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## Methodology for PLD Compilation and Cross-Functional Alignment

10-11 September 2018  
UNESCO Headquarters  
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This paper is presented to explain the methodology utilized in the development of two documents:

- 1) an aggregated compilation of the performance level descriptors (PLD's) of various international assessment instruments, and
- 2) an alignment of the international assessment PLD's to the UNESCO Global Framework for School Mathematics (GF).

## Methodology for compiling PLD's

The overall goal for the first document was to create two sets of compiled PLD's around a single cut point, thereby creating two categories—Proficient/Above Proficiency and Below Proficiency (the former will be shortened to “Above Proficiency” throughout the rest of this paper). Table 1 shows the descriptors for these two categories.

**Table 1. General definitions of performance levels.**

Performance Level Policy Descriptors	
Proficient/ Above Proficiency	Students at this level possess a satisfactory, or better, level of mathematical knowledge. They also demonstrate a satisfactory, or better, level of competency with mathematical skills and abilities. These includes the recall of mathematical facts, formulas, and algorithms, the ability to solve application problems, and varying levels of aptitude in using problem-solving strategies and communicating mathematically.
Below Proficiency	Students at this level possess a limited level of mathematical knowledge and demonstrate a lack of competency with most mathematical skills and abilities. They tend to struggle with all but the most routine and straightforward aspects of mathematics.

These policy descriptors are applied at three measurement points: grade levels 2-3; grade levels 4-6; and grade levels 8-9. The first step in determining the cut point was to determine a common cut point among the performance levels (PL's) of the various assessments, each of which has anywhere from 3 to 8 PL's. This information is shown in Table 5 (not included here), provided by UNESCO personnel. In this table, the PL's above the cut point are highlighted in blue—e.g., Levels 2-6 of the grade PISA assessment.

Despite the varying number of PL's in the different assessments, the PLD's themselves are all of a very similar format—each being comprised of several skill descriptors, which are typically presented as bullet points, or as individual sentences. (The term “skill descriptor” may be a bit misleading, as many, if not most, of them actually contain *more* than one skill; e.g., “model and solve equations”.) The next step in developing the aggregate PLD's was thus to analyze all of the individual skill descriptors for each category in a measurement point, such as Above Proficiency for grades 8-9. This analysis was focused on the *cognitive process* required for each skill, as described by the literal text of the individual skill descriptors. This analysis served two purposes: first, it identified descriptors that described, to varying degrees, the same skill—be it between PLD's of the same assessment, or between assessments, or both. Second, it identified closely related skills that could be combined into a single skill descriptor. Finally, the results of this analysis were used to create the aggregate PLD's. This basically involved rewording the original skill descriptors to the extent possible and/or

necessary, based on the analysis described above, the removal of redundant language, and the combining of skill descriptors where appropriate. Care was taken when combining skill descriptors to lessen the overall word count from the original assessments' PLD's without sacrificing clarity or the mathematical meaning of the original text. As an example, in the Above Proficiency category for grades 2-3, there were 21 individual skill descriptors containing 326 words. This was shortened during the compilation process to a slightly less unwieldy 18 skill descriptors, comprised of a much more readable 187 words.

The resulting PLD's differ to varying degrees in number of words and skill descriptors, and in coverage of the various domains of the Global Framework. This can be attributed to the different number of assessments in various measurement points; the different number of PL's in each assessment; and, of course, the differences in the PLD's themselves. Even the way in which an individual assessment's PLD's were written was a contributing factor in some cases. It should also be noted that very little latitude was given when analyzing the mathematical language of the assessment PLD's for identification of skills and cognitive processes, unless analysis of other PLD's warranted otherwise. That is, mathematical language was taken *literally* whenever possible; for example, skill descriptors involving "algebraic expressions" were taken to mean polynomials and such, rather than interpreting the term more widely to include inequalities and equations (in American judicial terms, this practice is known as "strict constructionism"). This approach was utilized as a matter of overall alignment philosophy and is critical in creating a product that matches the original assessment PLD's as closely as possible. Only in cases of ambiguous language or meaning in the assessment PLD's was any interpretation allowed, and in those cases, the goal was always to divine the original intent.

## Methodology for aligning PLD's to the Global Framework

The alignment of the assessment PLD's to the Global Framework utilized the previously described analysis of PLD language to identify the cognitive process described in each individual skill descriptor. However, before this could take place, it was first necessary to determine to which level of granularity of the GF the PLD's would be aligned. The sub-construct level of the GF is closest in format to the PLD's in its descriptions of individual mathematical skills; it thus made sense to choose this level for alignment to the PLD's. It was also necessary to perform an analysis of the GF sub-constructs to determine the necessary cognitive process for the skills described in each sub-construct (a painstaking process, as some sub-constructs contain descriptions of over 20 skills).

Once the analyses of the two documents were complete, it was then possible to perform the alignment. An alignment between a GF sub-construct and a PLD skill descriptor was determined to exist when the *same cognitive process* is present in both areas. In the alignment document, the text of the skill descriptor is entirely or partially bold-faced; the bold-faced text indicates the part (or entirety) of the descriptor that reflects the cognitive process that determined the alignment. In some cases, more than one cognitive process alignment exists between a sub-construct and a skill descriptor; other than the aforementioned bold-faced text, no indication of multiple alignments was deemed necessary, and thus none is indicated in the alignment spreadsheet.

Because many assessment PLD's describe the same or closely related skills, many of the GF sub-constructs were aligned to multiple skill descriptors; this is also due, in many cases, to

the wide range of skills described by some sub-constructs. This even led to instances where the same skill is present in both the Above Proficiency and Below Proficiency categories at a measurement point. Conversely, there were a number of sub-constructs that had no alignment to any skill descriptors. Finally, there were also a handful of skill descriptors that did not align to any sub-constructs; these skill descriptors are listed at the bottom of the alignment spreadsheet.

In terms of individual assessments, Tables 2 and 3 display the alignment of content coverage based on the PLD's from each assessment. Table 2 displays each assessment's coverage of each domain in the GF, using one of three categories—Minimal, Moderate, or Extensive. These categories reflect the number of alignments between each assessment's PLD's and the sub-constructs in each domain—a rating of Minimal indicates from 1-3 alignments; Moderate, 4-6 alignments; Extensive, more than 6 alignments. Table 3 displays each assessment's coverage of the GF sub-domains. However, instead of categorizing the number of alignments at each sub-domain, as in Table 2, Table 3 merely indicates the presence (or absence) of one or more alignments.

**Table 2. Analysis of the coverage of the Global Framework for School Mathematics domains, based on the Performance Level Descriptors of international assessments.**

TEST	GRADE	GLOBAL FRAMEWORK DOMAINS					
		MATH PROFICIENCY	NUMBER KNOWLEDGE	MEASUREMENT	STATISTICS	GEOMETRY	ALGEBRA
EGMA	N/A		Extensive			Minimal	Minimal
ASER	N/A		Moderate				
UNICEF MICS6	N/A		Moderate				Minimal
Uwezo	N/A		Extensive				
PASEC	2		Extensive			Minimal	Minimal
SERCE	3		Moderate	Extensive	Minimal	Extensive	Extensive
TERCE	3		Extensive	Extensive	Minimal	Extensive	Minimal
TIMSS	4	Minimal	Extensive	Extensive	Extensive	Extensive	Moderate
PILNA	4/6*		Extensive	Extensive	Minimal		Moderate
PASEC	6	Moderate	Extensive	Extensive	Minimal	Minimal	Minimal
SACMEQ	6	Extensive	Extensive	Extensive	Minimal		Moderate
SERCE	6		Extensive	Extensive	Minimal	Extensive	Moderate
TERCE	6		Extensive	Extensive	Moderate	Moderate	Extensive
PISA	8	Extensive	Extensive				Minimal
PISA-D	NA	Extensive	Extensive				Minimal
TIMSS	8	Moderate	Extensive		Extensive	Extensive	Extensive

\*The Performance Level Descriptors for PILNA overlap between grades 4 and 6.

**Table 3. Analysis of the coverage of the Global Framework for School Mathematics sub-domains, based on the Performance Level Descriptors of international assessments.**

TEST	GRADE	GLOBAL FRAMEWORK SUB-DOMAINS																
		1.1	1.2	1.3	2.1	2.2	3.1	3.2	4.1	4.2	5.1	5.2	5.3	6.1	6.2	6.3	6.4	6.5
EGMA	N/A				X	X												
ASER	N/A					X												
UNICEF MICS6	N/A					X									X			
Uwezo	N/A				X	X												
PASEC	2				X	X					X	X			X			
SERCE	3					X		X	X	X	X	X	X	X	X	X		X
TERCE	3					X		X	X	X		X		X				
TIMSS	4		X	X		X		X	X		X		X			X		X
PILNA	4/6*					X		X	X						X			X
PASEC	6	X				X		X	X		X	X	X		X			
SACMEQ	6	X	X		X	X		X	X							X		X
SERCE	6					X		X	X		X				X			X
TERCE	6					X		X	X		X		X		X			X
PISA	8	X	X	X		X												X
PISA-D	N/A	X	X	X		X												X
TIMSS	8	X	X			X			X	X	X		X		X	X		X

\*The Performance Level Descriptors for PILNA overlap between grades 4 and 6.