating success in solving the problem	(D3) Monitoring, providing feedback and adapting the team organisation and roles

For Singapore, key challenge going forward is to get from this …



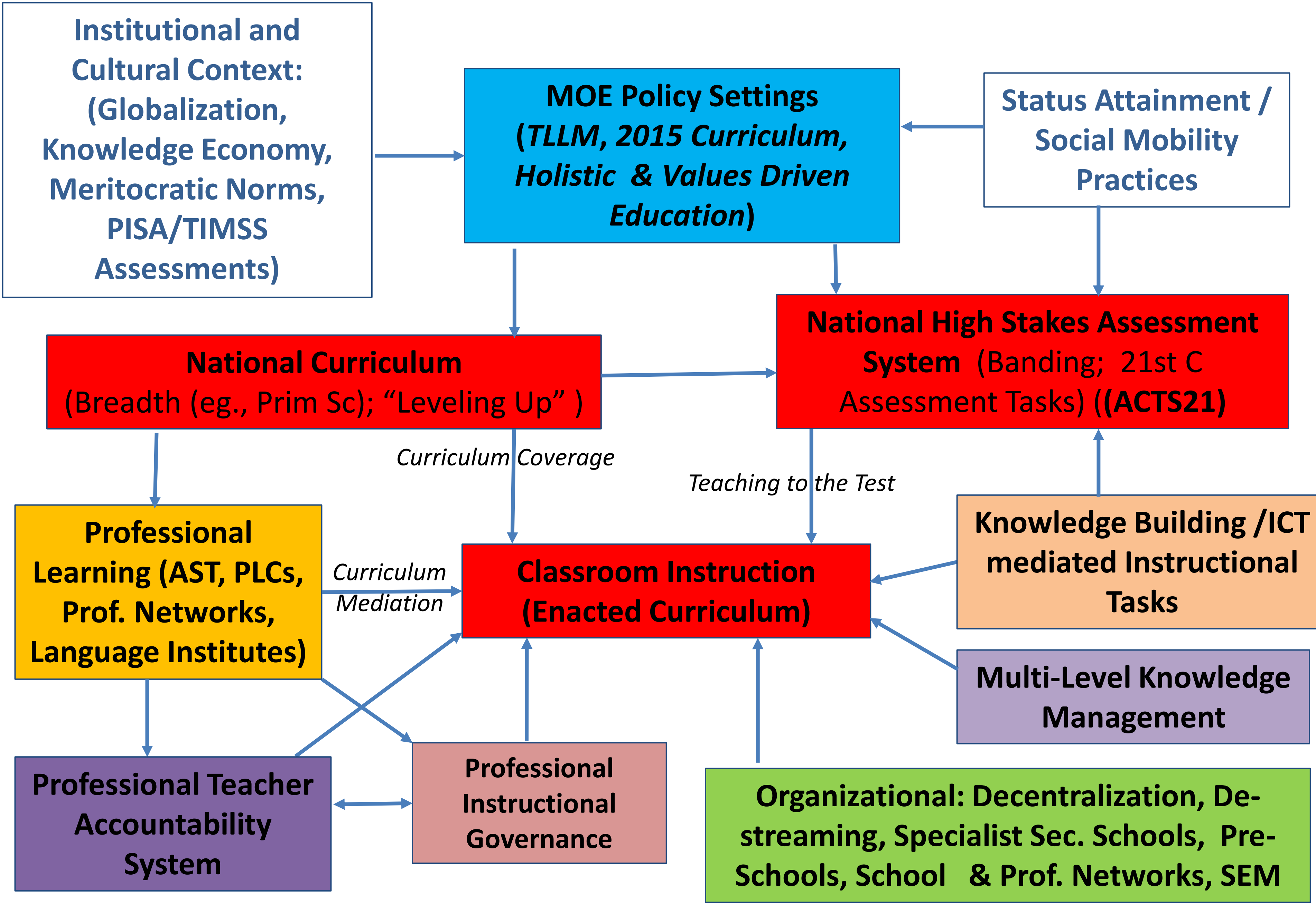
To Something Like this:
Re-weighted and Tighter Integration of Knowledge Transmission and Knowledge Building Pedagogies…



How Does MOE Plan To Get There?
Recent Reform Initiatives…

1. **Curriculum Reform**: strengthening disciplinarity and creating a national curriculum Framework
2. **Assessment Reform**: PSLE and authentic assessment tasks
3. **Instructional Reform**: Lesson planning, task design, implementation and fidelity; classroom interaction and epistemic talk
4. **Organizational Reform**: Limited de-streaming
5. **Capacity Building**:
   - Less focus on assessment & teacher accountability as preferred **drivers of instructional improvement** and more on teacher and school capacity building
   - Shift in **focus of PD programs** from conventional workshops, courses etc. to targeted, coordinated (AST), domain-specific, *in-situ*, collaborative and collective forms of professional learning / pedagogical knowledge building
   - Development of subject **professional organizations** and teacher/school networks
6. **Instructional Governance** (less prescriptive "state theory of learning," stronger professional autonomy, more capacity building)
7. **Knowledge Management** (research priority setting, funding, management, reporting and translation)
8. **Investing in Equity**: Closing the Achievement Gap ("Levelling Up").

Current Pedagogical Initiatives in Singapore



A Comparative Perspective: Instructional Infrastructure & Pedagogical Alignment in the USA and Singapore

While there are limits to the Singapore model, compared to the US and other decentralized systems, Singapore's system exhibits a well-developed "instructional infrastructure" (David Cohen) and a high degree of pedagogical alignment that secures a well integrated and highly effective pedagogical system:

"Because local control and weak government were the foundation of US public education, it never developed the common instruments that are found in many national systems and in a few US subsystems. These include common curriculum or curriculum frameworks, [common textbooks], common examinations that are tied to the curricula, teacher education that is grounded in learning to teach the curriculum that students are to learn, and a teaching force whose members succeeded in those curricula and exams as students, among other things. Teachers who work with such infrastructure have instruments that they can use to set up academic tasks tied to curriculum and assessment. The framework can help them define quality in students work and valid evidence of quality. They have a common vocabulary with which they can work with each other to identify, investigate, discuss and solve problems of teaching and learning. Hence they can have professional knowledge and skill, held in common. School systems with such infrastructure also have means with which the system might influence instruction, at scale."

David Cohen, "Teacher Quality: An American Educational Dilemma." In M. Kennedy, ed., *Teacher Assessment and the Quest for Teacher Quality. A Handbook*. San Francisco: Jossey-Bass, 2010, pp. 375-376.

9. Conclusion.

Whither Australian Pedagogy?
A Metaphysics for the Incurably Hopeful

Whither Australian Pedagogy?

1. In general, Australia performs at well above the OCED average in both TIMSS and PISA **international assessments**.

   No reason then for Australia to despair over its TIMSS and PISA results, *in general* (although issues of equity are another matter entirely).

   In any case, the gap between Singapore and Australia for problem solving much less than the gap for mathematics, reading and science.

   Further, there are arguably more important national educational priorities than edging higher up the international CIAs leagues tables, although it is important that we not slip too much.

2012 PISA Problem Solving

Country	Solution Rate for *Acquisition of Knowledge* Tasks % Correct	Solution Rate for *Utilization of Knowledge* Tasks % Correct	Solution Rate for *Static* Problem Situations % Correct	Solution Rate for *Interactive* Problem Situations % Correct
1. Singapore	**62.0**	**55.4**	**59.8**	**57.5**
2. Korea	62.8	54.5	58.9	57.7
3. Japan	59.1	56.3	58.7	55.9
4. Macao-China	58.3	51.3	57.0	51.7
5. Hong Kong - China	57.7	51.1	56.1	52.7
6. Shanghai - China	56.9	49.8	56.7	50.3
7. Chinese Taipei	56.9	50.1	56.3	50.1
8. Canada	52.6	52.1	52.7	50.5
9. Australia	**52.3 (-7.7)**	**51.5 (-3.9)**	**52.8 (-7.0)**	**49.9 (-7.6)**
10. Finland	50.2	51.0	52.1	47.7
PISA Average	45.5	46.4	47.1	43.8

Source: PISA 2012, Vol. 5, p15.

Whither Australian Pedagogy?

2. Overall, although the comparative data base is very limited, the **quality of instructional practice** in Australia is not too bad relative to other countries.

   Relatively strong commitment to engaging students in complex cognitive work / knowledge building

   While instructional practices can be improved, there is no good reason for Australian teachers and policy makers to wring their hands in despair and throw their lot in with **doomsayers** when comparing their instructional practices to those of other high performing systems.

Whither Australian Pedagogy?

3. Still, the quality of teaching and learning should and can be improved.

   But Australia cannot hope, and should not, attempt to ***imitate*** or ***mimic*** Singapore's performative instructional regime, given how dependent it is on Singapore's unique institutional and cultural context.

   In any case, Singapore is now in the middle of a two decade long process to reconstruct its pedagogical regime.

   But Australia can ***learn from*** Singapore's experience, although what we might learn will depend on which learning goals policy-makers prioritize at the national and state level:

   1. prioritizing **increasing achievement scores** on PISA, TIMSS and the rest

   2. prioritizing **deep learning, the development of disciplinary expertise, knowledge building, knowledge transfer and metacognitive self regulation** *(~ 21st century understandings and skills).*

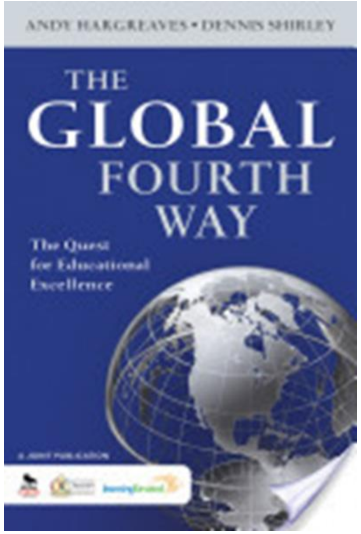
   I will focus my comments on 2 on the grounds that 2 is likely to lead to 1 while 1 is unlikely to lead to 2.

Whither Australian Pedagogy?

By all means **benchmark** Australia's performance, but benchmark against jurisdictions and assessment regimes that share our national learning goals, have similar cultural backgrounds and institutional arrangements and who recognize that high levels of performance and equity are complementary.

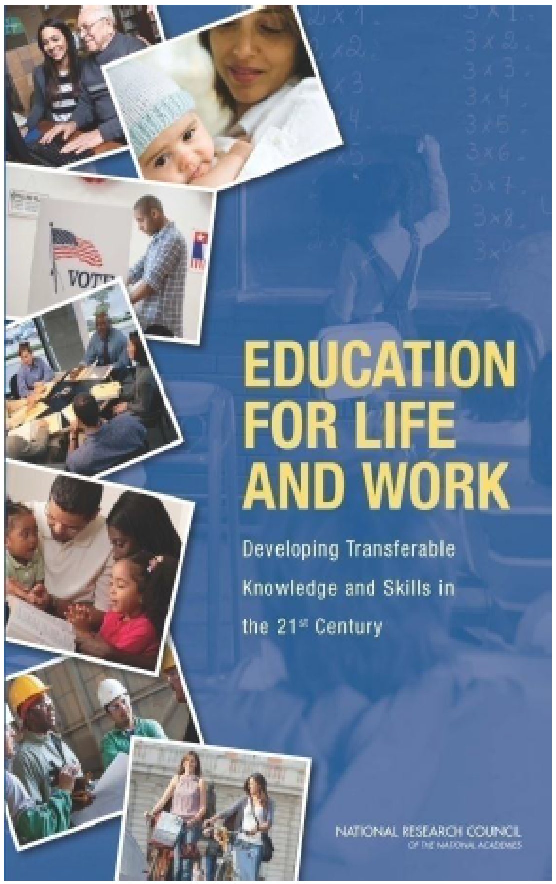
Use benchmarked results as an occasion to critically reflect and evaluate Australia's pedagogical practice and performance levels, especially those who perform poorly, not automatically trash the curriculum, bash teachers, ignore educational research, and instigate and justify educational reform for partisanal ideological and political purposes

"The main purpose of benchmarking is to prompt *learning about* and *inquiry into* one's own performance as a result of comparing it with a thorough review of the performance of the those who do it even better." Andy Hargreaves and Dennis Shirley, *The Global Fourth Way: The Quest for Educational Excellence.* Corwin, 2012, p. 13.



Education for Life and Work:

Developing Transferable Knowledge and Skills in the 21st Century



Committee on Defining Deeper Learning and 21st Century Skills

Division of Behavioral and Social Sciences and Education
National Research Council

Whither Australian Pedagogy?

4. Secure **national agreement** at the policy level to reduce political pressure at the state, school and classroom level to focus on optimizing NAPLAN scores rather than depth of learning, the development of disciplinary expertise, metacognitive wisdom …

5. The *primary* focus of state educational policy – and the essential *precondition* for substantial and sustained improvement in teaching and learning -- should be developing a coherent and appropriately integrated **instructional infrastructure** and improving the quality of **teaching**, especially the design and implementation of initiatives to improve the **instructional core and student and teacher learning.**

   All else is secondary, including the development of assessment based performative accountability systems.

6. The key to developing coherent **instructional infrast**ructure is to ensure the proper alignment (not too tight, not too loose) of curriculum, instruction, student assessment, teacher learning (pre-service training and in-service PD) and teacher assessment

   Cohen, Elmore, Fullan and Langsworthy

Towards Collective PCK:
Strong and Coherent Instructional Core (Elmore) / Infrastructure (Cohen)

A strong and coherent instructional infrastructure as the basis of productive pedagogical alignment:

- Common curriculum or curriculum framework with clear and high standards
- Textbooks and curriculum framework tied to the curriculum framework
- Common assessments tied to the curriculum framework*
- Teacher education grounded in the curriculum that students are to learn
- Teaching force whose members succeeded in these curriculum based exams, among other things
- Teachers who work with such infrastructure have instruments that they can use to set academic tasks tied to curriculum and assessment. They have a common vocabulary with which can work to identify, investigate, discuss and solve problems of teaching and learning. Hence they can have professional knowledge and skill, held in common. School systems with such infrastructure also have means with which the system might influence instruction, at scale."
  - David Cohen, "Learning to Teaching Nothing in Particular." *American Educator*, Winter 2010-2011, p. 45.
  - David Cohen, "Teacher Quality: An American Educational Dilemma." In M. Kennedy, ed., *Teacher Assessment and the Quest for Teacher Quality. A Handbook*. San Francisco: Jossey-Bass, 2010, pp. 375-376.

The Instructional Core and Student Learning

"There are only tree ways to improve student learning at scale.

The *first* is to increase the level of knowledge and skill that the **teacher** brings to the instructional process.

The *second* is to increase the level and complexity of the **content** that students are asked to learn.

And the *third* is to change the **role of the student** in the instructional process.

That's it. If you are not doing one of these three things you are not improving instruction and learning. Everything else is instrumental. That is, everything that is not in the instructional core can only affect student learning and performance by somehow influencing what goes on *inside* the core.

Furthermore, if you change any element of the instructional core, you have to change the other two"

Source: E. City, R. Elmore, S. Fiarman and L. Teitel, *Instructional Rounds in Education*, Cambridge, MA: Harvard Education Press, 2009, p.24.

Whither Australian Pedagogy?

7. The key to improving the **instructional core** – and student motivation, engagement and the quality of learning -- is the design and implementation of **instructional tasks conceived as multi-dimensional opportunity systems**.

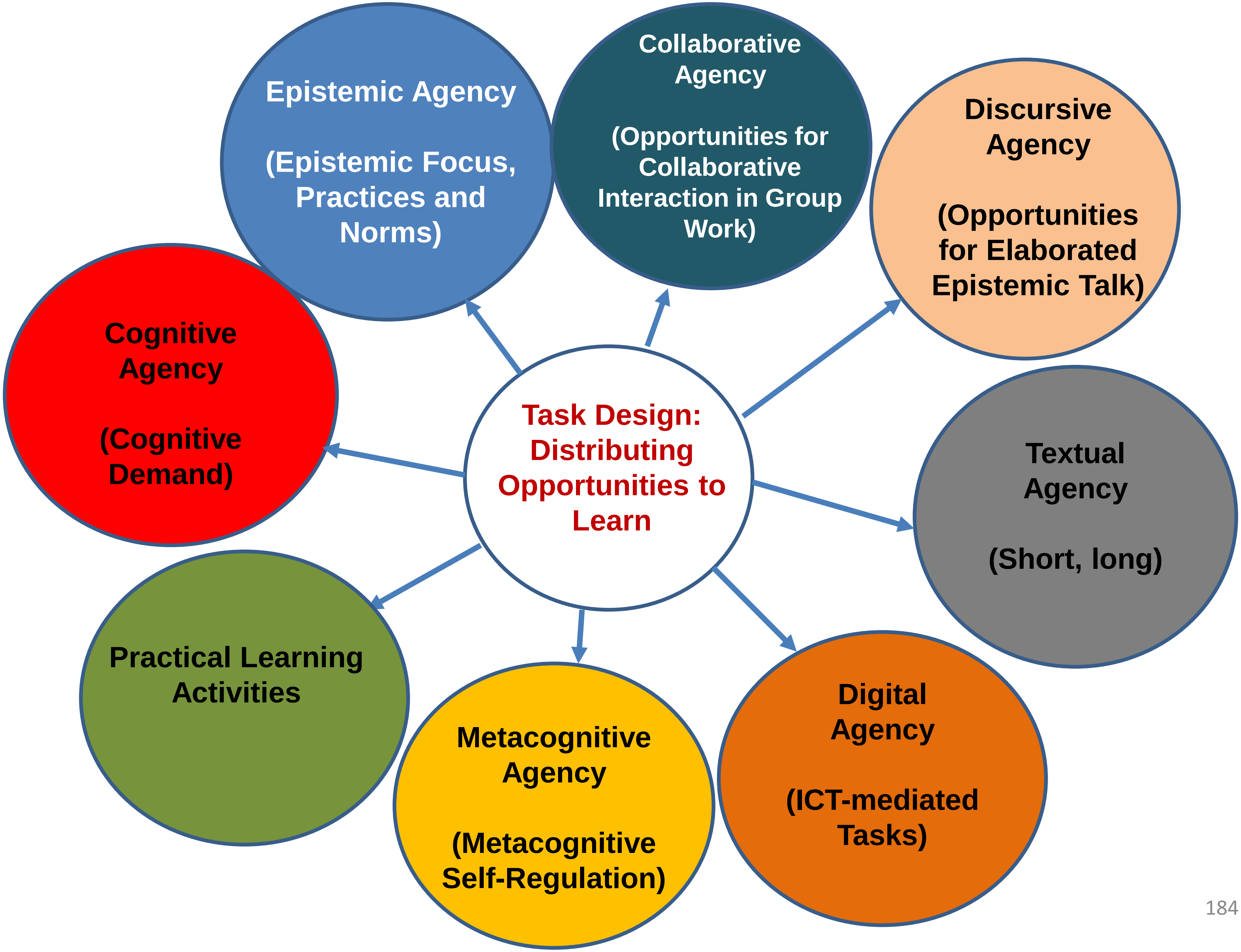
   Tasks drive (as well as predict) performance. This is especially critical for systems committed to developing a **knowledge building pedagogy.**

   The starting point "new pedagogies" is the formation of **new learning relationships** between students and teachers based on new definitions of their respective roles in the learning process in which the role of teachers shifts from focusing on covering all required content to focusing on the learning process, developing students ability to lead their own learning and to do things with their learning…

   A second "core component of the new pedagogies is what we call **deep learning tasks**. These tasks harness the power of …new learning partnerships [between teachers and students] to engage students in practicing the process of deep learning through discovering and mastering existing knowledge and then creating and using new knowledge in the world."

   M. Fullan and M. Langsworthy, *A Rich Seam: How New Pedagogies Find Deep Learning*. Pearson: London, 2014, pp.7, 21.

Instructional Tasks as Multi-dimensional Opportunity Systems.



Building Teacher Capacity: PCK / PKB

8. Improving the quality of the instructional core and therefore the quality of student learning depends substantially but not exclusively on **teacher capacity building** and improving the **quality of teaching** rather a primary focus on teacher quality and teacher accountability. But the design of teacher capacity building (i.e., PD) is critical: some designs have limited impacts, some designs have moderate impacts, and some have a substantial impact.

8.1. **Limited impact** on teacher beliefs and practices

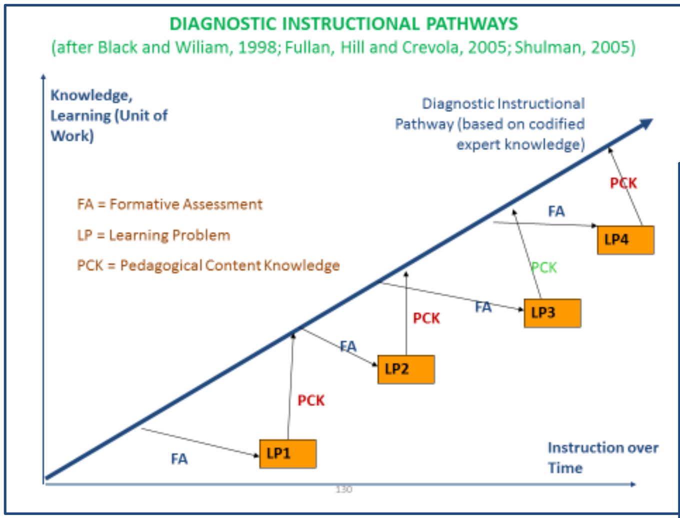
- **Conventional** presentations, workshops, retreats (no impact on student performance in Singapore)
- Conventional graduate school **course work** in generic educational subjects
- Distributing **books/articles** on effective teaching to teachers

8.2. **More substantial** impact on teacher beliefs and practices

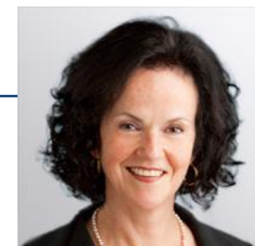
- Dedicated **pedagogical graduate course work** that focuses explicitly on domain-specific curriculum content and on PCK for specific topics in the curriculum
- **Individual level PD** focused on monitoring, modelling and mentoring (M^3 PD) *in-situ* by senior or expert teachers to enhance PCK /PKB (Singapore excels in this using a modified action research model)
- The **codification, validation and dissemination of expert PCK** : e.g., Lee Shulman's *Signature Pedagogies* for PD and Deborah Ball's *TeachingWorks* initial teacher education program at the University of Michigan with its focus on "high leverage" content and instructional practices

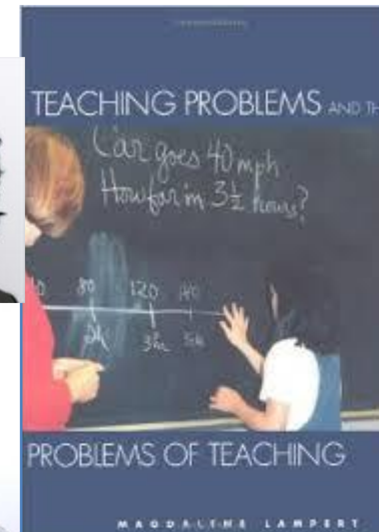
Building Teacher Capacity: PCK / PKB

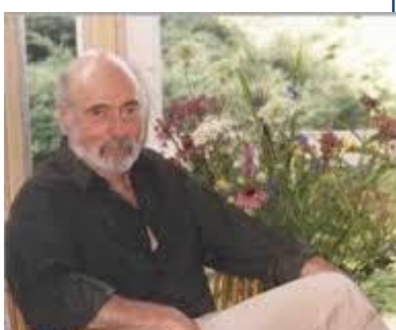
The **codification, validation and dissemination of expert PCK** : Lee Shulman's *Signature Pedagogies* for PD, Deborah Ball's *TeachingWorks* initial teacher education program at the University of Michigan with its focus on "high leverage" content and instructional practices: not learning about teaching but learning to teach. James Hiebert's work on the development of instructional "artifacts" (including highly annotated iterative lesson plans) also addresses the importance of developing collective forms of PCK, along with David Cohen's emphasis on the development of coherent instructional "infrastructure."



TeachingWorks
UNIVERSITY of MICHIGAN







Towards collective PCK: Knowledge Artifacts

"The belief that teaching can be improved by improving the quality of teachers" is undermined by the assumption, among others, "that knowledge for teaching should be held in the heads of individual teachers rather than in artifacts. Artifacts, or knowledge products, survive individuals and can be shared and improved over time…

In our opinion, two kinds of instructional products are especially useful: specially annotated lesson plans and common assessments."

J. Hiebert and A. Morris, "Teaching, Rather Than Teachers, As a Path Towards Improving Classroom Instruction." *Journal of Teacher Education*, Jan 2012.

Lesson Plans and Collective PCK. p. 95

“Building and using annotated lesson plans and common assessments. Annotated lesson plans contain knowledge of two kinds—what to do and why/how to do it that way. “What to do” offers prescriptions that teachers can implement to help students achieve the specified earning goals; “why/how to do it that way” provides a rationale or local theory for why the prescription might work along with information that teachers will likely need to understand and implement the plan as described.

More precisely, the annotated lesson plans we have in mind contain the following features. First, the learning goals for the lesson are stated as explicitly and completely as possible. The more explicit and precise the learning goals, the more clearly they guide the selection and implementation of instructional activities and the easier it is to assess whether the activities are helping students achieve the goals. Second, the rationales for key instructional moves are presented so teachers understand the reasons for the instructional decisions and can adapt them to local settings without changing the core aims of the lesson. Third, the learning goals, rationales, and instructional activities are described in enough detail that teachers can implement them as intended. Fourth, students’ likely responses to instructional tasks and questions are predicted to allow teachers to plan how to use students’ thinking during the lesson. Suggestions for the teacher are provided. Finally, information is presented to help teachers implement the lesson. This information moves beyond rationales and includes things like background information on the key concepts, helpful hints to prevent common difficulties for the teacher or the students, and markers in the lesson where particular kinds of explanations will be especially beneficial.

It is not hard to see how each feature of a lesson plan can improve with each implementation. Information can be gathered on the completeness and clarity of the learning goals and of the rationales, on the effectiveness of the instructional activities, on students’ responses, and on the aspects of the lessons for which instructors need more assistance. Those who revise lessons can take advantage of this information to elaborate and refine each feature. This yields continuously improving lessons and increasingly useful knowledge.”

Conceptually, closely related to Japanese study lessons.

J. Hiebert and A. Morris, “Teaching, Rather Than Teachers, As a Path Towards Improving Classroom Instruction.” *Journal of Teacher Education*, Jan 2012

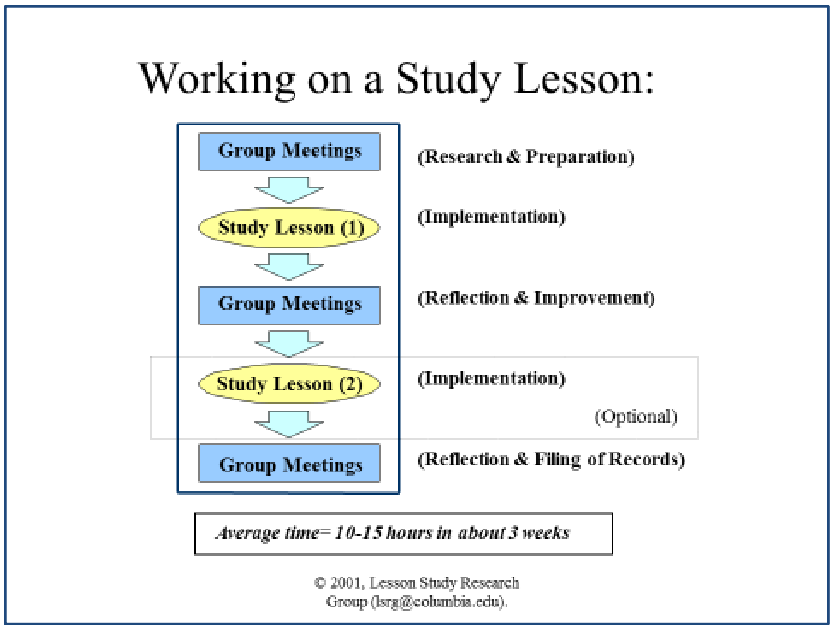
Building Pedagogical Content Knowledge Collectively

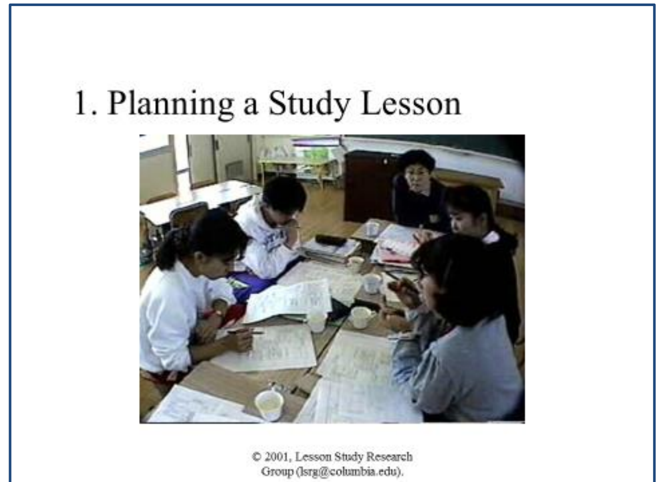
8.3 The strongest models focus on **collective or joint forms of pedagogical knowledge building (PKB)** in a deliberate and sustained attempt to reconstruct the instructional core of the practice of teaching and achieve **instructional coherence at scale**

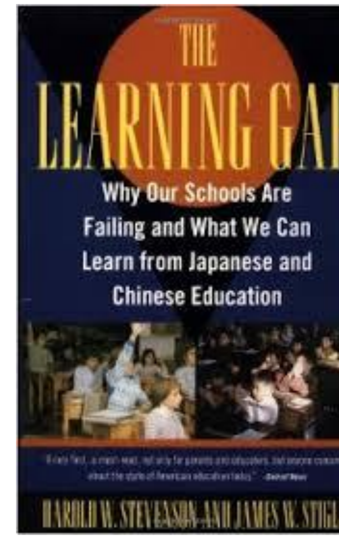
8.3.1. **Observation / videography / analysis / formative feedback** of individual lessons by peers within school / network of schools. Highly collaborative, less demanding and relatively sustainable, but effectiveness depends on CK and PCK of teachers involved.

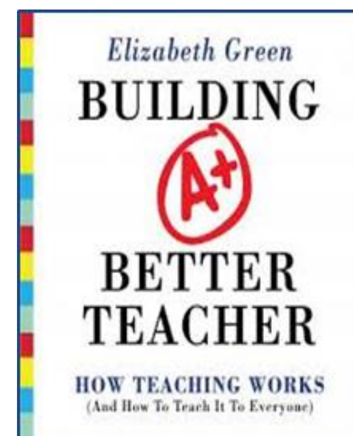
Building Pedagogical Content Knowledge Collectively

8.3.2. Japanese Lesson Study (*jugyokenkyu:* “no teacher works alone”): teachers working collaboratively on developing, implementing, revising and implementing instructional tasks and strategies and lesson plans more generally (Japan, Singapore, Taiwan, elsewhere). Demanding of time, resources and teacher commitment but very effective.

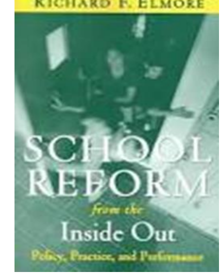


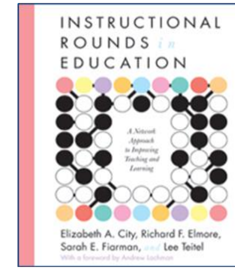






Building Pedagogical Content Knowledge Collectively





8.3.3. Instructional Rounds as Collective Pedagogical Knowledge Building: Richard Elmore's model of de-privatized classrooms and *collective* practices of instructional improvement that focuses on developing a coherent *collective* instructional core and shared PCK across classrooms within and across schools at scale.

"…the problem of instructional innovation is not so much resistance to change but that innovations rarely get inside the closed, privatized world of the classroom and *challenge the mental world of teachers' instructional beliefs, conceptions of learning and teaching.*

Richard Elmore, Getting to Scale with Educational Practice. *HER,* 66, 1, 1966.

Improving the quality of teaching and learning is a direct "function of learning to do the right things in the setting where you work. … The problem is that there is almost no opportunity for teachers to engage in *continuous learning about their practice in the setting in which they actually work*, *observing and being observed by their colleagues in their own classrooms and classrooms of other teachers in other schools confronting similar problems of practice*."

Richard Elmore, *School Reform From the Inside Out*, 2004, pp 73, 127.

"…you cannot change learning and performance at scale without creating a strong, visible, transparent common culture of instructional practice."

E. City, R. Elmore, S. Fiarman and L. Teitel, *Instructional Rounds*, 2009, p. 32.

Building Pedagogical Content Knowledge Collectively - Instructional Rounds

Teams of expert teachers / senior PD staff visit (do instructional rounds) of teachers classrooms for extended visits and detailed and sustained observation, description, analysis, judgement and feedback focusing on four sets of questions:

- What **instructional tasks** have teachers asked their students to do and explained why?
- **What are students actually doing**? Are they working on the instructional tasks that teachers set for them? What kind of learning is occurring in this lesson and is cumulative over the course of the lesson?
- Are the **instructional strategies** teachers use to support student learning effective? Do teachers give student time to think, ponder, question, try alternatives, critique, etc?
- **What should the teacher do next** to improve the instructional core and the quality of learning? What is the next level of work in this classroom? What support and resources does this teacher need to do so?

To be effective, formative evaluation of teaching and the improvement of teaching and learning requires a distinct bureaucratic line of reporting and accountability to the summative evaluation of teacher performance in order to generate trust, transparency, risk taking and innovation.

Building Pedagogical Content Knowledge Collectively

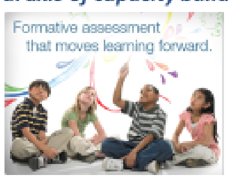
6.340. PLC (of which Dylan Wiliam's *Keeping Learning on Track* in the US is a particularly strong model: 3 day workshop, plus resources, structure, and curriculum for 2 years of ongoing embedded learning focused on formative assessment in highly structured teacher learning communities)

Formative Assessment and PD: Keeping Learning on Track

"*Keeping Learning on Track* (KLT) is fundamentally a sustained professional development program for teachers, and as such, it has deep roots in the notion of **capacity building** developed by Elmore…

We were lead to **teacher professional development** as the fundamental lever for improving student learning by a growing body of research on the influences on student learning which shows that teacher quality trumps virtually all other influences on student achievement…

Through this logic, we joined Elmore and others – notably Fullan, Hill and Crevola (2006) – in pointing to ***teacher professional development focused on the black box of day to day instruction as the central axis of capacity building efforts***."



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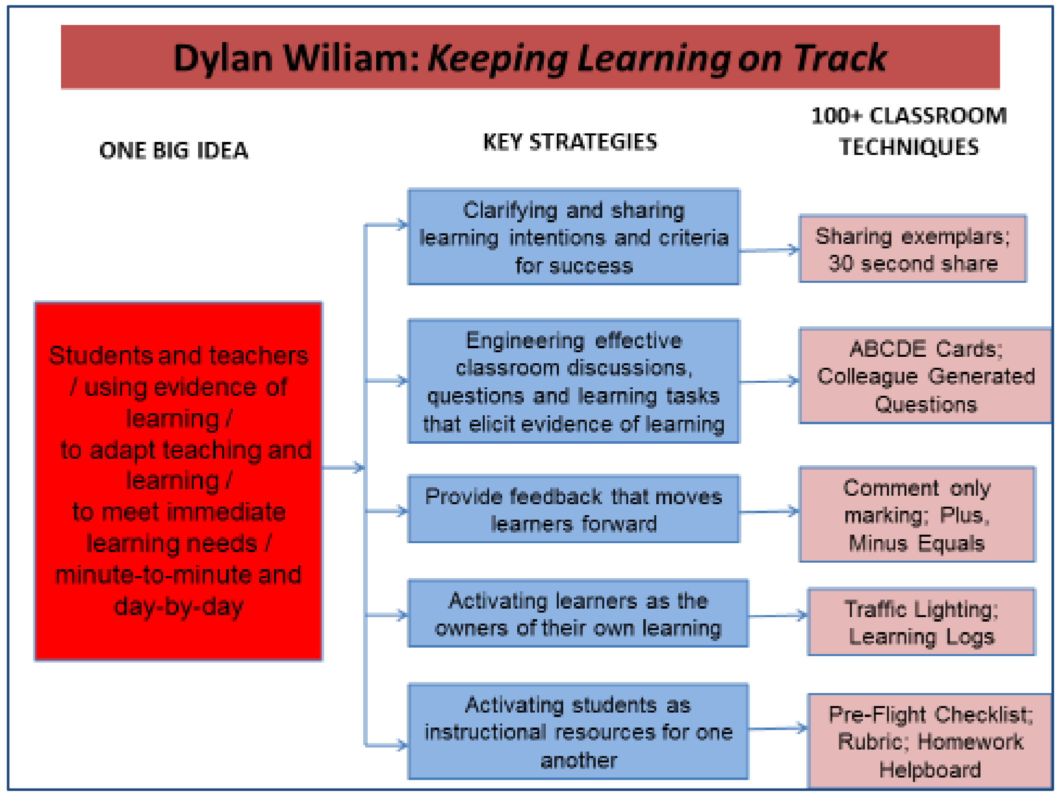
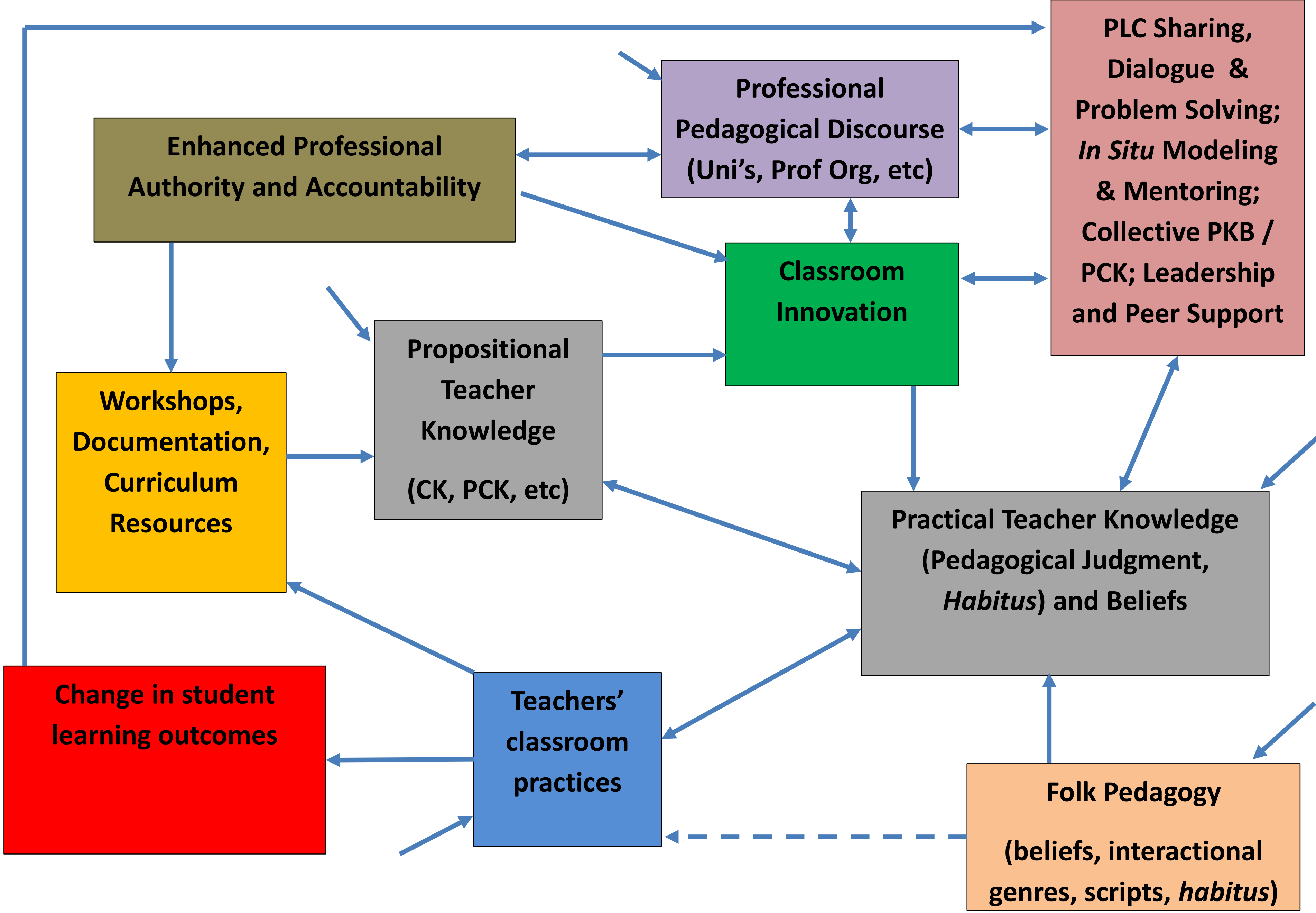


Capacity Building vs Accountability Drivers

Ineffective Drivers	Effective Drivers
Accountability strategies that focus on structure, procedures and other formal attributes of the system: standards, monitoring, assessments and test results and teacher appraisal to reward or punish teachers	Capacity building strategies that work directly on changing the culture of the school systems (values, norms, skills, practices, relationships) and teaching and learning in classrooms
Foster performative orientation to teaching and learning	Foster intrinsic motivation of teachers and students
Rely on technology (computers, internet, specialized software) to enhance the quality of teaching and learning	Encourage educators and students in continuous improvement of instruction and learning
Rely on individual teacher and leadership qualities	Building social capital: rely on team work and collective practices
Fragmented and uncoordinated change strategies	Systemic change strategies: affects all teachers and students ("systemness")

M. Fullan, *Choosing the wrong drivers for whole system reform*. Melbourne: Centre for Strategic Education, April 2011.



Effective Teacher Learning and Instructional Change

Building Pedagogical Content Knowledge Collectively

9. Where ever possible, incorporate complex 21st century knowledge tasks (including "rich tasks" and collaborative ICT mediated 21st century tasks) into **high stakes assessments**. Not easy, but will drive significant change in instructional practice (as in "teaching to the test"). Major efforts on going internationally now and will feature in **PISA 2015**.

	(1) Establishing and maintaining shared understanding	**(2) Taking appropriate action to solve the problem**	**(3) Establishing and maintaining team organisation**
(A) Exploring and Understanding	(A1) Discovering perspectives and abilities of team members	(A2) Discovering the type of collaborative interaction to solve the problem, along with goals	(A3) Understanding roles to solve problem
(B) Representing and Formulating	(B1) Building a shared representation and negotiating the meaning of the problem (common ground)	(B2) Identifying and describing tasks to be completed	(B3) Describe roles and team organisation (communication protocol/rules of engagement)
(C) Planning and Executing	(C1) Communicating with team members about the actions to be/ being performed	(C2) Enacting plans	(C3) Following rules of engagement, (*e.g.*, prompting other team members to perform their tasks.)
(D) Monitoring and Reflecting	(D1) Monitoring and repairing the shared understanding	(D2) Monitoring results of actions and evaluating success in solving the problem	(D3) Monitoring, providing feedback and adapting the team organisation and roles

Fullan and Langworthy on 21st tasks

The starting point "new pedagogies" is the formation of new learning relationships between students and teachers based on new definitions of their respective roles in the learning process in which the role of teachers shifts from focusing on covering all required content to focusing on the learning process, developing students ability to lead their own learning and to do things with their learning…

A second "core component of the new pedagogies is what we call deep learning tasks. These tasks harness the power of …new learning partnerships [between teachers and students] to engage students in practicing the process of deep learning through discovering and mastering existing knowledge and then creating and using new knowledge in the world."

M. Fullan and M. Langsworthy, *A Rich Seam: How New Pedagogies Find Deep Learning*. Pearson: London, 2014, pp.7, 21.

Building Pedagogical Content Knowledge Collectively

10. Invest in **reducing class load** rather than reducing **class size**: enable collective PKB/PCK.

11. Invest in **equity**. Implement Gonski recognizing --
    - that there is no necessary trade off between equity and excellence
    - that the marginal returns for investing in low achieving students > marginal returns for investing in high achieving students
    - that classroom composition (who students go to class with) matters more than which particular family students come from

And take a good hard look at Singapore's "levelling up" initiative and extensive top down T&L learning support for struggling schools …

ABC Lateline, 16/07/2012

STEVE CANNANE: OK. If there's not an issue around equity in Australian schools, why is it that the bottom 10 per cent of maths students in Shanghai perform at a level that is 21 months ahead of the bottom 10 per cent of students in Australia?

CHRISTOPHER PYNE: Because the education system is failing our students.

STEVE CANNANE: But the gap between the highest performers and the lowest performers in Shanghai and in Singapore and Korea is much narrower than in Australia. Doesn't that show that Australia has an equity problem compared to those school systems you were quoting?

CHRISTOPHER PYNE: No, it doesn't. No, it doesn't show that it has an equity problem. It shows that it has a student outcomes problem. It shows that we are failing our students when they are so far behind our East Asian neighbours, but it's not about equity, it's about the outcomes of our poor students who aren't being given the right education in the first place.

STEVE CANNANE: So isn't dragging students from the bottom up, isn't that an issue about equity?

CHRISTOPHER PYNE: No, it's not. The greatest determinants of the outcome of students is the parental involvement in their children's lives at school, it's about principal autonomy, it's about the independence that teachers have to teach, it's about governing council control of schools.

STEVE CANNANE: But it's also about socioeconomic background, isn't it?

CHRISTOPHER PYNE: No, not really. The biggest determinant of whether a student succeeds or not is the parents' involvement in their student's education systems, the autonomy of school systems, so that's why in the non-government school systems students tend to perform better and in the non-government school systems, of course, they are much more autonomous.

2012 PISA Mathematics: Equity Statistics

Country	Australia	Singapore	OECD Average
Overall Score	**504**	**573**	494
% < Level 2 (<420.7)	**19.6%**	**8.3%**	**23.0%**
% Level 5 and 6 (> 606.9)	**14.8%**	**40.0%**	12.6%
Index of Academic Inclusion (IAC) (BSV/BSV+WSV) [WSV=L1 only]*	**72.1**	**92.5***	64.2
% of resilient students (PISA 2012) (Disadvantaged students who perform much higher than would be predicted by their background).	**6.3%**	**15.1%**	6.5%
% of resilient students (PISA 2009)	**7.7%**	**11.9%**	7.7%

Source: PISA 2012, Vol. 1. pp. 297, 305, 320; Vol. 2, p.174, 194, 196; PISA 2009, Vol. 2, p.169.

OECD, Inequality and Growth Report,2014

Key findings

- The gap between rich and poor is now at its highest level in 30 years in most OECD countries.
- This long-term trend increase in income inequality has curbed economic growth significantly.
- While the overall increase in income inequality is also driven by the very rich 1% pulling away, what matters most for growth are families with lower incomes slipping behind.
- This negative effect of inequality on growth is determined not just by the poorest income decile but actually by the bottom 40% of income earners.
- This is because inter alia people from disadvantaged social backgrounds underinvesting their education.
- Tackling inequality through tax and transfer policies does not harm growth, provided these policies are well designed and implemented.
- In particular, redistribution efforts should focus on families with children and youth, as this is where key decisions on human capital investment are made and should
- promote skills development and learning across people's lives.

Why does inequality reduce growth?

The evidence is strongly in favour of one particular theory for how inequality affects growth: by hindering human capital accumulation income inequality undermines education opportunities for disadvantaged individuals, lowering social mobility and hampering skills development.

Impact of social background

Analysis drawing from education data and the recent OECD Adult Skills Survey (PIAAC) shows that the human capital of people whose parents have low levels of education deteriorate, as income inequality rises. By contrast, there is little or no effect for the human capital of people with middle or high levels of parental educational background. These patterns hold for both the quantity of education (e.g. schooling years) and its quality (e.g. skills proficiency).

An example for numeracy scores: a 6 points increase in income inequality (corresponding to the US-Canada differential in 2010) would lower numeracy by around 6 points among low-background individuals. This is nearly 40% of the gap relative to individuals with medium parental backgrounds.

In sum, the analysis suggests that inequality significantly shapes the opportunities of education and upward mobility of disadvantaged individuals.

OECD, *FOCUS on Inequality and Growth.* OECD, Paris December 2014, p.3

What about Policy, Institutions and Pedagogy?

12. Culture matters, but culture is not destiny

Policy, institutions and agency matter as well, and can mediate and moderate the impact of culture and history over the medium to long term.

Pedagogy (curriculum, assessment and instruction) matters as well, but is deeply embedded in cultural formations and institutional arrangements.

Pedagogical practices can be changed by policy, but only slowly and only if --

- There is considered **consultation and deliberation** beforehand
- Teachers consider the recommended changes **sensible**, informed, principled and responsible
- There is adequate and timely **capacity building**, resourcing and learning support for teachers
- There is intensive and continuous interrogation of relevant **teacher beliefs, preconceptions and instructional *habitus*** (“culture work”)
- There is adequate opportunity for **teacher mediation and adaptation** at the local level
- Changes are **not rushed**
- **Pedagogical alignment** is established or sustained between curriculum, assessment and instruction

Whither Australian Pedagogy?

13. **Traps for the unwary**:

- Creeping governmental prescriptivism in the **national curriculum and instructional practice** ("state theory of learning"). Importance **local mediation** and **adaptation**.

- Creeping institutional authority **of NAPLAN** resulting in
  - escalating pressure for teachers to teach to the test
  - low ceiling effects that constrain appetite and opportunity for innovation and improvement.

  [Restrict / reframe NAPLAM as one among many diagnostic tools, not a comparative summative judgement].

- Confusing **teacher quality** with the **quality of teaching**

- Teacher and school accountability systems that constrain (principled) **risk taking and innovation**

- Narrow band-with **accountability systems** that neglect learning outcomes valued by teachers and the parent community at the school level ("rich accountabilities")

- **Cherry-picking** instructional practices from other countries without recognizing the nature of the cultural and institutional contexts in which these practices are embedded and gain traction.

NAPLAN and Teaching to the Test

COMMONLY SHARED VIEWS

NAPLAN is seen as a significant event in the annual school calendar which impacts, to varying degrees, on every aspect of the school community: students, their families and teachers, the curriculum and the relationship between all of these.

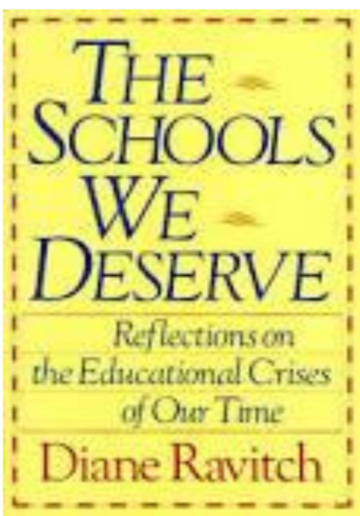
NAPLAN is regarded as a requirement that teachers and Principals strive to make the most of. The benefit of NAPLAN was seen to be a tool that may identify trends or gaps in skills and knowledge that the school may need to address. Teachers and Principals were especially concerned about NAPLAN's narrow focus on literacy and numeracy, its cultural insensitivity, its negative impact on 'best practice' pedagogy and its capacity to undermine students' self-confidence. Teachers and Principals acknowledged the fine balance and pressure associated with ensuring the welfare of their students, yet improving performance because of its relationship to funding decisions…

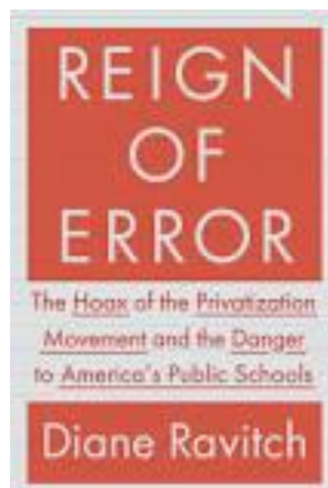
The results of this study confirm … that NAPLAN is a significant pedagogical intervention which has some positive uses, but is plagued by negative impacts on learning and on student well-being. While it may provide a diagnostic tool for some teachers to re-evaluate their approach and how they teach literacy and/or numeracy, there is a disconnect between the formal and inflexible style of NAPLAN and learning and teaching approaches that emphasise deep learning supported by student and teacher teamwork in a process that tailors learning to the student's needs. Resignation to NAPLAN was one of the most common responses by teachers and school Principals.

J. Wyn, M. Turnbull and L. Grimshaw, *The Experience of Education: The Impacts of High Stakes Testing on School Students and their Families.* Whitlam Institute, University of Western Sydney, May 2014, pp. 5-6.

- Be Careful of What You Wish For…

“China has the best education system in the world because it can produce the highest test scores. But … it also has the worst educational system in the world because these test scores are purchased by sacrificing creativity, divergent thinking, originality and individualism.” Dianne Ravitch, “The Myth of Chinese Super Schools.” *NYRB*, November 20, 2014, p. 26.





- Finally, don’t assume that there are easy or **simple solutions** to complex, multidimensional, multilevel problems of the kind that confront policy makers, administrators, principals and teachers.

  In pedagogy, as in life and even the movies, there is no magic bullet, no metaphysical redemption, no Holy Grail –

Thank you

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