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RESEARCH ON IMPROVING SYSTEMS OF EDUCATION

# System (in)coherence

## Quantifying the alignment of primary education curriculum standards, examinations, and instruction in two East African countries

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Oxford Policy Management

Blavatnik School of Government, University of Oxford

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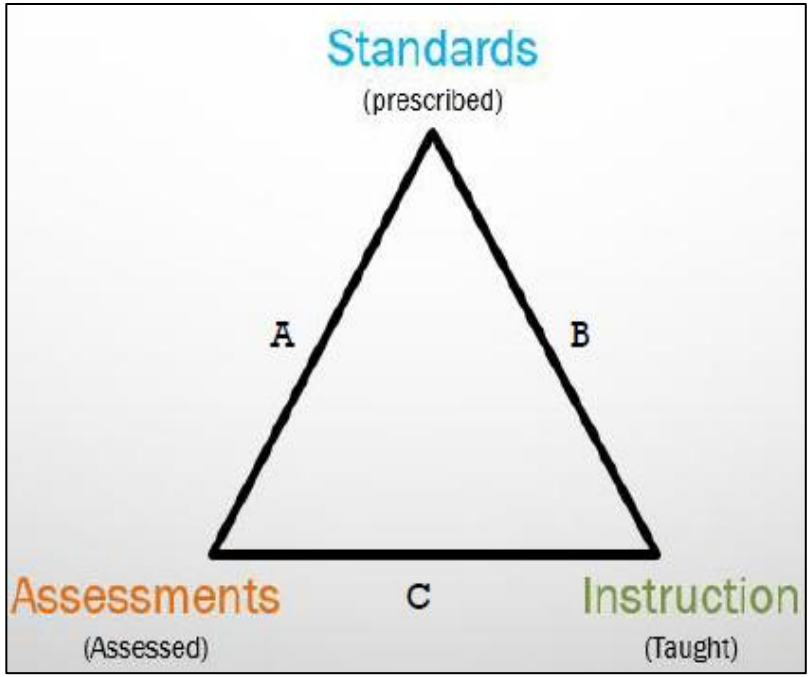
# Instructional coherence

- Instructional coherence is important for learning
  - e.g. Alignment of curriculum, materials, assessments, support, instruction
  - (Crouch and DeStefano, 2017; Piper et al., 2018; Banerjee et al., 2016; Crouch, 2020; Smithson and Collares, 2007; Gamoran et al., 1997; Porter, 2002)

- Teachers have many responsibilities – which may compete or be contradictory (Porter, 2002; Pritchett, 2015)
  - Completing the curriculum, preparing children for exams, among others

**Triangle of relationships for instructional coherence**

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# Instructional coherence

- Instructional components may be incoherent with each other, and/or incoherent for learning
  - Separate agencies + poor coordination in development of curriculum and exams (GoU, 1973; GoU, 1983; World Bank, 2012; Munene, 2017; GoT, 1973; GoT, 1975; MoEST, 2018)
  - Overambitious curriculum (Pritchett & Beatty, 2012)
  - Exams poorly designed or designed for selection (Allen et al., 2016; Burdett, 2016)

- How to measure instructional coherence and diagnose incoherence?
  - This presentation will illustrate a tool for diagnosing and exposing systemic challenges to improving learning at scale

# Surveys of Enacted Curriculum (SEC)

- Tools for academic content analysis, alignment analysis, teacher support (Blank, Porter, & Smithson, 2001; Smithson, 2013)
  - Facilitates teacher reflection and professional development and education content reform

- Systematically analyze and quantify the content and coherence of primary curriculum standards, national exams, and teacher instructional content in Uganda and Tanzania

- Implemented through partnership between Twaweza East Africa and Wisconsin Center for Educational Research/Center for Curriculum Analysis

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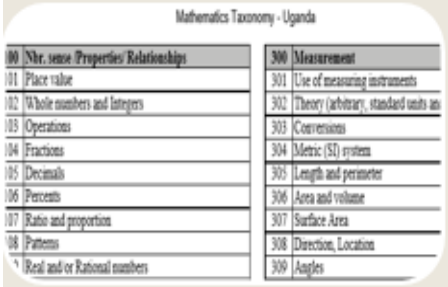
# Surveys of Enacted Curriculum (SEC)

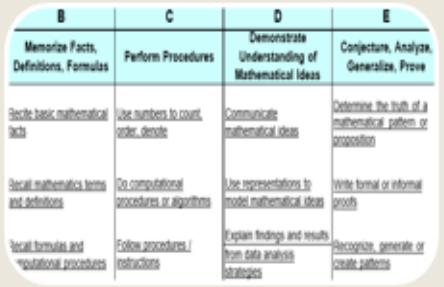
## SEC inputs – outputs


Mathematics Taxonomy - Uganda

| 00 | Nbr. sense /Properties/ Relationships |
|---|---|
| 01 | Place value |
| 02 | Whole numbers and Integers |
| 03 | Operations |
| 04 | Fractions |
| 05 | Decimals |
| 06 | Percents |
| 07 | Ratio and proportion |
| 08 | Patterns |
| | Real and/or Rational numbers |

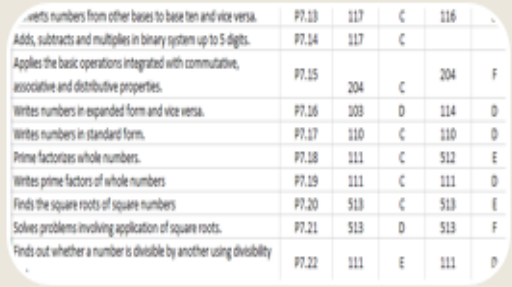
| 300 | Measurement |
|---|---|
| 301 | Use of measuring instruments |
| 302 | Theory (arbitrary, standard units an |
| 303 | Conversions |
| 304 | Metric (SI) system |
| 305 | Length and perimeter |
| 306 | Area and volume |
| 307 | Surface Area |
| 308 | Direction, Location |
| 309 | Angles |

Taxonomy of topics/subtopics



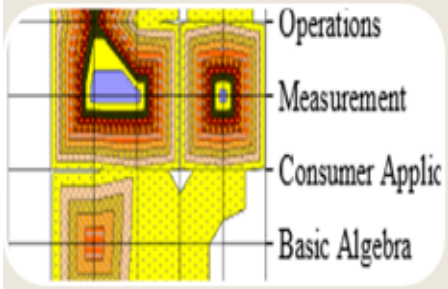
| B | C | D | E |
|---|---|---|---|
| Memorize Facts, Definitions, Formulas | Perform Procedures | Demonstrate Understanding of Mathematical Ideas | Conjecture, Analyze, Generalize, Prove |
| Recite basic mathematical facts | Use numbers to count, order, denote | Communicate mathematical ideas | Determine the truth of a mathematical pattern or proposition |
| Recall mathematics terms and definitions | Do computational procedures or algorithms | Use representations to model mathematical ideas | Write formal or informal proofs |
| Recall formulas and computational procedures | Follow procedures / instructions | Explain findings and results from data analysis strategies | Recognize, generate or create patterns |

Performance expectations for students learning

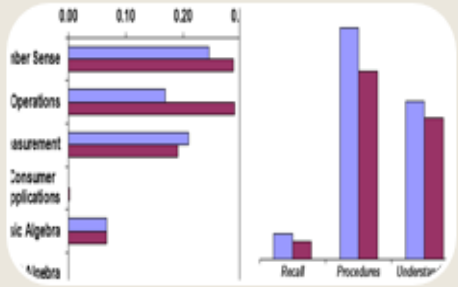


| | | | | | |
|---|---|---|---|---|---|
| verts numbers from other bases to base ten and vice versa. | P7.13 | 117 | C | 116 | |
| Adds, subtracts and multiplies in binary system up to 5 digits. | P7.14 | 117 | C | | |
| Applies the basic operations integrated with commutative, associative and distributive properties. | P7.15 | 204 | C | 204 | F |
| Writes numbers in expanded form and vice versa. | P7.16 | 103 | D | 114 | D |
| Writes numbers in standard form. | P7.17 | 110 | C | 110 | D |
| Prime factorizes whole numbers. | P7.18 | 111 | C | 512 | E |
| Writes prime factors of whole numbers | P7.19 | 111 | C | 111 | D |
| Finds the square roots of square numbers | P7.20 | 513 | C | 513 | E |
| Solves problems involving application of square roots. | P7.21 | 513 | D | 513 | F |
| Finds out whether a number is divisible by another using divisibility | P7.22 | 111 | E | 111 | D |

Teacher or expert judgement of content & practices




Descriptive content maps

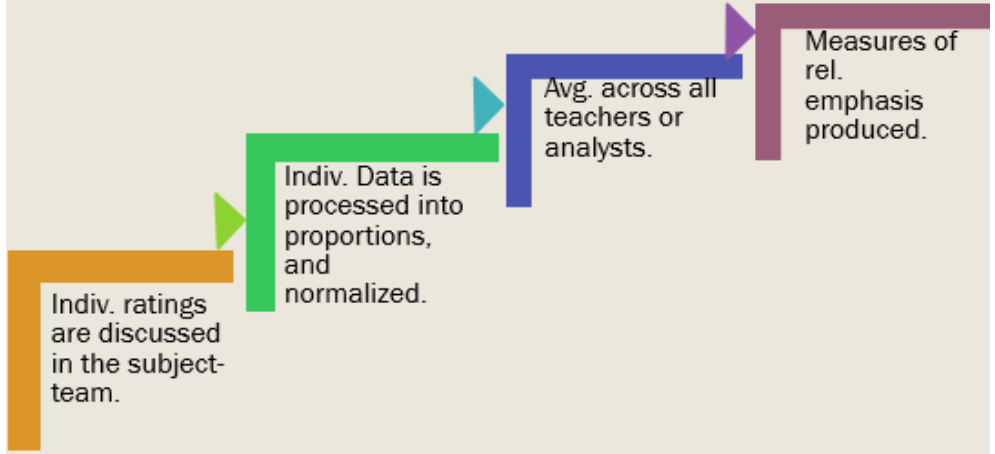



User-friendly marginal charts

| rimary 5 teachers all | Alignment | Balance of Representation | Categorical Concurrence | Cognitive Complexity |
|---|---|---|---|---|
| | | (Topics) | | (Cog. Dmn. |
| lumber Sense | 0.37 | 0.06 | 0.58 | 0.73 |
| Operations | 0.35 | 0.07 | 0.60 | 0.27 |
| Measurement | 0.24 | -0.01 | 0.42 | 0.67 |
| er Applications | 0.00 | 0.00 | 0.00 | 0.15 |
| Basic Algebra | 0.22 | 0.01 | 0.41 | 0.71 |

Alignment tables & indices

## SEC data analysis & processing




- Analysis results reported as alignment indices on a 0 – 1 scale

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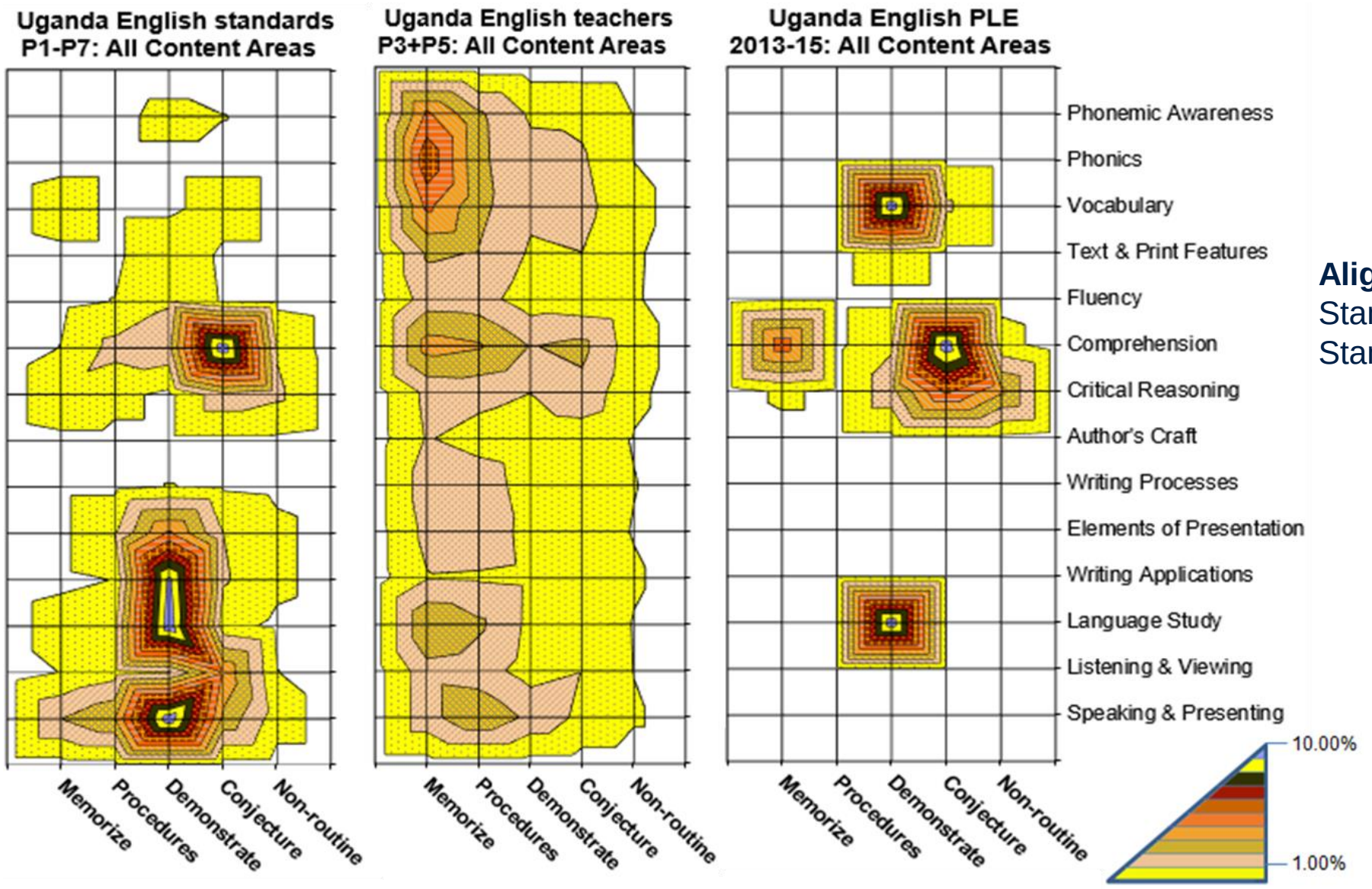
# Primary English in Uganda




**Alignment measures:**
Standards vs. Exams 0.36
Standards vs. Instruction 0.34

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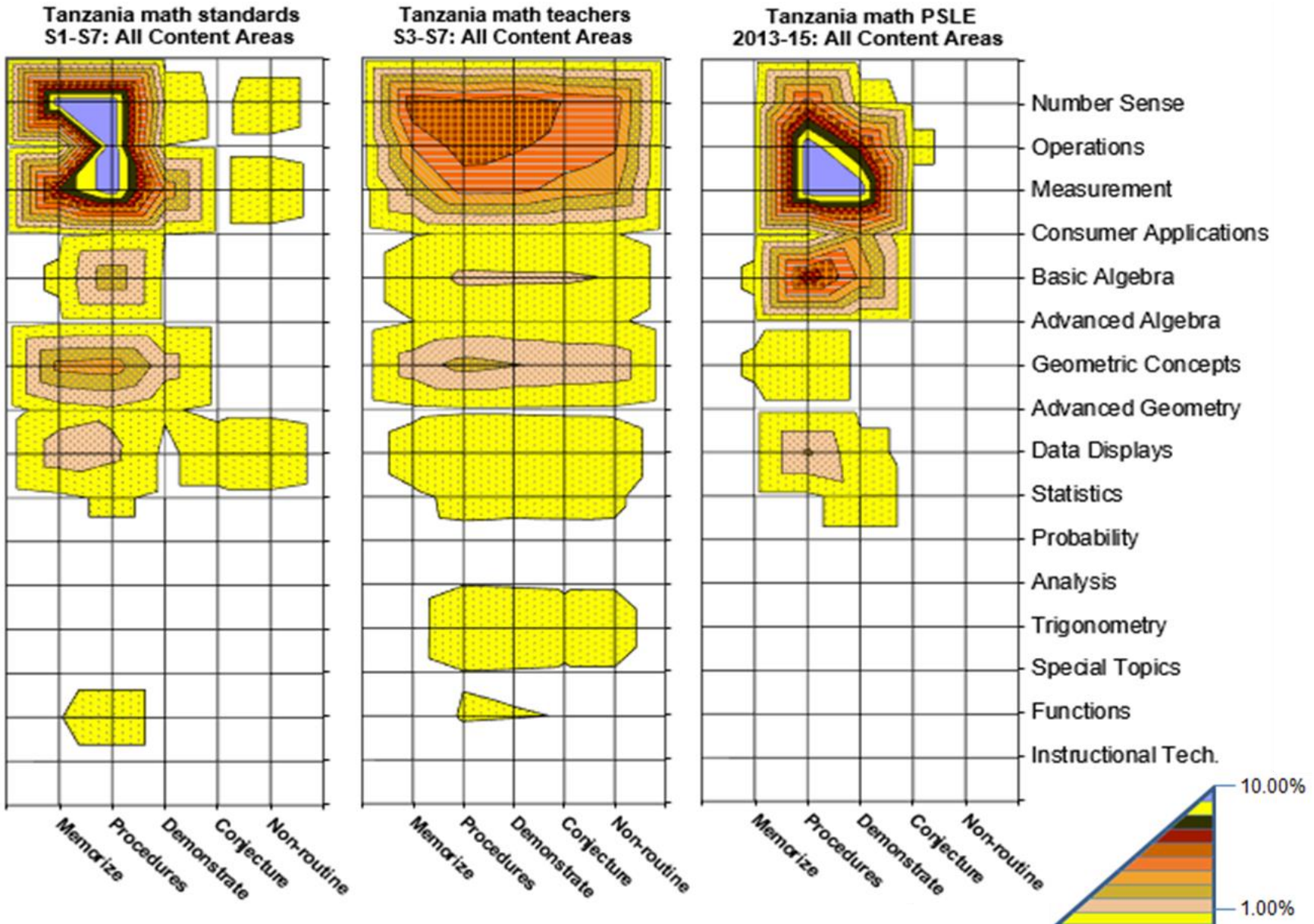
# Primary Math in Tanzania




**Alignment measures:**
Standards vs. Exams 0.44
Standards vs. Instruction 0.44
Instruction vs. Exams 0.33

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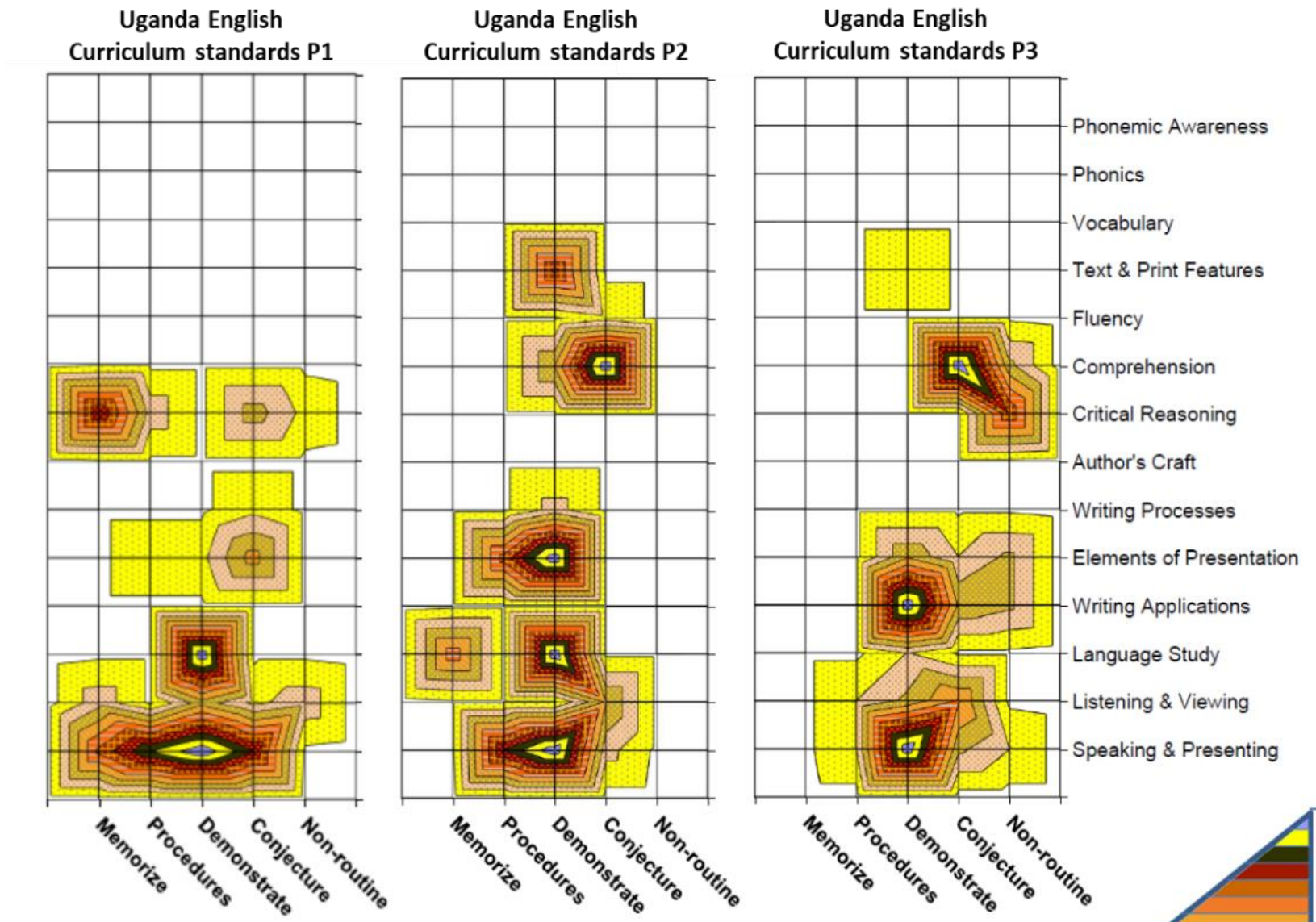
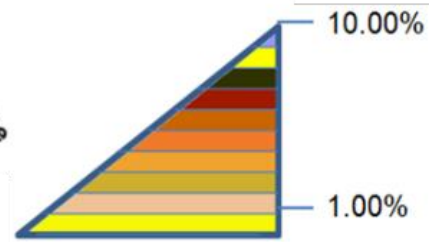
# Primary 1 - 3 English Curriculum Standards in Uganda




- Topic coverage skips around from year to year
- Omits foundational literacy skills like phonemic awareness, phonics and vocabulary

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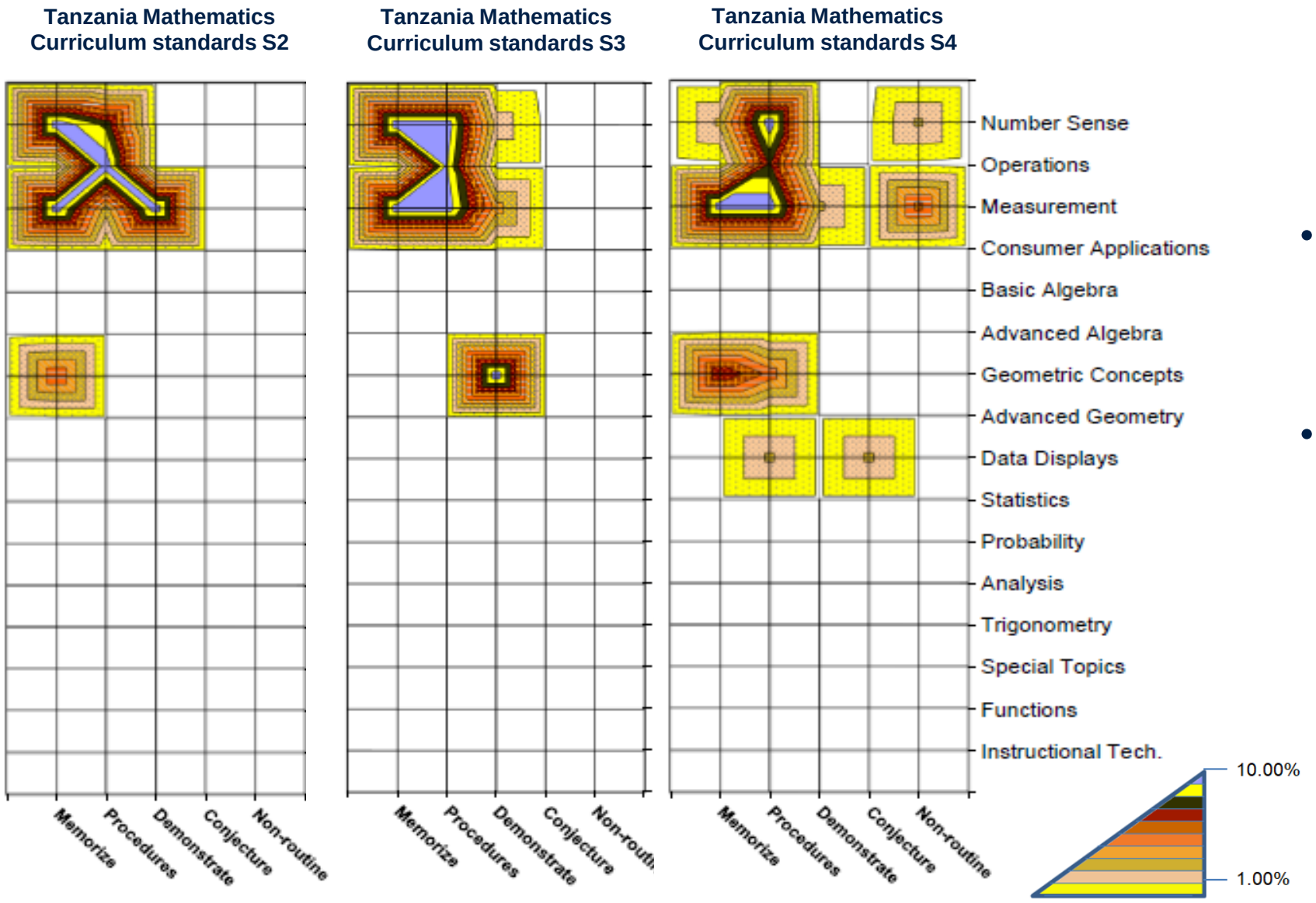
# Primary 2 - 4 Mathematics Curriculum Standards in Tanzania




- Covers foundational skills in early years
- Extends level of cognitive demand in Standard 4

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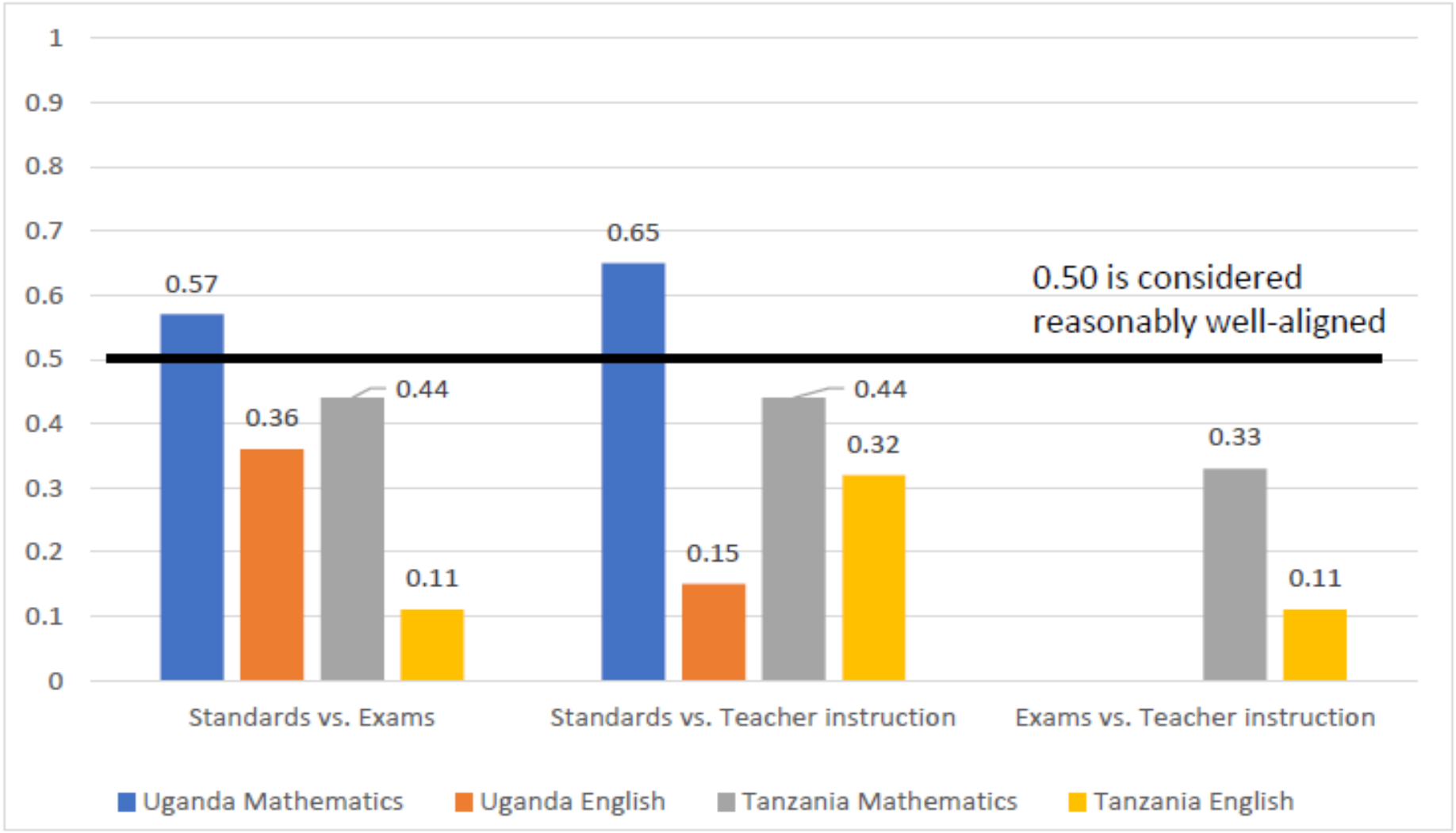
# Alignment measures: Mathematics and English in Uganda and Tanzania



- Important to emphasize: SEC methodology does not take a normative stance on what coverage *should* look like

- It is a positive diagnosis of what coverage *does* look like
  - Tool for curriculum, assessment, and instruction experts to use to inform content reforms

# Summary

- Generally low alignment across the three instructional components, though with variation

- In both countries the prescribed content structure is similar for both subjects:
  - Fairly smooth content progression for math, steeper stretches for English

- Teachers tend to cover broad swathes of content and cognitive demand levels, which is not well aligned with either curriculum or exams, but may be better aligned for children's learning

- On national exams certain content areas tend to be over emphasized; exams are internally well-aligned year-to-year

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# Discussion

- Poorly structured curriculum standards likely **frustrate efforts to develop literacy** skills in early years of school and may constrain efforts to improve learning at scale
- Low alignment between standards and exams likely placing **incoherent demands on teachers**
- Low alignment between standards and instruction could indicate inadequacy of prescribed standards
  - Suggests teachers are either in the dark about how well their teaching aligns with the prescribed curriculum or have deliberately opted to defy standards that are unrealistic to the demands of their classrooms

- These findings reveal system components that may constrain or challenge efforts to improve learning at scale.
  - The impact of improvements to one component may be constrained by incoherence with another component
  - Improving learning at scale may require dynamically improving multiple instructional components to bring them into alignment with each other

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# Instructional incoherence through a systems lens

- Teachers operate in a broader system
- The RISE systems framework characterizes the system through four relationships of accountability and five design elements
- Teachers may be **delegated** different tasks by different actors (curriculum body, exams body, parents) (B1 and B2 in figure)
- Teachers may or may not be adequately **supported** to perform tasks (A1, A2, A3)

**Figure 1. Education systems framework of accountability**

| Five design elements | Principal-agent relationships of accountability | | | |
|---|---|---|---|---|
| | Politics (Citizens to Executive Authority) | Compact (Executive Authority to Education Authorities) | Management (Education Authorities to Front-line providers) | Voice/ Client power (Citizens to Front-line providers) |
| Delegation | | | $A_1, B_1$ | $B_2$ |
| Finance | | | | |
| Support | | | $A_2$ | |
| Information | | | $A_3$ | |
| Motivation | | | | |

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