How does the ISA align with the IB curriculum?

More than two-thirds of ISA schools use an International Baccalaureate (IB) component in their curriculum. This document shows how the ISA assessments can be broadly aligned with the PYP and MYP Curricula.

The ISA assesses mathematical literacy, reading, writing and scientific literacy using the internationally-endorsed frameworks from the Programme for International Student Assessment (PISA). The ISA items address the extent to which an individual student can mobilise their knowledge in a domain to solve authentic problems. The ISA does not assess a particular curriculum, and it is not designed to address the full scope of the curriculum in mathematics, reading, writing and science for any school. It addresses as broad a range of key skills and understandings as is possible in a short, standardised test. Matching the ISA items to the PYP or MYP curricula must always be done with the understanding that some key parts of the curriculum will be addressed by the ISA and other key parts will not.

To assist teachers in the diagnostic interpretation of the ISA data, the ISA class report provides an individual description of the key skills addressed by each item. This allows teachers to interpret and explain student performance at the item level.

The items in each test are also classified into several broad groups to allow teachers to interpret and explain student performance in a group of related skills. The PYP and MYP curricula are divided into strands. The ISA classifications do not directly match these strands, as the items are classified according to the aspects used by PISA. However, the strands used in IB, and the aspects used in PISA can be broadly mapped to one another. The purpose of this document is to show the match between the ISA/PISA classifications used to group items in the ISA class reports with the PYP and MYP strands for mathematics and the PYP scope and sequence chart for reading. Similarities between the ISA writing construct and that of PYP and MYP is also shown.

Mathematical Literacy

Each task in the ISA Mathematical Literacy assessment is defined according to its content and the type of process needed to complete it successfully. Process variables describe the typical stages of mathematical thought and action that are needed to solve mathematical problems (See Appendix A).

ISA content variables: Uncertainty and Data, Quantity, Space and Shape, Change and Relationships

ISA process variables: Formulating, Employing, Interpreting

It is relatively straightforward to match the ISA content variables to the PYP and MYP strands. The main differences are in terminology. The ISA process variables are also fairly well-aligned to the MYP Mathematics Assessment Criteria and the PYP description of the 'stages through which children learn mathematics'.

PYP and ISA Content Variables

Table 1 - Content comparisons between ISA and PYP mathematics

ISA Content Variable	PYP Strand
Uncertainty and Data	Data Handling
Quantity	Number and Measurement
Space and Shape	Shape and Space
Change and Relationships	Pattern and Function

As is evident in Table 1, the terms used vary, but the match is reasonably close. One point of difference between ISA and PYP classifications is that the two distinct strands in PYP mathematics - Number and Measurement - align neatly with one ISA content variable: Quantity.

PYP and ISA Process Variables

The PYP mathematics curriculum has not been classified according to the processes students use to solve problems. However, there are some references to these skills. In the PYP description of 'how best will students learn', the kind of mathematical reasoning described seem to coincide with the three PISA process categories as shown:

Table 2 - Process comparisons between ISA and PYP mathematics

ISA Content Variable	PYP Stages
Formulating	Constructing meaning Transferring meaning into signs and symbols
Employing	Understanding and Applying
Interpreting	Understanding and Applying

The key difference between Employing and Interpreting in the context of PYP is as follows:

<u>Employing</u> mathematics involves applying mathematical procedures to find a mathematical solution. It involves working within a context that has already been formulated mathematically and therefore does not need explicit translation between the mathematically formulated situation and the real-life problem. Typical actions would include manipulating numbers, applying mathematical facts, rules and algorithms, and extracting data from mathematical diagrams, graphs and constructions.

<u>Interpreting</u> mathematics involves reflecting upon mathematical solutions or results and interpreting them in the context of a real-life problem or challenge. It includes evaluating whether a mathematical result is reasonable in the context of a real-world problem, making contextual judgements about how a mathematical result should be adjusted or applied, and recognising underlying assumptions and limitations of the mathematical model used to solve a problem.

MYP and ISA Content Variables

Table 3 - Content comparisons between ISA and MYP mathematics

ISA Content Variable	MYP Branch
Uncertainty and Data	Statistics and Probability
Quantity	Number
Space and Shape	Geometry and Trigonometry
Change and Relationships	Algebra
	Discrete Mathematics

In Table 3 the terms used vary, but the match is reasonably close. The one clear exception is MYP Discrete Mathematics, which has aspects that align with each of the ISA content variables: Uncertainty and Data, Quantity and Space and Shape. Another point of difference is that the MYP branch Geometry and Trigonometry does not align neatly with the ISA content variable Space and Shape. There are concepts in MYP Geometry and Trigonometry, such as mensuration, that align with the ISA Quantity content variable.

It should be noted that, as in all such constructs, the division between variables is somewhat arbitrary and there is much overlap. For instance, many algebraic and geometric calculations rely heavily on knowledge and skills from the Quantity variable.

MYP and ISA Process Variables

The ISA process variables have parallels with the MYP Mathematics Assessment Criteria: Knowledge and Understanding, Application and Reasoning, Communication, and Reflection and Evaluation.

<u>Knowledge and Understanding</u> aligns most closely with the Employing process variable e.g. 'using numeric, algebraic, graphical and other forms of representations' and 'moving between different forms of representations'; although there may be some elements of Interpreting as well e.g. 'using knowledge and understanding to make deductions'.

<u>Application and Reasoning</u> aligns with all three process variables of the ISA/PISA framework. Formulating would include 'selecting and using appropriate mathematical knowledge and skills'; 'recognising patterns and structures and describing them as relationships or general rules' might include elements of Formulating and Employing; 'drawing conclusions consistent with findings, and justifying mathematical relationships' could involve Interpreting.

Communication includes encoding and decoding, describing in words a line of reasoning, explaining solutions, and presenting mathematical information clearly and logically. These primarily match the Formulating and Interpreting process variables. Formulating involves translating a problem in context into a form amenable to mathematical manipulation (moving from the 'real world' to the 'mathematical world'), whereas Interpreting involves translating a purely mathematical solution so that it makes sense within the contextual framework of the question (moving from the 'mathematical world' to the 'real world').

Reflection and Evaluation includes reflecting on and evaluating methods and processes during investigations which could be open ended. This is primarily linked to the Interpreting process variable.

The skills component of the MYP mathematics curriculum could also be matched to the ISA/PISA process variables. The following are some instances:

Formulating - solving problems involving optimal solutions (Discrete Mathematics); calculating probabilities of combined and conditional events (Statistics and Probability); constructing plots and graphs appropriately, constructing logical diagrams, locating paths and tours, classifying and describing topological objects (Discrete Mathematics).

Employing - performing basic operations, performing higher-level operations (Number); expanding, factorizing, simplifying, substituting (Algebra); naming and classifying, applying area/volume formulae, rotating, reflecting, translating and enlarging; solving problems by applying Pythagoras' theorem, trigonometric ratios and rules, properties of shapes and angles (Geometry and Trigonometry); calculating probabilities of simple events (Statistics and Probability); performing set operations (Discrete Mathematics). Estimating, classifying, apportioning (Number); solving equations … by a variety of methods, solving higher-level equations, manipulating rational and logarithmic expressions (Algebra).

Interpreting - analysing time-series data and other bivariate data, making inferences and drawing conclusions (Statistics and Probability); performing and discussing problem-solving strategies, communicating and reasoning orally and in writing (all).

Reading

Reading literacy in PISA is defined as 'understanding, using and reflecting on written texts, in order to achieve one's goals, to develop one's knowledge and potential and to participate in society.' While this definition and the construct of reading that grew out of it were developed with 15-year-olds in mind, the ISA construct of reading maintains the general thrust of a reading assessment that goes beyond the notion of decoding and literal comprehension (though at the lowest levels these are included), and recognises the full scope of situations in which reading plays a role for students from Grade 3 to Grade 10.

Each Reading task in the ISA is defined in terms of the aspect or approach to reading that it requires, and according to the text format of the reading passage on which the task is based.

Aspect Variables

Access and Retrieve (AR) is defined as locating one or more pieces of information in a text.

Integrate and Interpret (II) texts is defined as constructing meaning and drawing inferences from one or more parts of a text.

Reflect and Evaluate (RE) is defined as relating a text to one's experience, knowledge and ideas.

Text Format Variables

Continuous Texts are typically composed of sentences that are, in turn, organised into paragraphs. These may fit into even larger structures such as sections, chapters and books. Continuous texts include narrative pieces, exposition, description, argument and instructional passages.

Non-Continuous Texts, or 'documents' as they are known in some frameworks, can be described in structural terms as texts composed of one or more lists. In less formal terms, they can be described by their everyday appearance in such formats as tables, graphs, maps and diagrams.

PYP and the ISA Reading Aspects

The PYP language scope and sequence chart does not classify reading by aspect or text format. Curriculum expectations for reading are grouped in relation to sample activities for each level of the PYP. Some the PYP expectations are suited to assessment in a pen and paper test and fit the PISA construct. Other expectations focus on reading strategies and reading activities that are not readily addressed by a pen and paper test. These expectations, and the expectations of students aged 3-5 years, are not considered here.

Table 4 shows one possible way of grouping those PYP expectations that can be addressed by the ISA. Many of the expectations fit under the PISA classifications of Interpreting or Reflecting. The two classifications of Form & Structure and Author's Purpose have

been separated out. Under the PISA construct these kinds of skills would be categorised as <u>Reflecting</u> if the student was required to draw on outside knowledge, and <u>Interpreting</u> if the question focused on the meaning of the content of the text.

Table 4

	Access and Retrieve (AR)	Integrate and Interpret (II)	Reflect and Evaluate (RE)	Form and Structure	Author's Purpose
5-7 yrs		Predict what might happen next in a story	Identify with a character or situation	Recognise that a story has a beginning, middle and an ending	Understand the role of an author or illustrator
		Know the difference between fiction and non-fiction	Understand and respond to the ideas and feelings expressed in various reading materials	Recall plot and characters of a story	
				Recognise and talk about a range of different text forms	
7-9 yrs	Read quickly and scan to find specific information	Make inferences and be able to justify them	Understand and respond to the ideas, feelings and attitudes expressed in various texts	Identify and describe the elements of a story (setting, plot, characters and theme)	Begin to recognise the author's purpose (to inform, persuade, entertain, instruct)
		Respond to texts by identifying the main idea, recognising cause and effect, distinguishing between fact and opinion, questioning and drawing conclusions	Begin to understand that texts may be interpreted differently by different people	Recognise that there are more complex story structures than beginning, middle and end	
9-12 yrs	Locate and access information from a variety of sources	Recognise and understand figurative language (e.g. similes, metaphors, idioms)	Generate new questions after reading and connect these to prior knowledge and experience	Identify the elements of plot and the pattern in story outline	Infer the author's purpose
		Show awareness that poems have layers of meaning	Critically evaluate their own choices in books	Categorise literature into type and genre	
		Understand that words can evoke mental images	Be aware that poems are open to a range of interpretations	Identify the five basic types of conflict in a story	
		Organise and synthesise information from a variety of sources		Identify and discuss forms and structures	
		Use specific vocabulary to comment on and analyse poetry			

The ISA text format classifications match the general expectation of the PYP and MYP that students read a range of different text types.

MYP and the ISA Reading Aspects

The MYP does not have a scope and sequence chart for <u>Language A</u>. The ISA/PISA aspects provide teachers with diagnostic information that can be aligned with the MYP final objectives.

Writing

The ISA Writing construct supports a developmental approach to writing that recognises early through to mature writing skills. In ISA Writing, the scoring and reporting scheme that has evolved is similar to that used in the International Baccalaureate PYP and MYP, and the AERO standards for writing. It also references well-known writing frameworks such as the McRel Standards, the Alberta writing program, and the Six Traits of Writing (Ideas, Organisation, Word Choice, Sentence Fluency, Voice, Conventions).

The ISA Writing construct is similar to that of PYP and MYP in that students learn to use language in a variety of ways to suit different intentions, audiences and contexts, as they do in PYP and MYP. They learn to vary their content, organizational strategies, sentence structure, tone, and word choice depending on their chosen purpose and audience elicited by the given writing prompts. The MYP Language and Literature pilot guide states that students are taught with the aim that they will 'create works that demonstrate insight, imagination and sensitivity' and these writing qualities are definitively emphasized in the detailed ISA criteria.

The ISA Writing assessment includes two extended writing tasks: one narrative/reflective task and one exposition/argument task. For the narrative/reflective task the students are asked to write a story, or a reflective piece. The exposition/argument task requires a piece of writing setting out ideas about a proposition. In the latter, students may take an explanatory approach (exposition), a persuasive approach (argument), or they may combine the two approaches.

Each writing task is scored on three major criteria, as summarized in the table below.
Table 5

Narrative/Reflective Writing	
Content	This criteria includes consideration of the quality and range of ideas, development of plot, characters and setting, the writer's sense of audience and purpose, and the overall shape of the writing.
Language	This includes consideration of sentence and paragraph structure, vocabulary and punctuation, and the writer's voice.
Spelling	This includes consideration of phonetic and visual spelling patterns and the kind of words attempted, and correctness.
Exposition/Argument Writing	
Content	This includes consideration of the depth and range of ideas, the quality of the reasoning demonstrated, the ability to provide evidence and the presence of logical argument in support of a position.
Language (ESOL)	Because of the high number of ISA students who have a language background other than English, the Language criterion for this task considers ESOL Language features and it is scored by considering grammatical correctness and command of English syntax, sentence fluency and variation, and vocabulary use (applied to all students' writing regardless of their language background).
Structure	Consideration is given to the overall global structure, e.g. presence of a clear introduction, development and conclusion. The internal coherence of the piece is assessed, such as the linking between and within paragraphs.

The two writing tasks of the ISA aim to capture students' abilities to analyze, to reflect, to develop arguments and to be creative. This design reflects the PYP and MYP aims regarding range and content of student writing. Through the reporting on each of the criteria outlined in the table above, the ISA Writing assessment provides teachers with detailed diagnostic information for individual students that can be aligned with the PYP and MYP English Language Arts standards.

APPENDIX A

ISA/PISA Mathematical Literacy Content variables

<u>Uncertainty and Data</u> - This content area reflects how real life data is commonly collected, organised, analysed and displayed with a view to making interpretations and forming conclusions. Many decisions are made on the basis of statistical analysis of data. Real life also contains elements of chance where outcomes are not certain but based upon probabilities. Increasingly decision-making is qualified with a statement of risk and society is presented with more and more information to make sense of, so competence in this area is of great significance.

<u>Quantity</u> - This overarching content area also features in the three other content areas to varying degrees. It focuses on the need for quantification in order to organise the world. It is not hard to find examples of quantification in our day-to-day living. We use money, make measurements, estimate and calculate. Increasingly we make use of technology to assist us but we also still perform many calculations mentally and approximately. Quantitative reasoning requires number sense: that is, having a feel for the magnitude of numbers, using strategies and tools appropriately, and being able to check solutions for reasonableness.

<u>Space and Shape</u> - Shapes and constructions are all around us physically as real objects but also as representations in the form of photographs, maps and diagrams. Constructing and interpreting such representations is an important skill. Using geometric shapes whose mathematical properties are known to model more complex shapes is an important problem-solving tool. Knowledge and appreciation of the beauty and function of geometric shapes and spaces has applications reaching from art to advertising.

<u>Change and Relationships</u> - Noticing and using patterns in number and shapes, and finding and describing relationships between variables, lies at the heart of mathematics. As organisms or populations grow and as stock markets ebb and flow, we describe the patterns in words, in tables and sometimes in algebraic notation. Commonly we chart the changes in graphical form. These patterns can be linear, non-linear, cyclic or exponential, to name but a few. Being able to link between these various representations and use the language, notation and algorithms of change and relationships is critical to making sense of the patterns in our world.

ISA/PISA Mathematical Literacy Process variables

A second set of variables upon which the ISA mathematics testing is constructed is the 'process variables'. There are three process variables in ISA:

<u>Formulating</u> mathematics involves identifying opportunities to apply and use mathematics. It includes being able to take a situation as presented and transform it into a form amenable to mathematical treatment, providing mathematical structure and representations, identifying variables and making simplifying assumptions to help solve the problem or meet the challenge.

<u>Employing</u> mathematics involves applying mathematical reasoning and using mathematical concepts, procedures, facts and tools to derive a mathematical solution. It includes performing calculations, manipulating algebraic expressions and equations or other mathematical models, analysing information in a mathematical manner from mathematical diagrams and graphs, developing mathematical descriptions and explanations and using mathematical tools to solve problems.

<u>Interpreting</u> mathematics involves reflecting upon mathematical solutions or results and interpreting them in the context of a problem or challenge. It includes evaluating mathematical solutions or reasoning in relation to the context of the problem and determining whether the results are reasonable and make sense in the situation.

Further Information

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