## The Relationship between Teaching, Learning and Digital Assessment

FINAL REPORT

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# **EXECUTIVE SUMMARY**

### Introduction

The relationship between teaching, learning and assessment has always been a topic of curiosity to those with a passion for education. In this research study, we examine the key trends shaping education in the digital space and identify how these can inform and strengthen practices within IB programmes.

Within the IB context, we focus on the evolution of digital technologies – particularly in the realm of assessment – and discuss how the IB can **move into the future** in a way that best balances technological advances with an approach that stays true to the philosophy of the IB and its programmes.

The report is the culmination of a lengthy and multi-faceted study which has involved four distinct but linked research activities, predominantly over a 12 month period between October 2018 and September 2019. The research has been driven by four key questions, and each of these have had specific research activities associated with them:

Question I - What is the current state of the art understanding of digital assessment use within the future educational landscape? This involved a **literature review** that focused on pertinent trends in teaching, learning and digital assessment and identified some key considerations for the IB.

Question 2 - How do IB curricula and digital assessment affordances reflect the state of the art in digital assessment use? This involved an **expert review** of subject and programme guides and specimen assessments across the PYP, MYP and DP and in four subject areas (mathematics, science, history and language and literature).

Question 3 - What is the backwash effect of digital assessments on teaching and learning? This involved a **survey** of teachers and coordinators in IB schools around the world which collected data on their experiences of,

and attitudes towards, digital assessment and digital pedagogy and a series of **interview and focus groups** with IB staff in The Hague and Cardiff that highlighted some major topics around how the IB can best serve its stakeholders.

Question 4 - How can the IB innovate future versions of digital assessment task design and development? This has involved a **synthesis** of all the sources of data identified above to identify possible forward directions for the IB and can be found at the end of this report.

This report presents a summary of the four data sources. Further details can be found in the separate full literature review and in the appendices to this report. The report is not an evaluation of current practices but should be read as a forward looking document, providing the IB with a review of the key considerations that need to be brought into decisions around how best to serve their schools and enhance learning opportunities for learners in IB programmes.

#### Literature review

The literature review involved the synthesis of insights from more than 300 sources, a combination of academic research, practical examples, useful background information from 'grey' literature and publicly-available sample assessment materials.

With attention to digital assessment, the review considers a range of ways in which this has evolved and is practiced in contemporary education, including the opportunities that it offers and the key design considerations.

The review presents three key movements that are reshaping contemporary education:

- The notion of learning progressions and a growth mindset;
- The move from formative/summative assessment to ongoing assessment; and

• The use of data analytics to gather data on learning.

In this context, digital tools are now commonly used for teaching, learning and assessment and in the field of assessment there are a number of exciting possibilities, including adaptive testing, the integration of artificial intelligence, the evaluation of 21st century skills, virtual reality, gamification and the use of avatars.

Yet most digital assessment continues to be 'paper-on-screen' due to the cost of using other approaches and anxiety around jeopardising high-stakes potentially assessments. Indeed, the most innovative approaches tend to be seen in formative assessment. While digital assessment offers a of possibilities for rethinking range assessment, these can only be optimised if there is an appetite for transformation.

While innovations in digital assessment are flourishing, robust academic investigation of their impact on learning is lagging far behind. In terms of assessment as a whole, best practice means that the learning of individuals is made visible through the use of efficient and well-targeted tools, in a way that can identify where learners currently are and the future steps for them to take.

With this understanding, 'best practice' in digital assessment means that digital technologies are used in a way to enhance the achievement of this goal. For the IB, making the best possible judgement about the format of assessment that will best meet the needs of its programmes and stakeholders inevitably needs to take place in something of a vacuum in which many of the answers needed remain opaque.

Beyond formative assessment, something that is largely not made public, innovation tends mainly to be found in very large scale assessment programmes such as PISA, in some national assessment programmes and in English language proficiency tests. These all have the economies of scale to use innovative approaches and information about them is publicly available (which tends not to be the case for commercial assessment products).

While it may be tempting to focus on innovating approaches in digital assessment, fundamentally, assessment is merely a vehicle to gather useful information on learners' skills and knowledge. It is thus important that this key purpose is borne in mind when considering the viability of digital approaches.

**Backwash** – in which the format of assessment influences teaching and learning – is a known phenomenon. Equally important, however, is **forewash**, in which approaches to learning and teaching influence assessment design. This points to a need for learning, teaching and assessment to work in harmony, with a focus on the dynamics involved between them. Key to these are the participants, processes and products that comprise them.

Both backwash and forewash are mediated through a range of variables, including teacher and learner attitudes and experiences. Teachers are increasingly under pressure to master Technological Pedagogical Content Knowledge (TPACK) and to be digital learning designers. At the same time, there is uncertainty about learner skills, with the notion that all learners are 'digital natives' who can easily adapt to all new technology having largely been debunked.

In addition, the digital divide caused by an imbalance in resource availability means that teachers and learners across IB programmes have differing access and exposure to digital tools. For all of these reasons, there is a need for the careful consideration of support and training needs, scaffolding and the understanding that there is no one-size fits all approach.

### Expert review of programme and subject guides

Experts undertook an in-depth review of IB 'From Principle into Practice' (FPiP) documents and subject guides across the DP, MYP and PYP in the four exemplar subjects of language and literature, science, mathematics and history. The goal of the review was to answer the question 'How do IB curricula and digital assessment affordances reflect the state of the art in digital assessment use?'

In programme and subject documentation, ACER focused on the extent to which programme coordinators and teachers were provided with indications about the incorporation of digitalisation in teaching and Other referential learning. documents including teacher support materials Teaching and Learning with Technology and Assessment Principles and Practices: Quality Assessments in a Digital Age guide were not included in the review due to its subject specific scope but the reviewers noted where these were referred to.

Reviewers considered subject guides as the first point of reference for subject coordinators and teachers. Since it cannot be assumed that programme coordinators and teachers refer to other documentation beyond these, the expert reviewers viewed the documents reviewed here as 'setting the scene' for the programmes and subjects as a whole and they were reviewed with this consideration in mind.

The reviewers further noted that there had not previously been a requirement to include reference to any digital tools in subject guides, that the *Teaching and Learning With Technology* and *Assessment Principles and Practices: Quality Assessments in a Digital Age* documentation currently gives the state of IB guidance with regards to aspects of sound use of digital pedagogy and that the age of the documents varied considerably (released between 2008 and 2018.

Drawing on their own teaching experience, their depth of knowledge in how their subject(s) can be taught, their knowledge of digital assessment and pedagogy and the literature review, the reviewers decided on a set of elements that they would expect that contemporary teachers would wish to be given guidance on. These related to the whys, hows and whats of digital pedagogy and assessment and these elements formed the basis of their review:

- Approaches to digitalisation;
- Relevance of digitalisation;
- How to incorporate digitalisation;
- When digitalisation may or may not be appropriate;
- Reference to research on using digitalisation to enhance teaching and learning and outcomes;
- Ethical considerations around digitalisation;
- Digitalisation to enhance global mindedness;
- Critical digital literacy;
- Using digitalisation to enhance learner equality; and
- Any opportunities to incorporate mention of digitalisation where it is not currently referenced.

The detailed review can be found in **Appendix 2**. Overall, reviewers found that the mathematics MYP and DP guides, in addition to the three PYP FPiPs, provide some of the most coherent and explicit reference to digitalisation through a focus on the appropriate use of ICT tools and resources and the impact on learning. These provide some good examples that it would be useful for other subject guides and programme FPiPs to follow.

The reviewers felt that there is scope for the inclusion of examples of digital activities such as web quests, viewing and or creating videos, interactive maps and data analysis. This need not be prescriptive but would help teachers become aware of the possibilities that exist if they are not already familiar with them.

None of the documents reviewed provide much mention of when it is or is not appropriate to use digital tools, nor of ethical considerations, critical global literacy, improving learner equality or the enhancement of global mindedness. All of these could usefully be referenced in future versions. In addition, the sections on assessment in general, and formative assessment specifically, could usefully be revised to identify how the use of digital tools can support the approach to assessment to one that is ongoing.

In the subject guides for **language and literature**, reviewers found very little reference to the opportunities offered by digitalisation. They were surprised that this was the case given the profound impact of digitalisation of communication and forms of text. These could be enhanced by mention of the affordances that digitalisation can create for teaching and learning.

In the subject guides for **history** (individuals and societies in MYP), the reviewers again found very little reference to digitalisation. This is despite the fact that ability to investigate and interpret history has been profoundly impacted by the array of digital tools and approaches now available. There are opportunities to mention digitalisation both in terms of the topics of study as well as the approach to the subject.

In the guides for science (biology and chemistry in DP) the reviewers found very little mention of digitalisation other than in the DP chemistry guide which notes the need for learners to develop 'digital technology skills, which are essential in 21st century scientific endeavour'. Considering that science is increasingly influenced by digital tools and technology it would be useful to position the subject within this context in all guides, explaining how the core elements of inquiry based learning can be enhanced and facilitated through digital tools and technology.

In the guides for **mathematics**, the reviewers noted that all of them reference digitalisation, albeit to differing degrees. The DP guides (the most recent ones) in particular provide a great deal of reference to the integral impact of technology on the mathematics courses, noting that 'fluency in relevant mathematical software and hand-held technology' is an important mathematical skill. The MYP and DP guides also include advice

for teachers on how to incorporate digitalisation but all four guides still have opportunities to further reference digitalisation.

Overall, the reviewers suggested a series of considerations as digitalisation continues to impact the nature of subjects, how they are taught and the skills and knowledge that learners need to gain. They recommended finding the right balance between being too prescriptive but providing enough information to ensure that the spirit of programmes and approaches to subjects is consistently applied.

The reviewers further suggested that it is important that schools, teachers and learners without good access to digital devices and/or suitable infrastructure are not disadvantaged in their learning. This means that the IB needs to continue to make thoughtful revisions to their subject guides and programme FPiPs as they evolve into the future.

#### Expert review of specimen assessments

Expert reviewers undertook a detailed review of DP assessment instruments and MYP eAssessment instruments across the same four subjects as the programme and subject guides.

The focus of the review of the DP assessment tools considered their potential for being converted to a digital version and any advantages or disadvantages this would create. In contrast, the focus of the review of MYP assessment tools was to consider how well the affordances of digital assessment had been used in order to enhance the authenticity and quality of assessment materials, and to identify any ways in which this could be improved.

The reviewers also drew on their expertise to ask a series of questions of each item:

- What skill and/or knowledge does this item measure?
- Is this skill and/or knowledge relevant to the subject and level of study?

- Is the item well written, likely to be clear to learners and does it have appropriate response options?
- Is this the most appropriate or efficient way of measuring this skill and/or knowledge?
- Could this skill or knowledge be measured in a different way which would enhance the efficiency and/or quality of the assessment tool?
- Does the item make good use of information presented in the stimulus?
- Does the item fit with others items in the same task (if any)?
- How does the item transform traditional ways of assessing?

All expert reviewers are themselves assessment developers so undertook this review with a recognition of the constraints in which assessment development takes place. Since the reviewers drew on the specimen assessment materials that were available at the time of the review, these may now have been replaced with more recent versions. As such, some of the aspects of the assessment materials noted by reviewers may already have been altered following feedback from schools and the ongoing review of bestpractice approaches to assessment that takes place within the IB.

Overall, the reviewers felt that the assessment materials they reviewed were of high quality with good and often rich stimuli used which frequently referred to authentic scenarios. Nevertheless, the reviewers also noted a number of areas which could be addressed in order to enhance the quality and effectiveness of the assessment materials.

The review of DP **language and literature** specimen assessments found that all items could easily be converted to an on-screen format. Advantages would include the option of both reading and listening to texts as well as enabling learners to type (and hence edit) their responses. An important consideration if any items of this kind are to be converted to an on-screen format, however, is the placement of the display and response sections on the screen. Ideally the screen would be split horizontally to allow learners to scroll up and down in the text at the same time as, and independently from, typing their responses.

Reviewers wondered whether a combination of item types would better allow learners to demonstrate their skills and knowledge, for example shorter response items that focus on asking learner to extract particular sections of text and evaluate or critique them as well as a long open response. This would enhance speed, accuracy and efficiency of marking while also providing learners who may be less competent in writing lengthy texts to demonstrate their skills.

In the MYP e-Assessment for language and literature the reviewers noted the use of interesting stimuli to make tasks more engaging for learners but suggested including examples to indicate what was expected of learners in certain tasks and also noted that functionality could be improved in some cases. Reviewers also suggested the use of tasks such as drag and drop followed by an explanation as a way to make items more appealing and authentic for learners.

The review of **history** specimen assessments looked at paper-based DP assessments and MYP e-assessment. In DP, the reviewers identified opportunities for enhancing the authenticity of tasks by providing learners access to video or audio sources, making tasks more like something that a contemporary historian would engage with, albeit with attention needing to be given to the number of sources that learners could be expected to utilise.

Again, reviewers wondered whether a combination of different items types would be useful to include, such as requiring learners to create concept maps or short multimedia presentations. If such response formats were to be introduced it would be critical to ensure that learners had gained prior experience so that they were not disadvantaged in the summative examination.

For the MYP on-screen assessment of Individuals and Societies, reviewers felt that the digital opportunities had been utilised well to stimulate and engage learners in authentic tasks, with a range of item types to make marking efficient. They did, however, wonder if further optimisation of the digital platform could have been achieved, such as calling on learners to add elements to an action plan and then justifying their choices.

Reviewers of **mathematics** specimen assessments felt that the papers were of high quality with good and often rich stimuli used which frequently referred to authentic scenarios. Moreover, many stimuli incorporated relevant graphs and diagrams which required learners to consider realworld applications of mathematics.

In terms of the possibility of transitioning DP assessment to on-screen delivery, the reviewers felt that there were both potential advantages and potential disadvantages in doing so. One advantage noted by reviewers was that an on-screen environment would enable the use of stimuli that were more authentic – such as an image (static or video) of an object rather than a pencil drawing.

Reviewers also felt there would be greater opportunities to create items that called for the use of mathematics in investigation in an on-screen environment, something that would stimulate more higher-order skills in responses. For mathematics assessment experts, a barrier to on-screen assessment has until recently been the challenge of learners writing equations or showing mathematical workings. Recent innovations such as Numbas or Wiris, however, offer new opportunities of addressing this challenge. Additional opportunities of a digital environment include elements such as having learners use a digital line drawing tool.

In the MYP mathematics e-Assessment, the expert reviewers liked the way in which the on-screen interface was used to provide learners with engaging and stimulating tasks. Overall, they found this to be a very interesting paper that provided learners with a range of stimulus material that contextualised the mathematics problems they faced in real world scenarios, such as videos and images, and with digital tools such as sliders and measuring tools a great addition. In some cases, however, reviewers felt that the stimuli were not entirely required for task responses.

The review of the DP science specimen assessments in biology and chemistry felt that all tasks could easily be transformed into a digital mode, enabling marking to be largely automated and enhancing authenticity. In several cases the use of images of real creatures or cells would enable new opportunities, such as selecting an element of a diagram or labelling different components.

In the MYP science assessment the reviewers found that the digital environment and its associated functionality has been optimised quite well, such as through the use of interactive animations and items that called on them to calculate and identify elements or plot data from a table. The stimuli were not always required to complete items, however. Reviewers noted additional possible ways of assessing learners such as through a 'pro' and 'con' table, as well as reusing stimuli across items.

Overall, the reviewers felt that the majority of assessment items from the paper-and-pen specimen DP assessments could easily be converted into a digital format and that that MYP items used digital functionality well. Ultimately, however, item design should be driven by considerations about the skill that learners are required to demonstrate and the best possible way for them to demonstrate this, making advantage of on-screen functionality, facilitating consistent marking and optimising validity, reliability and authenticity.

Greater levels of digital assessment would require attention to be given to learners whose typing skills and comfort with digital devices is limited and to the skills required of test developers who need to have both a high level of skill in test development as well as a deep understanding of the functionality possible in a given test system. In the context of the IB, there are likely to be a whole range of as-yet untapped opportunities to assess learners in ways that may be able to enhance assessment

### Interviews and focus groups with IB staff

The goal of interviews with IB staff was to supplement surveys of teachers to identify understandings of digital assessment from the perspective of those within the organisation and to give a sense to schools and leadership the resources that can be optimized and drawn on to enact a vision of digital assessment that reflects future learning.

Eight focus groups with IB staff included subject coordinators and curriculum coordinators from the four subject areas of history, science, mathematics and language and literature, in addition to interviews with staff across the organisation. senior Participants were asked about a range of issues including impact on teachers, backwash, the digital divide, accessibility, learner inquiry and meeting learner needs. Overall, the findings painted a picture of an organisation endeavouring to find the right pathway into the future that balances a number of crucial demands.

On the one hand, a key IB principle is to ensure inclusivity and there is a strong desire to cater to the needs of the wide range of schools who take on IB programmes. On the other hand, there is a strong desire for the IB to be at the forefront of contemporary education, drawing on the best that technology has to offer to provide learners with a world class educational experience that gives them optimal preparation for the future.

One of the key issues that was brought up by IB staff in discussions was the need for approaches to teaching, learning and assessment to reflect the reality of learners' lives, and the ways in which they are learning, and teachers are teaching. Many staff highlighted the possibility of assessing deeper concepts with digital assessment and equally emphasised that this should be regarded as an extension of what happens in the classroom, with the incorporation of digital technologies in teaching and learning activities enabling 'epistemological growth and more complex thinking'.

Those staff who have been directly involved in MYP onscreen reported that they had seen a positive effect on teaching and learning, with teachers learning from the sample examinations and introducing an increasing amount of technology into their teaching practice. They further reported that learners are engaged in more inquiry, with staff noting that 'when we do good assessment, backwash is a positive backwash'.

While the majority of IB staff were in favour of the integration of greater digital tools in assessment, in order to both reflect and drive their incorporation in teaching and learning, this was accompanied by significant concern to ensure that no learners, teachers or schools were disadvantaged.

In addition to expressing their concerns, however, staff referred to the digital divide to be primarily 'attitudinal'. This meant that it related more to the perceptions of schools and teachers than major contrasts in access to digital tools. Staff hence focused on their need to 'provide much more support to schools to alleviate some of the fears they have'. Staff felt that the IB should tailor its support to teachers with a range of perspectives. This could include those who are already on board in terms of understanding the value of digitisation and those who are interested but report that 'I need somebody to show me how it's done'.

Key topics that were raised under the theme of the desirable form and function of a system were the expectations of universities; the way in which the system should be designed; crowd-sourcing content; balancing system security and flexibility; the use of new functionalities; being forward looking; and limitations.

In terms of optimising the opportunities that digital assessment could offer, staff commented on a range of advantages this would provide to learners, and in the assessment of learner competencies. Equally, they identified that certain subjects may 'lend themselves more to being assessed in a digital way' and they suggested that it would be beneficial to maintain a spectrum of types of assessment from traditional forms to those that are really advanced.

Overall, the focus groups and interviews emphasised the efforts being made by IB staff balance а range of competing to responsibilities as they navigate a world in which digital technologies are increasingly on teaching, learning impacting and assessment.

#### Survey of IB teachers

An online survey of IB teachers in all four programmes was disseminated to a sample of schools with the goal of collecting their insights into the relationship between teaching, learning and digital assessment. The survey tool varied slightly per programme and was provided in English, French and Spanish. Questionnaire items were based on seven focus areas used to form a comprehensive evaluation of respondents' perspectives on digital tools and assessment:

- Prior experience using digital assessment;
- Respondent opinions about digital teaching, learning and assessment;
- Backwash from formative assessment;
- Backwash from summative assessment;
- The preferred format for digital assessment;
- Current use of digital pedagogy; and
- Estimation of learners' ICT skills.

For the MYP, currently the only IB programme to offer e-Assessment, a focused set of items were developed to better

understand how e-Assessment is currently being used in the IB and respondent attitudes towards this. Throughout the questionnaires a balance of open and closed items were used.

It is important to note that this is an exploratory study that covered a number of different areas. This has innate limitations including that its focus was necessarily broad, that there may be a difference between what respondents report doing and what they actually do and that there is no way to measure how teachers actions play out in practice, nor their impact on learners. This summary should be read with these limitations in mind.

Moreover I, the design of the survey instrumentation was strongly influenced by elements that arose from other components of this study, namely the literature review, the focus groups and interviews and the expert reviews of curriculum materials and specimen assessment. As such, this section should be read in conjunction with those parts of this report in order to provide a broader context for the issues it addresses.

Overall, 2,775 educators responded to the questionnaires (65 percent female, 82 percent aged 31 to 59 and 63 percent teaching in private schools). The majority of responses were from those involved with the DP programme, followed by PYP, CP and MYP. Item responses were analysed by programme, region, gender, respondent age and school type, with programme identified as the most important, statistically significant factor. Quantitative data findings were supported by qualitative data from respondents. Key findings included:

- Just 16% of respondents report having prior experience using digital assessment, including in IGCSE, ICSE, BTEC and national programmes.
- 64% of respondents agree that digital assessment aligns well with the IB philosophy and that digital assessment should be included in IB programmes.

- 68% of respondents think that the use of digital assessment makes a positive contribution to the quality of learning and 66% report that most learners in their school will require training on how to use digital assessment tools.
- 70% of respondents report that the use of digital assessment increases their ability to monitor learner progress effectively and 71% that it changes the way that they select and conduct learning activities, but equally 78% report that teachers in their school require training and support in order to effectively use digital assessment.
- 76% of respondents agree that schools should be able to use an IB digital assessment platform to build their own formative assessments and 76% of respondents agree that their school requires support from the IB to use digital tools.
- 65% of respondents agree with that the IB should be seen as innovative in its use of digital assessment in comparison with other exam boards and 64% that IB programmes should reflect the increasing ubiquity of digital tools in daily life
- Only 29% of respondents agree that the use of digital assessment would have an influence on parent choice about whether to enrol their children in an IB programme.
- Teachers who currently using digital formative assessment note that the way in which they monitor learning is the most significant change in their teaching as a consequence.
- Teachers suggested that digital summative assessment would influence their teaching in similar ways as digital formative assessment currently does, and responded generally positively to the idea.
- 62% of teachers in the CP reported integrating digital pedagogy into their teaching in most or all lessons versus 30-40% in other programmes.
- Respondents are generally positive about the way in which the integration

of digital pedagogy has changed their teaching, for example with 72% reporting that it helps them cater to a range of learning styles.

- Challenges to integrating digital pedagogy noted by respondents include a lack of resources, time management (both in preparation and in class) and the need for more training.
- Respondents identified that a greater proportion of CP learners than those in other programmes are able to study and learn effectively in technology rich environments.

### Synthesis of research findings and key considerations

The IB suite of programmes are underlain by a unique set of principles that define the fundamental purpose and objectives of an IB education. Close to the third decade of the 21<sup>st</sup> century, the challenge for the IB lies in how to stay true to these principles in a context in which the world is being rapidly reshaped, particularly by the two forces of globalisation and digitalisation.

What does learning look like in this context? How can the IB best develop programmes that prepare learners for their future lives with these dynamics in mind? And how can the IB best support its schools to deliver appropriate support to learners?

Overarchingly the IB's approach to learning, teaching and digital assessment sits at the forefront of an area of education which is rapidly developing globally.

In order for the IB to continue this journey of providing the best possible service to its learners and teachers, the synthesis of all of the data collected in this study has illustrated the key contexts that are important for the IB to consider in determining its forward path. Among these are clear directions of travel that seem like they would be widely supported by IB staff, IB educators and that are backed by the review of literature and global best practice. **Learning progressions** - The notion of learning progressions emphasises the need for learning and teaching activities to be sufficiently flexible to cater to learners with a range of competencies and at different stages in their learning journeys. Within this, the role of assessment becomes that of monitoring progress and providing insights to learners and teachers on next steps.

**CONSIDERATION I** – The IB should seek to define appropriate learning progressions in all IB programmes and cross-disciplinary themes. Built into this process, the IB needs to explore validation methodologies for their learning progression approach.

Assessment can also generate the data required define the important ideas, principles, and skills of a subject in a sequence that represents how learner competence develops. If the IB is able to reach a stage where it has defined and validated learning progressions for all of its cross-cutting themes, this would certainly contribute to the IB's continued place at the cutting-edge of educational practice.

**Ongoing assessment** – there has long been a dichotomy between formative and summative assessment but this is increasingly being challenged by a focus on ongoing assessment in which a holistic picture is built of a learner's proficiency across a wide range of competencies, incorporating both formative and summative assessment. Finding ways to bring the range of assessment activities together is something that the IB could consider.

One approach would be to give schools access to the same digital platform as that used for the formative assessments so that they could use it in teaching and learning activities, including formative assessment. This would support teachers and learners to gain the confidence to use digital assessment and would make it possible to use formative assessment as a testbed and innovation lab.

CONSIDERATION 2 – The IB should consider moving away from a model in which summative examinations contribute most of the final grade to an approach in which from ongoing assessment data contributes their to overall performance. Naturally such a consideration would need to take into account the multiple purposes of assessment and the needs of schools in their contexts.

The ultimate goal for ongoing assessment would be to move away from so much weight being placed on summative examinations to a model where a greater proportion of the final grade comes from assessment throughout the course. This would, of course, need to be carefully considered in relation to tertiary entrance but it is likely that tertiary institutions may be amenable to this approach.

Collecting **data analytics** from digital assessments opens up an increased ability to use evidence to inform teaching and learning. Backwash from digital assessment has a big influence on the use of data analytics and the IB is uniquely well placed to leverage the value offered by data analytics since the network of IB schools around the world form an enormous ecosystem.

**CONSIDERATION 3** – The IB should develop an integrated system that can be linked to platforms for ongoing assessment across schools, data collected within schools and that can enable benchmarking to better support learning. This would also enhance the reporting on learner progress that could be provided to learners, teachers and parents. Ideally, this should be linked to any platforms used for digital summative assessment.

IB schools already collect a great deal of data on their learners and if this could be combined with data collected by the IB on MYP and DP summative assessment then it would strengthen the capacity of schools to identify how best to support learning.

Ideally, data collected and made available from digital assessment systems would include not only information on learner performance but also on how they approached the tasks. This can provide a rich seam of insight into learner behaviour that sheds light on more than their overall performance alone. The IB may also wish to consider psychometric analysis to add value to the data that can be extracted from assessment activities and enable the statistical validation of learning progressions.

**CONSIDERATION 4** – The IB should explore the applicability of psychometric approaches that might fit in their context to strengthen future assessment practice driven by effective pedagogy and be inclusive of the ways in which IB marking is quality assured. Psychometrics analysis does not need to be used in all assessment activities but will add value to the assessment practices of the IB and will be essential if the IB wishes to validate learning progressions (see consideration 1).

**Reflecting a Digital World** - Most digital assessment around the world have not progressed much beyond paper-on-screen, due to the cost of developing digital technologies for assessment and concerns about undermining the rigour of assessment practices. This tension could equally be said to apply to digital teaching and learning practices and is illustrative of a tricky balance for the IB, to be both innovative and inclusive.

Teachers and IB staff expect the IB to move ahead with digitalisation, particularly in assessment and this inevitably means finding the ideal balance between forward-looking digital approaches and accommodations for schools with limited resources. CONSIDERATION 5 – The IB should establish a coherent policy for the incorporation of digital tools across learning, teaching and assessment as and when required and support schools with resource restrictions to find sponsorship to supply required technology. Policies will need to strike a careful balance given the potential for intervention in largely school based processes.

This further highlights the need for the IB to find the best possible ways to support teachers and schools in incorporating greater digitalisation into education.

**Support for teachers** – Digitalisation can place immense pressure on teachers. Technological Pedagogical Content Knowledge (TPACK) requires teachers to be able to create interactions between the three bodies of knowledge of pedagogy, content and technology.

**CONSIDERATION 6** - IB staff should seek to identify relevant TPACK knowledge in their subjects as part of curriculum review. This understanding should seek to drive the development of a suite of support materials that can provide teachers across subjects and across programmes with suggestions, recommendations, good practice guides and case-studies from other teachers in IB programmes to support the enhancement of TPACK among teachers.

There is clearly a strong need for teachers to have support and training to use digital tools more widely and this raises questions about how the IB can best support teachers. There are divergent views among IB staff about the responsibility of the IB towards supporting teachers in IB programmes. One approach may be to leverage the IB educator network to support teachers in swapping examples of good practices in the use of digital tools in the classroom and in formative assessment. Learner skills – There is also a need for learners to receive support and training to use digital tools in learning and assessment activities. This, in addition to an emphasis on ethical uses of digital tools and critical digital literacy, as well as the opportunity for connected classrooms across countries could receive greater focus in subject guides and in programme FPiP documents.

**Digital Assessment Innovations** - There are pockets of innovation in digital assessment around the world but this remains an evolving space where nothing can be definitively concluded about what works and what does not. Insights indicate that where digital assessment is well integrated, a clear decision has been made by those in charge to move towards digital assessment but educational bodies have worked in a gradual and step-wise fashion to support stakeholders to adopt digital assessment if necessary.

CONSIDERATION 7 - The IB should license or develop a digital assessment delivery system that is able to support a wide range of item types and to collect and make available detailed data on both student performance as well as the way in which students navigate the assessment tools. This system should be made available to schools to enable them to build their own formative assessment tools and to familiarise students with the functionality used in examinations.

This indicates the need for the IB to work closely with different stakeholders on how best to expand digital technologies, and to identify how they respond. IB staff suggested that one approach to measuring the impact of innovation on schools was to include relevant questions in regular surveys of schools as a way of 'taking the temperature of how these things are landing in schools'.

Digital teaching, learning and assessment - Digital assessment is ideally

used in contexts in which there are close parallels with digitalisation in teaching and learning. Survey respondents report using digital pedagogy in much of their teaching and that it has a positive impact on learning.

**CONSIDERATION 8** – IB staff responsible for each subject / programme combination should strive to identify and justify the optimal approaches to learning, teaching and assessment, ensuring sufficient consistency (but not necessarily replication) across programmes and across subjects.

This indicates fertile ground in the IB for digital assessment but caution should be taken as this may not equally be the case across all programme/subject combinations. The IB may wish to reflect on where best to integrate digital assessment next. This means that where there is an obvious need for digital tools in particular subjects this would be the best place to consider using digital assessment in the DP, for example.

**Good Assessment Design** - Digital assessment makes the notion of what 'best practice' is in assessment even more difficult to identify due to the lack of empirical evidence about which forms of assessment are more effective than others. Ideally, the choice of assessment format is driven by identifying the most effective method of collecting data on learners' skills and knowledge in a way that generates useful insights to inform improvements.

Assessment design has to consider a whole series of elements, from efficiency and cost effectiveness to validity, reliability, innovation, scalability, timescales, accessibility, and so on.

This indicates that the IB needs to focus its continued improvements in assessment on enhancing the skills of all those involved in order to ensure that as new possibilities come into focus they are able to make informed decisions about how best to measure learner skills using the functionalities available to them, as well as to work closely with technical developers to design a system that best meets their needs.

CONSIDERATION 9 – The IB should ensure that global best practice in assessment design is applied to assessment activities. This should include: clear definitions of the purpose of each assessment tool in an assessment framework; involving students in testing (through cognitive laboratories and/or piloting) during development of assessment the materials; and using psychometric analysis where possible and appropriate identify to item performance as well as any differences in performance between students of different characteristics.

**Subject and programme resources** – Subject guides and programme documents are not currently consistent in the extent to which they address how the nature of subjects have changed as a result of digitalisation and if digital assessment increases across the IB. The IB may wish to make explicit links between transformations in subjects and ways to assess learners' skills.

**CONSIDERATION 10** – The IB should transform programme and subject guides into a searchable digital repository of a series of topics that teachers and other users can navigate as they need and that can be updated, amended, removed and added to as the context in which education takes place changes.

In conclusion, this research took a necessarily broad scope and could not cover in depth many aspects it brings to light to answer the research questions. The IB can consider many areas of further research with regards to the relationship between teaching, learning, and digital assessment. These areas can include further understanding of teacher and examiner practices with assessment; utilizing the considerable contributions of the learning sciences to specific designs and digital affordances of approaches in digital assessment design, data analytics, AI, and ongoing assessment that are reflective of appropriate pedagogical forewash.

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## INTRODUCTION

The relationship between teaching, learning and assessment has always been a topic of curiosity to those with a passion for education. It is a three-way dynamic that works best when in equilibrium, with each component feeding into the others and with the needs of learners central to all.

As 'digital' becomes regarded as an increasingly fundamental prefix to all three components, the dynamic is inevitably shifting. But in order to leverage the benefits that digital teaching, digital learning and digital assessment can offer to enhance the quality of learning, it is essential that one understanding remains constant – that the needs of learners must remain paramount.

In this research study we examine the key trends shaping education in the digital space and identify how these can inform and strengthen practices within IB programmes. We explore the way in which notions of learning, teaching and assessment have evolved over time and look at how notions of assessment have both reflected and informed ideas about learning, particularly with relation to learning progressions.

We consider ways in which the introduction of digital technologies into the learning and teaching space has transformed the understandings of what knowledge, application, achievement and success mean. Moreover, we look at the impact that this has had on teaching practice and learners.

Considering these key trends, we look at the unique perspective of the International Baccalaureate (IB) suite of programmes and considers how best the IB can navigate the opportunities and threats posed by emerging dynamics. The report is the culmination of a lengthy and multi-faceted study which has involved four distinct but linked research activities, predominantly over a 12 month period between October 2018 and September 2019.

The research has been driven by four key questions, and each of these have had specific research activities associated with them:

- Question I What is the current state of the art understanding of digital assessment use within the future educational landscape? This involved a literature review that focused on pertinent trends in teaching, learning and digital assessment and identified some key considerations for the IB.
- Question 2 How do IB curricula and digital assessment affordances reflect the state of the art in digital assessment use? This involved an expert review of subject and programme guides and specimen assessments across the PYP, MYP and DP and in four exemplar subject areas (mathematics, science, history and language and literature).
- Question 3 What is the backwash effect of digital assessments on teaching and learning? This involved a survey of teachers and coordinators in IB schools around the world which collected data on their experiences of, and attitudes towards, digital assessment and digital pedagogy and a series of interview and focus groups with IB staff in The Hague and Cardiff that highlighted some major topics around how the IB can best serve its stakeholders.
- Question 4 How can the IB innovate future versions of digital assessment task design and development? This has involved a synthesis of all the sources of data named above to identify possible forward directions for the IB.

This report presents a summary of the four data sources. The full literature review is available as an additional document and a summary of the key points is included a section of this report. Details of the expert review of programme documents (the From Principles into Practice documents for the PYP, MYP and DP) are provided in **Appendix 2** and a summary of these is included in this report. A summary of findings from the expert review of specimen assessments comprises a section in this report, while detailed findings including excerpts from assessment instruments are provided in **Appendix 3**.

The interview and focus group questions used with IB staff can be found in **Appendix** I while a section of this report includes a synthesis of the qualitative data collected using them. The survey instrument used with IB teachers is provided in **Appendix 4** and a summary of all data by programme is provided in **Appendix 5**, while a summary of key findings is included in a section of the report. In addition, the IB has been provided with all the quantitative and qualitative data that derived from the survey instruments.

In this study we have used the collection of data from all of the sources listed above to consider how the IB can approach the synthesis of contemporary trends in education with its focus on inquiry- and concept- based, contextualised, collaborative, differentiated and assessment-informed teaching and learning. Within the IB context, we focus on the evolution of digital technologies – particularly in the realm of assessment – and discuss how the IB can move forward in a way that best balances technological advances with an approach that stays true to the philosophy of the IB and its programmes.

While acknowledging the meta trends that are shaping contemporary education, we consider approaches that the IB can use to support the day-to-day efforts of teachers and schools to provide learners with a supportive and enabling environment in which to grow and thrive, and prepare themselves for their adult responsibilities.

We do not aim to be prescriptive around how the IB can select particular tools or resolve how best to assess learners in specific subjects. This is a very dynamic space and new approaches and tools are emerging on almost a daily basis. Nor do we set out to suggest how the IB should approach the assessment of particular subjects.

Furthermore, we are also not working on the assumption that a digital approach necessarily adds value. Poor teaching with a digital device is still poor teaching. And poor assessment on a computer is still poor assessment. The fundamentals of good education remain constant but in the 21<sup>st</sup> century the digitalisation of the world around us cannot be ignored, and this clearly has important implications for IB programmes.

Overall, we aim to provide the IB with a review of the key considerations that need to be brought into decisions around how best to serve their schools and enhance learning opportunities for learners in IB programmes.



# KEY INSIGHTS FROM THE LITERATURE REVIEW

### **Introduction**

The IB is at an interesting time in the use of digital assessment, with the use of e-Assessment in the Middle Years Programme (MYP) but retaining traditional paper-and-pen summative assessment in the Diploma Programme.

The IB also has a unique approach to education and key principles running through all IB programmes include inquiry, contextualisation of learning, learning how to learn, community service and global understanding. A recent IB publication states that 'technology should support assessment' (IBO, 2018, 6) but further states that this should not be done at the expense of these principles but rather to help better channel them into practices.

In this context, the literature review has focused on addressing the question 'What is the current state of the art understanding of digital assessment use within the future educational landscape?' It looks at the contemporary context within the evolution of key movements in education and identifies the role that digital assessment can and should play, and some key considerations for the IB to address moving forward.

Throughout the review we have retained a focus on the fundamental significance of purpose and on finding ways to ensure that the three components of learning, teaching and assessment work in alignment. This means that having a clear view of objectives is critically important in determining the form and function of digital assessment, as well as ensuring that there is alignment with teaching and learning.

The section of this report will give a synthesis of the literature review findings without references cited. For the full discussion and references please see the companion report 'The Relationship between Teaching, Learning and Digital Assessment-Literature Review'.

### <u>Methodology</u>

The literature review has focused on three key sources of information. First, academic journal articles and books written by educational researchers that reflect the key philosophies and movements in education and that also report on initiatives to enhance educational practices.

The limitation of academic literature is the time lag, however. It can be several years between research taking place and the publication of an article reporting on it. In a rapidly moving arena such as digitalisation, this means that the newest practices may not yet be reflected.

To address this, the literature review has also incorporated so-called 'grey literature' from organisations and governments who are engaged in relevant activities in the areas of teaching, learning and digital assessment. These include reports, blogs, websites, interviews and presentations which engage with the most contemporary movements in education.

Finally, the literature review has also engaged with publicly-available sample assessment materials from organisations engaged in some of the most innovative and forward-looking initiatives. These include large international bodies such as the Organisation for Economic Cooperation and Development (OECD) as well as some of the well-known global assessment organisations.

The researchers involved in this literature review undertook an approach which was informed by a combination of their own knowledge in this field, key word searches in academic databases, a web search of key organisations involved in assessment and utilising key themes that arose in the initial sources perused to lead them to other important areas of consideration.

The review considered a range of ways in which digital assessment has evolved and is practiced in contemporary education, including the opportunities that it offers and the key design considerations. Reviewers looked at a range of examples of digital assessment usage in international assessments, in language assessments, in national assessment programmes and in initiatives to measure twenty-first century skills. Both academic and stakeholder insights were drawn on to contextualise each of these examples.

Finally, the research focused on some of the key components of the relationship between teaching, learning and digital assessment in the context of best practice approaches to education. This included the issue of the importance of the skills of learners and teachers and the reviewers drew on research to identify best practice approaches in supporting these key stakeholders to navigate new dynamics in educational practice.

### Contemporary contexts

An appropriate balance between innovation and stability needs to be found in an educational landscape in which some contemporary forces are reshaping the nature of teaching and learning. The first of these is a shift towards knowledge creation rather than acquisition, and this is combined with the emergent understanding that all learners are on an individual learning pathway.

This pathway is demarcated by a series of learning progressions, along which all learners can make progress. Key to learning progressions is the regular collection of empirical evidence to help learners and teachers identify where they are and where they need to go next. Also crucial is the notion of a growth mindset in which all students have the opportunity to improve, albeit at their own pace.

As learning progressions raise the need for ongoing assessment, they move away from the mutual exclusivity of formative and summative approaches. Instead, assessment becomes a 'present to future' model in which a regular flow of insights to teachers and learners is enabled and assessment is fundamentally embedded in the everyday nature of teaching and learning rather than separate from these.

Part of the value of digital assessment is its ability to generate a whole series of datainformed insights into the way that learners are navigating the curriculum. This is often thought of in terms of the responses that learners have given to particular test questions, highlighting their skills and knowledge at a particular moment in time.

There is scope within digital platforms to generate much richer insights, including to measure time-on-task, misconceptions that lead to errors and decisions that learners make about order of responses. When it is also possible to collect data from digital platforms that learners use in learning activities, a wealth of insights is generated. And in a relatively closed – and huge – ecosystem such as the IB's suite of programmes the potential of using this data to enrich education is enormous.

This brings data analytics and artificial intelligence (AI) to the fore. AI in this context refers to the ability of digital devices and systems to undertake tasks normally performed by humans such as recognising speech while data analytics is the capacity to draw together a number of sources of data in order to draw conclusions.

These offer vast potential for not only identifying learner proficiency within traditional subject boundaries but also across them and in the sphere of 21st century skills. This has the potential to significantly reconfigure how education is enacted.

Thus the contemporary context of education calls for digitalisation to reflect the broader digitalisation of our lives. On the one hand, digital tools are increasingly mainstream in teaching, learning and assessment. On the other hand, however, the purpose of the use of digital tools in education remains somewhat unresolved.

Moreover, any mention of digitalisation raises

important questions about the unequal access of learners and teachers to digital tools – both in school and at home – and concerns about inequalities in access to quality education as a result.

A further issue in the context of the IB relates to the agency of schools. Schools offering IB programmes differ significantly around the world and in this context the question arises of what is the ideal balance for the IB in setting requirements without being prescriptive?

This returns us to a need to focus on purpose. If there is a desire for enhanced learning then to what extent can digitalisation support that move? How can digital assessment and digital pedagogy be best configured in order to allow for deeper, more effective or more efficient learner learning?

### **Digitalisation**

The addition of the prefix 'digital' to key elements of education is the contemporary expression of a long history of evolution in educational technology. In recent times, this evolution has been characterised by exponential growth. There is enormous scope to enhance educational opportunities but these can be neglected in the excitement of innovation for its own sake.

We are now at a point in which digital tools used for teaching, learning and assessment embody a range of exciting possibilities. Computer based testing has evolved to enable adaptive testing, the integration of AI, the evaluation of 21<sup>st</sup> century skills, virtual reality, gamification and the use of avatars. All of these have begun to be used in educational contexts with initial research indicating positive impact on learner motivation and learning.

Nevertheless, despite all of these stimulating advances, most digital assessment remains in a phase where it is basically 'paper-onscreen'. It is largely unchanged from traditional assessment other than learners type rather than handwrite their responses. The use of paper on screen models of digital assessment rather than more innovative approaches can be attributed both to the cost and skill required to create more forward looking tools, and is also due to a degree of anxiety around potentially jeopardising highstakes assessments through integrating technology that does not work.

This is a shame since digital platforms can enhance assessment in a number of ways, including: providing learners with new forms of representing knowledge and skill; facilitating peer- and self-assessment; providing the opportunity to move away from time specific testing; supporting collaboration; assessing complex problem solving; and enhancing feedback to learners.

Interestingly, these opportunities are much more likely to be utilised in formative types of assessment rather than in summative examinations due to the greater flexibility and lower stakes that characterise formative models.

Yet even in formative assessment they are often unable to be fully realised for practical reasons such as the digital proficiency of teachers and learners, the availability of digital devices, the ability of teachers and learners to use data to inform practice and ethical issues around the collection, usage and storage of data.

Another challenge lies in digital assessment design. There are multiple formats that could possibly be used for assessing learners but these require good assessment design matched to the design of appropriate digital affordances of the tools or systems.

Digital assessment is not necessarily good assessment and getting it right means starting from purpose and recognising that the best methods are those that are able to collect useful information about the position of learners in their learning. This means avoiding the trap of using digital assessment for its own sake and instead only deciding to use it because doing so offers clear added value that alternatives are unable to provide.

In addition, the flaws of traditional assessment practices do not disappear when a digital device is used. Assessment is still assessment, and much of it involves placing learners in stressful situations in which the entirety of their experience in a particular subject is expected to be summarised in a few hours of testing, with results potentially exerting a profound influence on their future lives. The traditional criticisms of this model in terms of its very limited ability to capture the gamut of learners' capacities remain intact regardless of the tools used.

While digital assessment offers a range of possibilities for rethinking assessment, these can only be optimised if there is an appetite for transformation. Many education professionals are very uncomfortable with changing the way that 'things have always been done' and this means that much digital assessment looks very much like traditional assessment, with the opportunity of evolving a new approach to the evaluation of learners frequently missed.

### Best practice in digital assessment

Innovations in digital assessment are flourishing but robust academic investigation of their impact on learning is lagging far behind. In terms of assessment as a whole, best practice means that the learning of individuals is made visible through the use of efficient and well-targeted tools, in a way that can identify where learners currently are and the future steps they need to take.

With this understanding, 'best practice' in digital assessment means that digital technologies are used in a way to enhance the achievement of this goal. This could mean the development of more efficient or better targeted tools that have an enhanced ability to identify learner learning. Equally, best practice in digital assessment could mean that assessment is able to measure types of learning that have previously been impossible to make visible (such as 21<sup>st</sup> century skills). The lack of a strong core of empirical evidence on the value of digital assessment, or indeed any aspects of a digital educational environment, places organisations such as the IB in a difficult situation. Making the best possible judgement about the format of assessment that will best meet the needs of its programmes and stakeholders inevitably needs to take place in something of a vacuum in which many of the answers needed remain opaque.

To address this, however, the IB can look to what initiatives are occurring in digital assessment, the extent to which assessment bodies have been able to use them to achieve valuable purposes and the ways in which they have been implemented. To inform this, the reviewers considered the most innovative approaches to assessment that are taking place around the world. This involved extensive research in academic and grey literature.

One of the challenges to this research - as well as in evolving the field of digital assessment practice – is that many innovations are hidden behind walls constructed to protect intellectual property. It is almost impossible to find any details about innovative approaches used by many commercial organisations, for example. Hence, the review has included examples of digital assessment where there is sufficient information available in the public domain to enable a clear picture of their characteristics, and the way in which they are used, to emerge.

Freely-available examples of state of the art use of digital assessment tend to be found in large-scale and often national or international assessment programmes. In addition to the open nature of these programmes, the innovative nature of these digital assessments could also be said to related to their ability to spread the cost of innovation as well as their low stakes nature for individual learners, allowing greater room for experimentation.

Examples from international assessments include the use of avatar-like agents to

support the assessment of collaborative problem solving in PISA 2015; a range of interactive stimuli including posts from a web forum in PISA 2018; the use of interactive scenarios in eTIMSS 2019; the requirement for learners to navigate a series of curated websites in ePIRLS 2016; and the use of dragand-drop tasks in ICILS.

From national assessments, learners in Denmark have free access to the internet during online assessments while in Finland learners and teachers have prior access to the testing system to enable familiarisation. In Norway all marking is fully digitised and in Scotland a form of adaptive assessment is used, with instant results provided to teachers for forward planning.

In English language proficiency tests, The International English Language Testing System (IELTS) is looking into the possibility of using video-conferencing for speaking assessment; PTE Academic is investigating the use of AI to assess speech and/or writing; and speaking and writing tasks for TOEFL are marked through online networks.

Concurrently, there is great interest in using digital assessment to measure 21<sup>st</sup> century skills in other contexts but this has been stymied by weak definitions of the constructs themselves. Nevertheless, ongoing efforts are being made such as the inclusion of modules on critical thinking, problem solving and global competency in PISA.

All of these examples have elements that the IB can learn from but, overall, the eassessment used in the IB's MYP programme is close to global best practice, and indeed eclipses some of these much larger-scale examples.

#### **Backwash and forewash**

For digital assessment to work in harmony with teaching and learning it is important that there is a focus on the dynamics involved between them. Key to these are the participants, processes and products that comprise teaching, learning and assessment. Both backwash (the influence of assessment on teaching and learning practices) and forewash (the influence of teaching and learning practices on assessment) are mediated through a range of variables, including teacher and learner attitudes and experiences, access to resources, and confidence. Importantly, both backwash and forewash can be both positive and negative.

In pedagogy, as in assessment, there are certainly many benefits in using digital tools. As in assessment, however, the benefits are often different to the ambitions. Moreover, there is little evidence for the widely held assumption that so-called 'digital natives' (whether teachers or learners) can more easily adapt to digitalisation in teaching, learning and assessment than others.

Equally, the backwash of digital assessment into teaching can put immense pressure on teachers as they are increasingly required to have Technological Pedagogical Content Knowledge (TPACK) and to be digital learning designers.

Achieving this requires a multiplicity of types of support, resourcing and changes in institutional cultures, along with the recognition that there is no one-size fits all approach. This poses interesting challenges for the IB as it considers how best to support teachers in its programmes, particularly in light of its 7 year curriculum review cycle.

Seven years is a very long time in the world of digitalisation and many educational practices can be transformed within this period, potentially leading to guidance documents becoming out-of-date increasingly quickly. Equally, constant innovation and change can be profoundly disruptive to learning and teaching and hence charting a sensible course between the two dynamics is extremely important.

### Resourcing digitalisation

A further consideration for the IB lies in the resourcing that schools require for digital teaching, learning and assessment to work in harmony with each other. All IB schools must have digital devices but the number, type and capabilities of these vary significantly. This means that teachers and learners across IB programmes have differing access and exposure to digital tools and modes of learning. Tailoring support in this context requires a deft approach.

There is extensive academic and grey literature about the digital divide between learners with greater access to digital tools and those with less, and the consequences that this can have in terms of disadvantaging some learners in relation to others. This is a major concern for educational bodies around the world and is an aspect that will not be easy for the IB to resolve. Even when learners have equal access to devices, irregular internet connectivity can undermine their opportunities to use them.

Moreover, the resources (particularly in terms of skills) required to design and develop digital assessment and teaching resources that makes the most of their promise cannot be understated. Moving to interactive, augmented reality, scenario-type assessment is very attractive in theory but the practicalities of bringing this to reality are very different.

The skill levels required, not only in terms of programming expertise design but also in terms of assessment design, greatly transcend those available within most educational bodies. Rapid developments in educational and instructional technology mean that skills also need to evolve continuously as educational bodies such as the IB perpetually evolve their approaches to digital assessment, as well as the digitalisation of teaching and learning.

Even at the level of simple paper-on-screen type assessments, a high degree of expertise is required to develop the types of items that can evaluate higher-order skills in a way that both enables automatic marking and the identification of misconceptions underlying errors. Taken together, these understandings point to a need for continued upskilling of IB staff and stakeholders and ongoing debate about how best to meet the needs of learners. They also raise questions for the IB about who should be involved in the design and development of assessments.

In addition, if robust learning progressions are to be developed, psychometricians are While well-defined learning reguired. progressions for subject areas - or indeed across them – offer great potential to support the tracking of learner growth, they are not easy to develop. The research- and practiceinformed initial stages can be done by those with an in-depth understanding of learning and subjects but collecting and analysing the statistical data to validate learning progressions requires sophisticated psychometric approaches.

Both of these have important implications for the IB's overall deliberations around digitalisation and the way that the IB addresses this within its curriculum documentation, curriculum review processes and the systems it develops to support schools.

### **Conclusion**

This review has emphasised the need for approaches to assessment to work in harmony with teaching and learning and to be driven by a clear purpose around the enhancement of learning.

The world of digital assessment is rapidly changing and there is enormous potential for the IB to innovate its approach to assessment. This includes moving to a model in which assessment is embedded within teaching and learning on an ongoing basis.

There are certainly a number of exciting ways in which digital assessment can provide positive support for teaching and learning but moving beyond a context in which 'new technologies are used to do old things' (Dolan, 2013) requires a vision and learning from the approaches already used in formative assessment and in the summative e-assessment used in the MYP.



EXPERT REVIEW OF PROGRAMME AND SUBJECT GUIDES

#### Introduction

As part of the curriculum audit phase of this study, a team of subject experts reviewed programme documents in the DP, MYP and PYP as well as subject guides for each level for the four exemplar subjects of language and literature, science (biology and chemistry in the DP), mathematics (both application & interpretation and analysis & approaches in the DP) and history (individuals and societies in the MYP). All documents reviewed were the most recent available on the IB portal at the time of the review.

The goal of the review was to answer the question 'How do IB curricula and digital assessment affordances reflect the state of the art in digital assessment use?' The review incorporated the From Principles into Practice (FPiP) documents that related to each programme and the within-programme guides specific to each subject. In FPiPs and subject guides, the reviewers focused on the extent to which programme coordinators and teachers were provided with indications about the incorporation of digitalisation in teaching and learning

It is important to note that the reviewers acknowledge that there are a number of other documents that are of reference to those leading and teaching in programmes and subjects, including but not limited to: Assessment Principles and Practices - Quality Assessments in a Digital Age; Programme Standards and Practices; Assessment Procedures; Projects Guide; Fostering Interdisciplinary Teaching and Learning in the MYP; Diploma Programme Assessment: Principles and Practice; The Role of Technology in IB programmes; and an array of Teacher Support Materials.

Nevertheless, as the main anchor documents for each programme, the programme FPiP is likely to be the key guiding resource for programme coordinators and also of great significance in giving teachers a sense of the expectations of their programme(s) beyond the subject-specific guidance contained in subject guides. Equally, the subject guides are likely to be considered by teachers as the key documents that they use in informing their approaches to teaching.

Since it cannot be assumed that programme coordinators and teachers refer to other documentation with reference to programme-specific or subject-specific information beyond FPiPs and subject guides, the expert reviewers viewed the documents reviewed here as 'setting the scene' for the programme as a whole and they were reviewed with this consideration in mind.

Moreover, the reviewers acknowledged the obvious links between different documents and the expected continuity across, for example, similar subjects within the same programmes (for example biology and chemistry in DP) and the same subjects across programmes (for example mathematics in the PYP, MYP and DP).

#### **Background and Methodology**

As discussed in the literature review in this study, good educational practice requires assessment, teaching and learning to work insync with each other due to the combined forces of backwash and forewash. In the context of the IB this meant that coming up with a frame of reference for a curriculum audit across the PYP, MYP and DP was challenging.

Digital summative assessment is at present only used in the MYP, and prior to the survey of teachers conducted as part of this study there was little known about the extent to which digital assessment in formative assessment was widespread across the IB. This meant that in the light of a study that focuses on digital assessment, there was little expectation that there would be any mention of digital assessment in FPiPs and subject guides.

Moreover, there has been no requirement for digitalisation to be mentioned in either FPiPs or subject guides in the past and hence finding an absence of mention was not something that could be criticised. A further challenge was the age of some documents – with a decade between the ones most and least recently published. In the world of digital technology a great deal has changed in a decade.

Taking this context in mind, the reviewers had several attempts at reviewing the documents until they identified an approach which yielded the greatest value. All reviewers were at least two of the following: test developers employed by ACER with of extensive experience developing assessment materials in their subject area around the world (across grade levels and curricula); former teachers in that subject (several of whom had taught in IB programmes); and experts in education in their subject area.

Drawing on their own teaching experience, their depth of knowledge in how their subject can be taught, their knowledge of digital assessment and pedagogy and the literature review, the reviewers decided on a set of elements that they would expect that contemporary teachers would wish to be given guidance on. These related to the whys, hows and whats of digital assessment and pedagogy.

The reviewers expected that all documents – whether at the programme or subject level – would provide teachers and other users with some mention of the **role** that digitalisation can play in education and its **relevance** to that programme or subject. While they did not expect to see this mentioned in depth, they were looking for some reference, however limited.

In addition, teachers tend to be interested in how they can integrate something that may be relatively new to them into their professional practice. As such, the reviewers expected to see something in FPiPs and subject guides on how teachers could go about **incorporating** digitalisation into that programme or subject. Recognising that digital tools are just tools, and that there may be circumstances in which they are likely to be more or less relevant, the reviewers also expected to see guidance to teachers in FPiPs and subject guides, perhaps in terms of 'key considerations' on when digitalisation may or may not be **appropriate**.

In considering the key role that FPiPs and subject guides play in guiding teachers, reviewers felt that it would be likely that the documents would include reference to **research** on how digitalisation can enhance teaching and improve outcomes for learners. Again, reviewers were cognisant of the fact that these references might be limited but felt that due to the profound influence of technology on teaching and learning they should at the very least be present.

Turning to the IB learner profile, reviewers considered ways in which they would expect to see digitalisation interpreted in relation to each of the components. In relation to being 'principled', 'communicators' and 'inquiring', reviewers felt that they should expect to see some mention of the **ethical** considerations in the use of digitalisation in the FPiPs and subject guides, something which is so often discussed in relation to contemporary education. The reviewers expected that these would touch on, for example, the avoidance of cyberbullying and the ethical use of online resources.

A great advance in the use of digital pedagogy has been the ability to link learners around the world together in shared classrooms and also to provide learners access to resources and perspectives from all around the world. The reviewers felt that these opportunities were ideal in relation to the IB learner profile component of **global mindedness** and therefore expected some reference to how digital tools could enhance learners' world views.

Considering the IB learner profile components that relate to knowledge, thinking and reflection, the reviewers expected to find reference in the FPiPs and subject guides to **critical digital literacy**, such as how teachers can guide learners to carefully evaluate sources that they retrieve from the internet.

Following discussions with IB staff during focus groups and interviews on the importance of the IB being inclusive, and the advantages of digital tools for widening accessibility, reviewers felt that it would be likely that the FPiPs and subject guides would make reference to the way in which teachers could utilise digitalisation to enhance **learner equality**. This would also tie into the IB learner profile component of 'caring'.

Finally, reviewers were aware that the contexts in which FPiPs and subject guides were written might mean that there were **opportunities** to make useful references to digitalisation in order to better support teachers' professional activities and to support professional learning.

Taken together, the reviewers came up with a list of elements that they would expect to see in the FPiP and subject guides and this formed the basis of their review:

- Approaches to digitalisation;
- Relevance of digitalisation;
- How to incorporate digitalisation;
- When digitalisation may or may not be appropriate;
- Reference to research on using digitalisation to enhance teaching, learning and outcomes;
- Ethical considerations around digitalisation;
- Digitalisation to enhance global mindedness;
- Critical digital literacy;
- Using digitalisation to enhance learner equality; and
- Any opportunities to incorporate mention of digitalisation where it is not currently referenced

Reviewers worked through all documents in depth in order to come up with their insights and these were initially summarised in detailed written reviews. Initially reviewers struggled to find mention of digitalisation in some documents so broadened the scope to include mention of technology in any form. The written reviews were somewhat wordy and repetitive and so, in a process of refinement, they were summarised in tabular format in order to provide an accessible overview of the findings. These tables can be found in **Appendix 2**. This section summarises the key findings and highlights the most significant considerations for the IB that arise from this expert review.

### Review of From Principle into Practice Documents

It is important to note that the MYP and DP From Principle into Practice (FPiP) are both for first use from 2015 (although the MYP FPiP was revised in 2017) while the three PYP FPiPs are from 2018, and could therefore be expected to be a little more up-to-date in terms of contemporary movements in education. Importantly, when the reviewers note an absence of something this should not be interpreted as a criticism unless this is specifically stated – it may simply mean that reviewers noted its absence but did not necessarily consider this to be problematic in that context.

Documents reviewed were:

- Diploma Programme: From Principles into Practice - For use from August 2015, last revised 2015
- Middle Years Programme: From Principles into Practice - For use from September 2014/January 2015, last updated 2017
- Primary Years Programme Enhanced: Principles into Practice – Learning and Teaching, Published October 2018
- Primary Years Programme Enhanced: Principles into Practice – The Learner, Published October 2018
- Primary Years Programme Enhanced: Principles into Practice – The Learning Community, Published October 2018

In terms of **approaches to and relevance of digitalisation**, the FPiPs all refer to the importance of enabling learners to function in highly connected global communities but vary in the extent to which they specifically note digitalisation in practice. The three PYP FPiPs emphasise the importance of using technology to both 'extend learners' thinking, research and communication skills during the inquiry process' and to develop their thinking skills and to help them make connections. In addition, explicit mention is made of the importance of digital and non-digital technology literacies in extending 'when, where and how learning and teaching takes place'.

Similarly, the MYP FPiP highlights the opportunities provided by technology for 'networking, sharing of initiatives, partnerships and impact' as well as providing example explorations in reference to scientific and technological innovation including digital life, virtual environments and the information age. In contrast, however, the DP FPiP does not specifically note the relevance of digitalisation and it would be useful to do so, particularly in terms of preparing learners for the highly digitised worlds of university and careers, as well as in ensuring consistency with the MYP and PYP FPiPs.

With relation to how digitalisation can best be **incorporated**, the PYP FPiPs provide a relatively large amount of guidance around technology and all that it can offer to learners, including that schools should provide learners with opportunities to *learn* technology, *learn about* technology and *learn through* technology. In addition, definitions and suggestions are given about the use of digital technology particularly in the realm of approaches to learning and conceptual understanding across the curriculum.

A different approach is taken in the MYP FPiP which includes reference to the ATL skills framework, incorporating examples such as participating in, and contributing to digital social media networks, collaborating with peers and experts using a variety of digital environments and media and using information from sources including digital social media and online networks). In MYP addition, the section on the

eAssessment provides a justification for using a digital model for assessment.

In the DP FPiP, however, there is only one reference to digitisation, in relation to the use of technology in peer assessment. The DP FPiP also highlights the ability for learners to submit work for assessment in a variety of media. There is certainly scope to incorporate greater reference to aspects of digitisation

For all three programmes there is little reference in any FPiPs to considerations about when digital tools may or may not be **appropriate**, nor to **research** about how digitalisation of pedagogy can be used to enhance teaching and learning outcomes. It would be worth including both of these elements in future versions of these guides.

In terms of **ethical** considerations around the use of digital technology, the PYP FPiPs refer to 'the ethical use of medialinformation (understanding and applying social and ethical technology)' and to the fact that learners need to learn to use technologies in ways that are socially and ethically responsible and that contribute to the global learning community.

In the DP FPiP there is reference to how individuals act and behave online as 'encouraging and expecting learners to act in an ethical manner to be respectful of themselves, other people and intellectual property'. The DP FPiP also touches on ethics in regards to digital citizenship noting that 'developing digital citizenship ... is about encouraging and expecting learners to act in an ethical manner'. In the MYP guide there is a reference to intellectual property rights but not to other ethical elements.

While **global mindedness** is a key philosophy underlying IB programmes, there is little reference to the link between this and digitalisation in any of the FPiPs. A mention of **critical digital literacy** is also largely omitted other than the ATL skills framework including reference to the need to use critical-literacy skills to analyse and interpret media communications and interpretations (including digital social media). In the PYP guide this is made a little more explicit with reference to multi-literacies including 'critical literacy: critical thinking through digital technologies'.

In reference to enhancing **learner equality**, the only guide with reference to this is the PYP Learning Community guide which includes reference to ensuring inclusivity by 'identifying and removing barriers to learning relating to ... resources' and this would be a good place to identify how digitalisation can assist with this, as well as for a similar mention to be made in other guides.

All guides have opportunities for **further reference** to digitalisation where it is not currently mentioned. As they are the most recent, the PYP FPiPs are the most comprehensive in their acknowledgement of the role of digitalisation but it will be important to ensure that these remain up to date as the field evolves. It would also be worth considering the inclusion of more guidance on how teachers and programme coordinators can incorporate digitalisation into their professional practice.

Overall, it would be useful to see the approach used in the PYP FPiPs expanded to the other programmes, providing teachers and programme coordinators with examples of how to incorporate those elements into learning and teaching. This would also lead to greater consistency across programmes. Examples could include web quests, viewing and/or creating video, interactive maps and data analysis. This need not be prescriptive but would help teachers become aware of the possibilities that exist (that they may, or may not, already know about).

In future versions of the FPiPs it would be worth including reference to considerations about when digital tools may or may not be appropriate and to research about how digitalisation of pedagogy can be used to enhance teaching and learning. A section on the important skill of critical digital literacy would also be valuable.

In the MYP FPiP it would be worth following the approach in the other FPiPs to the reference inclusion of to ethical considerations in the use of digital tools. In addition, the MYP and DP FPiPs would benefit from more reference to 'critical thinking through digital technologies' as there is in the PYP FPiPs. The PYP FPiPs reference to inclusivity could further be repeated in the MYP and DP FPiPs, in addition with some explicit mention of how digitalisation can help.

In the MYP FPiP it would be worth considering a number of revisions. The six global contexts for teaching and learning and at least three of the five MYP skill categories for teaching and learning are impossible to separate from the digital world. In all of these there is opportunity to reference digitalisation.

The section on resources in the MYP FPiP does mention classroom technologies, educational games and simulations and digital resources, including the internet but could be expanded to consider the range of digital tools now available. In addition, the section on approaches to teaching does not make specific reference to digital tools and this could be a useful addition.

In terms of ethics, the section on teaching academic honesty could usefully be revised to make explicit reference to the use of online resources. Furthermore, the section on the development of an academic honesty policy would be a good place to include a statement regarding ethical considerations in the use of digital technologies.

The opportunities offered by digitalisation to enhance global mindedness is not referred to in any of the FPiPs and it would be useful to include reference to the way in which digitalisation can offer learners access to global communities, as well as giving them a greater opportunity to engage in a range of perspectives, for example in a section on education for intercultural understanding.

Finally, the sections on assessment in general, and formative assessment specifically, could usefully be revised to identify how the use of digital tools can support an approach to assessment that is ongoing, and to give greater illustration of the value of peer- and self-assessment.

In the DP guide it would be useful to include reference to the way in which digitalisation can provide opportunities for deepening or enhancing learning, including in independent learner thinking leading to considered individual responses; the development of 21st century skills; collaborative learning activities; effective dialogue and feedback; and assessment for learning.

### Subject Guides

The subject guides were reviewed by those with specialist skills and teaching experience in those subject areas, many of whom had taught that subject / those subjects in IB programmes.

### Language and literacy

The guides reviewed were:

- Diploma Programme Language A: Language and Literature Guide – First exams 2015, Updated 2013
- Middle Years Programme Language and Literature Guide - For use from September 2014/January 2015, Updated 2017
- Primary Years Programme Language Scope and Sequence, Published 2009

In terms of **approaches** to digitalisation, the section on learning continuums in the PYP Language Scope and Sequence (SaS) notes the importance of acquiring digital literacy skills, includes digital outputs for written language and text types specifically reference blogs and wikis.

In the MYP language and literature guide there is reference to the use of ICT to access resources and gain skills while in the DP language and literature guide there is reference to a range of different text types including web pages, SMS messages, blogs, wikis and tweets.

None of the three language (and literature) guides include reference to the **relevance** of digitalisation, when digitalisation may or may not be **appropriate**, a reference to **research** about using digitalisation to enhance teaching and learning and outcomes or an indication of how digitalisation may enhance learner **equality**. The only reference to **ethical** considerations around digitalisation is in relation to cyber safety in the PYP language SaS.

The MYP language and literature guide does have reference to the impact of digitalisation on subject content, with relation to multimedia and the impact of media such as television, the internet and computer and digital technology. In addition, it notes the need for teachers to teach learners to use electronic media **critically** and to question, challenge and evaluate the meanings and purposes of texts (including multimedia) and it also includes reference to the value of including texts such as blogs.

Overall, there is room to **enhance** all three language (and literature) guides. The MYP guide has perhaps the most reference to digitalisation and it would be worth considering how strengths of the PYP language SaS and the DP language and literature guide can be combined with this to ensure more consistency across programmes.

The reviewers found that the limited amount of reference to digitalisation in the subject areas of language and literature was surprising considering that the impact of the digitalisation of communication and text has been profound and the subject area has been significantly impacted as a result. This goes far beyond text type to including the ways in which language is used for communication. It would be worth considering how this could be addressed in future versions of these guides.

Revisions could consider the way in which the nature of the subject has changed as a result of digitalisation, the affordances that digitalisation can create for teaching and learning and the ways in which digital tools can facilitate inter-country collaboration to enhance international understanding.

In addition, there is scope to refer to digitalisation in terms of the progression of learning, skills that learners need to acquire, how to plan the curriculum, approaches to teaching and approaches to assessment. Details about these opportunities are noted in the table in this section of **Appendix 2**.

#### History

The guides reviewed were:

- Diploma Programme History Guide -First examinations 2020, Updated 2018
- Middle Years Programme Individuals and Societies Guide - For use from September 2014/January 2015, Updated 2017
- Primary Years Programme Social Studies Scope and Sequence (SaS), Published 2008

There is very little reference to digitalisation in the DP history guide, MYP individuals and societies guide or PYP social studies SaS. The MYP guide refers to technology in terms of its impact on interconnectedness and one of the statements of inquiry references advances in communication technology including social media. In addition, multimedia is referred to as a form of an assessment task. But beyond these mentions there is nothing more, not even a reference to digital artefacts.

While it could be argued that history is in the past and thus the impact of digitalisation is not an important factor, human ability to investigate and interpret history has been profoundly impacted by the array of digital tools and approaches now available. Moreover, the digitalisation of artefacts has transformed the field of historical research and it is essential that teachers are able to ensure that the subject is taught in a way that acknowledges this reality

As such, there are almost unlimited opportunities to mention digitalisation across all three guides, both in terms of the topics of study as well as the approach to the subject. Specific areas in which a reference to digitalisation could be made include the nature of the subject, the theory of knowledge, teaching and learning through inquiry, social organisation and culture, MYP projects and assessment. Details about these opportunities are noted in the table in the relevant section of **Appendix 2**.

Overall, it would be beneficial for IB staff involved with developing history guides to work with colleagues across other subject areas where the subject guides reflect the impact of digitalisation on teaching and learning to a far greater extent.

### Science (Biology and Chemistry)

The guides reviewed were:

- Diploma Programme Biology Guide, First Assessment 2016, Updated 2018
- Diploma Programme Chemistry Guide, First Assessment 2016, Updated 2018
- Middle Years Programme Sciences Guide - For use from September 2014/January 2015, Updated 2017
- Primary Years Programme Science Scope and Sequence, Published 2008

The MYP sciences guide and the PYP science SaS fail to mention any aspects of digitalisation, other than a reference to e-Assessment in the MYP guide and to 'advances in technology' in the PYP SaS. The DP guides note the need for learners to develop 'digital technology skills, which are essential in 21st century scientific endeavour' (chemistry only) and the use of ICT in all aspects of the course in relation to both practical and
classroom activities. Both the DP Biology and Chemistry guides note that teachers are encouraged to use ICT throughout the course and they are directed to Teacher Support Materials (TSM) for more information on how to do so. In addition, the internal assessment parts of the DP science guides reference requisite ICT skills which are mandatory in their lab programs.

Considering that further studies and careers in science are increasingly influenced by digital tools and technology, it would be useful to position the subject of science within this context in all four guides, explaining how the core elements of inquiry based learning independent and collaborative investigation through research, observation and experimentation - can be enhanced and facilitated through digital tools and technology, including guidance on how to incorporate digital pedagogy tools, skills and contexts into teaching and learning.

Aspects in which further mention of digitalisation could be made include: the nature of the subject; aims and objectives; approaches to teaching and learning; supporting inquiry; processing and evaluating; interdisciplinary learning; and assessment. Details about these opportunities are noted in the table in the relevant section of **Appendix 2**.

#### **Mathematics**

The guides reviewed were:

- Diploma Programme Mathematics: Analysis and Approaches Guide, First Assessment 2021, Published 2018
- Diploma Programme Mathematics: Applications and Interpretation Guide, First Assessment 2021, Published 2018
- Middle Years Programme Mathematics Guide, For use from September 2014/January 2015, Updated 2017
- Primary Years Programme Mathematics Scope and Sequence, Published 2009

All four mathematics guides reference **approaches** to digitalisation and its

**relevance**. The DP guides both specify that the 'use of technology is an integral part of DP mathematics courses'. The section references both how to use technology and the ways in which technology has 'supported and advanced the teaching and learning of mathematics', noting that the use of technology should be prominent. The DP guides note that 'fluency in relevant mathematical software and hand-held technology' is an important mathematical skill.

Similarly, in the MYP mathematics guide there is a section on the effective use of information and communication technology mathematics with specific mention of technology enhancing teaching and learning. Teachers are provided with a list of the ways in which ICT can help teaching and learning. The PYP mathematics SaS includes digital tools in learning continua including the use of web applications, web measuring tools and computer based modelling applications. Beyond this, the PYP guide has no further reference to digitalisation.

The MYP and DP guides include advice for teachers on how to incorporate digitalisation. The DP guides list ways in which learners can use technology, such as through searching for patterns, testing conjectures, justifying interpretations, analysing data and collaborating with peers, and identifies a number of examples such as dynamic graphing software, simulations and apps.

Similarly, the MYP guide encourages teachers to use ICT. Teachers are encouraged to use ICT 'whenever possible and appropriate as a means of enhancing learning', and the guide includes examples such as graph-plotter software internet search engines and computer algebra systems.

None of the guides make reference to **research** about using digitalisation to enhance teaching, learning and outcomes, nor do they mention **ethical** considerations around digitalisation, the impact of digitalisation on subject content, when digitalisation may not be appropriate or **critical** digital literacy, all of which would be worthwhile to include.

The DP guide is the only one to mention any link between **global mindedness** and digitalisation, for example indicating that global mindedness can be fostered through access to mathematical resources provided by international organisations. Both the DP and MYP guides refer to the use of technology to enhance learner equality including aiding visualisation and enhancing understanding and through adaptive technologies.

All four guides have **opportunities** to further incorporate mention of digitalisation In the DP guides, one of the aims listed is to 'appreciate how developments in technology and mathematics influence each other'. Given the focus on technology throughout the guide, it would be worth considering whether a further aim should refer to supporting learners to gain a degree of confidence in using an array of digital mathematical tools in assessment, although this would depend on the nature of the assessment shifting from paper-based to the use of a digital interface.

It would also be useful to include reference in the DP mathematics guides to the value of ongoing assessment to enable learners and teachers to monitor progress and receive timely input on areas that require enhancement.

In the MYP mathematics guide, mention of the way in which technology has transformed mathematics would be valuable, as would reference to how mathematics is applied in the real world. There is also further scope for including additional reference to digitalisation in a number of sections including aims, objectives, projects and assessment. Similarly, in the PYP mathematics SaS there are a number of ways in which digitalisation could be discussed, such as in regards to application of knowledge, learning continuums and assessment.

#### **Conclusion and considerations**

This section has summarised the expert review of programme FPiP from the DP, MYP and PYP as well as the subject guides across all these programmes from the exemplar subjects of language and literature, history, science and mathematics. Full details are available in **Appendix 2**.

Overall, reviewers found that the MYP mathematics guide and DP mathematics guides provide some of the most coherent and explicit reference to digitalisation through a focus on the appropriate use of ICT tools and resources. The inclusion of a section in the MYP guide entitled 'Subject-specific guidance - Effective use of information and communication technology (ICT) in mathematics' and in the two DP guides of 'use of technology' is something that would be useful to have in other guides, both at other programme levels as well as in other subjects.

The documents were reviewed with reference to ten key themes. **Approaches to digitalisation** was referred to in some documents but not in others and this was surprising, particularly in language and literature and history in which subjects have been significantly impacted by the use of digital tools, such as for communication and for access to historical artefacts. It is important that the IB considers updating these guides so that they better reflect the contemporary nature of these subjects.

In the mathematics and science guides, as well as in the PYP FPiPs, the **relevance** of digitalisation was made explicit. In other documents, however, there was little reference to the relevance of digital tools in the study of subjects and – in line with the comment in the previous paragraph – this may be a consideration for revision across all documents.

It is likely that teachers look to programme FPiPs, and particularly to subject guides, to get an insight into **how** best to incorporate digitalisation in their subjects. Beyond the DP mathematics guides, there was surprisingly little reference to this. Focus groups and interviews with IB staff indicate their fear of being overly prescriptive in programme and subject guides. This is understandable in programmes of the nature of the IB, and yet it needs to be balanced with supporting teachers to select and incorporate valuable approaches to teaching and learning.

Some subjects have tackled this by making explicit reference to the teacher support materials, such as the DP science guides. Alternatives may include a stand-alone document that showcases a range of possible approaches to digitalisation in different subjects or utilising the IB educator network to encourage the sharing of best practices. The IB can consider which, or which combination, of these would be most valuable to teachers.

As the literature review emphasised, digital tools have no inherent value unless they are able to enhance learning. This means that teachers need to give careful consideration to their use of digitalisation, including when it may or may not be **appropriate**. None of the documents made reference to this and the IB may like to consider how best to approach this, perhaps leaving the decision to teachers or perhaps providing support in how to make those decisions, such as through the inclusion of 'key considerations'.

All documents reviewed had a marked lack of reference to relevant literature overall, including research on using digitalisation to enhance teaching and learning and learner outcomes. It may be that the IB chooses to avoid making their documents look too academic and focuses instead on making them as accessible as possible for users. Nevertheless, for something as important as the impact of different approaches to digitalisation on learner cognition it may be useful to include a limited number of references for teachers to follow up on if they are interested.

Few documents other than the PYP FPiPs discussed **ethical** issues around digitalisation or the need for learners to gain skills in **critical** digital literacy. There is growing awareness of the need for learners to understand safe uses of digital devices, both for their own protection and to avoid harming others, and this may be something that the IB considers for inclusion in future subject guides and programme FPiPs.

Other than the DP mathematics guides, the documents make no reference to enhancing **global mindedness** through the use of digital tools. Leveraging the global ecosystem of schools, teachers and learners would seem to be an excellent opportunity for learners to enhance their global mindedness and activities such as shared online classrooms are now tried-and-tested techniques for doing so. The IB may wish to consider including reference to this in future versions of the programme and subject documents.

The MYP and DP mathematics guides refer to opportunities to use digital tools to enhance accessibility, and hence **equality**, for learners but similar references are not included in other subject and programme documents. Since the IB has made great advances in accessibility provisions through its MYP eAssessment, it would be worth considering whether this is an aspect that should be referred to in future programme and subject guides.

Finally, as the suggestions in **Appendix 2** illustrate, there are many **opportunities** to incorporate mention of digitalisation where it is not currently referenced in programme and subject documents. It is important that there are high quality approaches to digitalisation across IB programmes and subjects, but also that schools, teachers and learners without good access to digital devices and/or suitable infrastructure are not disadvantaged in their learning. This means that the IB needs to continue to make thoughtful revisions to their subject guides and programme FPiPs as they evolve into the future.

The reviewers suggested a series of considerations as digitalisation continues to impact the nature of subjects, how they are taught and the skills and knowledge that learners need.

First, there is debate within the IB about the degree to which the materials they provide about programmes and subjects should guide subjectteachers, and programmecoordinators. around Concern being prescriptive tends to mean that there is sometimes too little guidance provided. This indicates the need to carefully consider what the right balance is – how can the IB provide enough information to users to ensure that the spirit of programmes and approaches to subjects is consistently applied without taking away user agency by being overly dogmatic?

Second, in addition to programme guides and subject guides there are a number of other support materials available for users, for example teacher support materials. There appears to be a lack of clarity about which of these are most used by staff in schools to inform their professional practices. As such, there is little agreement on the best location for practical information to teachers.

It is recommended that the IB undertakes some research into how users navigate the array of information on offer so that it can better target support to users. Expecting users to read a number of guides and then self-assimilate all the information contained in them may be asking a great deal. For teachers in countries in which teacher preparation is poor, this could actually impede a pedagogical approach which is in the spirit of the IB.

Third, there is a lack of consistency in references to digitalisation across programme guides, across subject guides in the same subject area across different programmes, as well as between different subject guides at the same level of study. This has the potential of causing a degree of confusion among stakeholders, including students. To counteract this, it is recommended that the IB consider a more unified approach in how these are developed to support consistent practices.

For example, if a subject is described as having been transformed by digitalisation in one guide, it is essential that it is described in a similar fashion across all guides for that subject. Since teachers may be teaching across programmes, this will help to minimise any confusion or lack of consistency. This is particularly the case as in some schools learners will move between IB programmes.

Fourth, the seven year cycle for revising guides is not a good fit in a world in which digital approaches are evolving constantly. This indicates two possible solutions – first that guides are revised more frequently and second that there is a digital annexe for guides that is revised on a regular basis.

In relation to the first option, the process involved seems to be hugely complex and thus reducing this seven year cycle could be seen as an impossible task. The second option would allow a greater deal of flexibility. Moreover, as guides increasingly become digital, searchable resources themselves, it would be easy to update certain components as and when required.

Overall, and following the theme of this report, any revisions to guides should return to purpose. At the moment the guides seem to be trying to accomplish a range of objectives, not all of which sit comfortably alongside each other. Having a clear idea of the users for these guides and how they use them will help to better target the contents, identify any elements that are surplus to requirements and enhance their value.

This may require the approach that the IB uses to all programme and subject guides and associated resources to be turned on its head – reshaping these into a searchable, digital repository of a series of topics that teachers and other users can navigate as they need and that can be updated, amended, removed and added to as the context in which education takes place changes around us.



# EXPERT REVIEW OF SPECIMEN ASSESSMENTS

#### **Introduction**

This section presents a summary of the expert review of a selection of specimen assessment tools from the MYP and DP. The purpose of the review was to consider how digital assessment affordances reflect the state of the art in digital assessment use. Both MYP e-assessments tools and paper-based DP assessments tools were reviewed. The reviewers looked at one example of a DP paper-based and one example of an on-screen MYP assessment per subject. All of the specimen assessments focused on were summative examinations, not internal assessments.

The expert review of specimen assessments involved assessment experts undertaking an in-depth review of the most recently available assessment tools in four subject areas:

- Mathematics;
- History / Individuals and Societies;
- Science /Chemistry and Biology; and
- Language and Literature.

The focus of the review of the DP assessment tools considered their potential for being converted to an on-screen version and any advantages or disadvantages this would incur. In contrast, the focus of the review of MYP assessment tools was to consider how well the affordances of the digital assessment system had been used in order to enhance the authenticity and quality of assessment materials, and to identify any ways in which this could be improved.

It is important to note that since expert reviewers are experienced assessment developers, they are familiar with the challenges and limitations faced by those tasked with designing assessment materials. This includes the tightness of timelines, budgetary limitations, the need to optimise validity and reliability, and assessment workflows. The comments made by reviewers were from this standpoint rather than from a consideration of what might be possible in an (unrealistic) ideal world. Full details of the reviews of these specimen assessment, which have been summarised with the use of images of items to contextualise the analysis, can be found in **Appendix 3**.

# <u>Methodology</u>

Despite the fact that several members of the review team were former IB teachers, it is difficult for those who are external to the IB to have full visibility of its assessment practices. For example, reviewers did not have access to the assessment frameworks that underpin the development of the assessment tools; the opportunity to engage in item panelling with test developers in which they could discuss underlying assumptions behind tasks and items; access to detailed psychometric statistics on the functioning of each assessment item; or the opportunity to engage in cognitive testing with learners. These are methods that can help assessment experts evaluate the quality and functioning of assessment items and, in their absence, the assessment tasks which experts reviewed had to be taken at face value.

With these limitations in mind, it is also important to note the background of the reviewers themselves. The team was predominantly comprised of assessment experts who not only have advanced qualifications and teaching experience (several in IB programmes) in their particular subject areas but whose work predominantly requires them to develop assessment materials on a daily basis.

Team members have experience developing assessment tools across multiple curricula, class levels and countries and are frequently called on to train teams of test developers around the world on how to develop assessment items and instruments. Team members are also all highly familiar with digital assessment and familiar with drafting items for use in both static, pen-and-paper assessments and in dynamic, adaptive and digital assessments for use on computers and tablets. In their review of the assessment instruments, the reviewers drew on their expertise to ask a series of questions of each item – these are the standard questions that any assessment expert would ask of an assessment item:

- What skill and/or knowledge does this item measure?
- Is this skill and/or knowledge relevant to the subject and level of study?
- Is the item well written, likely to be clear to learners and does it have appropriate response options?
- Is this the most appropriate or efficient way of measuring this skill and/or knowledge?
- Could this skill or knowledge be measured in a different way which would enhance the efficiency and/or quality of the assessment tool?
- Does the item make good use of information presented in the stimulus?
- Does the item fit with others items in the same task (if any)?
- To what extent does the item transform traditional ways of assessing?

In addition to these fundamental questions, the reviewers focused on digital functionality. For items in the MYP e-Assessment tools this meant considering how well the digital functionality had been used to enhance the quality, relevance and/or authenticity of the item and/or to engage learners. For items in the DP assessment tools, this meant considering how well the item could be transferred to a digital environment, and any advantages or disadvantages this would generate in the measurement of learning. Since it is common for a single stimulus to be used for more than one item, the interrelationship between the stimulus and items was a further area of focus.

The reviewers worked through all assessment tools individually and then discussed their findings with similarly expert colleagues before writing a detailed written summary. Since many of the comments about items were similar, making the written reviews somewhat repetitive, it was decided that the most useful approach would be select exemplar items that could be discussed in a way that summarised experts' insights about the papers as whole.

For the DP papers, this meant a focus on items that could usefully illustrate the considerations that would come into focus were they to be converted to an on-screen mode. For MYP tools, reviewers identified exemplar items that made the most of the on-screen environment and exemplar items with scope for improvement. Screenshots of items are included to add clarity to the discussion and to make the findings accessible to those who may not be fully familiar with the assessment materials. All of these can be found in **Appendix 3**.

Since the reviewers drew on the specimen assessment materials that were available at the time of the review, these may now have been replaced with more recent ones. As such, some of the aspects of the assessment materials noted by reviewers may now have been altered following feedback from schools and the ongoing review of best-practice approaches to assessment that takes place across the IB, informing continuous innovation.

# Good practice examples

Prior to elucidating points of the review on a subject by subject basis the reviewers would like to highlight good practice examples from the MYP e-assessments. These items illustrate ways in which the IB is leveraging digital stimuli to transform traditional approaches to assessment.

In <u>language and literature</u> one item used photos to provide a stimulus for writing a screenplay. The use of colour images with interesting scenes was a significant improvement over what could be done on a traditional assessment and added an authentic context to the task.

In individuals and societies, learners were asked to complete an action plan for a film director. In this item there was re-use of stimuli from the previous item which is a good way of spreading the cost of developing stimuli across a number of tasks. In addition, the short-response option used in this task is more able to be consistently marked than a long response option would be. In another individuals and societies task, learners were asked to analyse the usefulness of a range of sources about living conditions. The task utilised photographs which could be clicked on to show further details which contributed to making the task engaging and authentic for learners.

In <u>mathematics</u> a number of animations were used extremely well to provide learners with information that they needed in order to respond to the items, in some cases complemented by other materials. This is a valuable way to contextualise information about the items in a way that is meaningful and necessary for learners.

The most impressive items were those that enabled learners to respond in a different way than usual. For example in the <u>mathematics</u> assessment learners had to use an interactive slider in order to respond to the items, significantly adding value to the tasks that learners are expected to undertake.

In <u>science</u>, some of the stimuli used really gave learners a good sense of an authentic problem. For example an animated stimulus about a plane dispersing an oil spill was use very effectively.

#### Language and Literature

The review of language and literature specimen assessments looked at:

 Diploma Programme - Specimen Assessment - Group I - English A: Language and Literature, Higher Level and Standard Level, Specimen papers I and 2, for first examinations in 2013; and  Middle Years Programme – Specimen Assessment – Language and Literature, May 2018.

One exemplar item selected for discussion in relation to DP language and literature is the HL DP literature paper (paper code SPEC/I/AIENG/HPI/ENG/TZ0/XX) which asks learners to 'write a literary commentary on one of the following' and provides an excerpt from Don't Let's Go To The Dogs Tonight by Alexandra Fuller as well as the Margaret Avison poem The Dumbfounding. The texts are printed on separate pages to the response sheet to allow learners to read and respond simultaneously. They can be viewed in **Appendix 3**.

Items of this kind can easily be converted to an on-screen format. Advantages include the option of both reading and listening to the texts as well as enabling learners to type (and hence edit) their responses. An alternative would be to have learners view a video, for example of a poem being read or, for example, to compare and contrast a written text as well as a theatrical or screen adaptation.

An on-screen environment should be able to allow learners to change the size of the font, to utilise a digital dictionary and/or thesaurus to look up unfamiliar words and the option of using a text editor to support their writing, all of which are authentic approaches to writing in the contemporary world.

An important consideration in the case that any items of this kind are to be converted to an on-screen format, however, is the placement of the display and response sections on the screen. Ideally the screen would be split horizontally to allow learners to scroll up and down in the text at the same time as, and independently from, typing their responses.

The item type – a long open response – is a common way to assess learner skills and knowledge in literature but alternative item types may also wish to be considered. These could include some shorter response items

that focus on asking learners to extract particular sections of text and evaluate or critique them in addition to a long open response. This would enhance speed, accuracy and efficiency of marking while also allowing learners who may be less competent in writing lengthy texts to demonstrate their skills.

In the MYP e-Assessment, two tasks were selected to illustrate the findings of the review, task two and task three. Task two comprises one item that asks learners to write a screenplay on the basis of a choice between two images. The reviewers felt that this was a stimulating and interesting task for learners to complete but were concerned about the assumption that all learners would know how to write a screenplay. They felt that it would be useful to include an example excerpt from a screenplay as a way of illustrating the requirements to learners who may be less familiar with the format.

The reviewers did feel that functionality was rather problematic in this item. The two images presented to learners are quite small and - particularly in relation to the second one - it is difficult to see what this shows. This means that details that would be useful in inspiring the screen play are very difficult to see.

The image can be expanded to a large size but doing so covers up the response box, meaning that it not possible to both view the large image and type in the response box at the same time. This could be irritating for learners who need to see some of the detail while writing, requiring them to open and close the image repeatedly while responding. This could be solved by using a vertically split screen which would allow the large size image to be seen at the same time as the response box. In its current design, this item is more problematic in the digital version than it would be in a paper-and-pen instrument and thus is not really making the most of the digital environment.

The reviewers felt that task 3 is a very stimulating and interesting item that would be challenging for learners. This item asks learners to write a proposal for an outdoor learning space. The reviewers noted that this item is presented exactly as it would be on paper, with the only benefit of the on-screen version lying in the ability of learners to type rather than handwrite their responses. While this may be the most appropriate task format to measure the skills in question, meaning that a change to task type may not be essential, consideration could be given to adding some images in order to stimulate learner responses, for example of an oldfashioned classroom and a forest or field.

Alternatively, a different way of measuring this skill, such as providing learners with the possibility of dragging and dropping a few design items into a plan and then explaining their rationale for doing so, might help make this item more stimulating and authentic for learners, although this functionality would need to be balanced against the cost of creating a stimulus such as this.

#### **History**

The review of history specimen assessments looked at paper-based DP assessments and MYP e-assessment:

- Diploma Programme Specimen Assessment – History, Higher level and standard level, Paper 1, 2016; and
- Middle Years Programme Specimen Assessment – Individuals and Societies, May 2018.

Several items were selected to exemplify the feedback from reviewers. In the DP examination paper SPEC/3/HISTS/BPI/ENG/TZ0/XX/Q, one task selected for discussion is about rights and protest, which comprises four items. This can be viewed in **Appendix 3**.

This is an example of a set of items where learners can draw on a number of written sources. If this was to be converted to an onscreen format the sources could be replaced with video or audio resources (with subtitles if necessary to aid comprehension). This would add authenticity to the task and would help to contextualise the task for learners with a number of aural and/or visual clues that can portray a great deal more of the situation than can be gleaned from a written text.

This would support learners, for example in responding to item 14, by providing them with more information on the value and limitations of a particular source. Using audio or visual resources would help the task to become more like something that a contemporary historian would be likely to engage with. It would support a more indepth evaluation of the perspective of a source and hence stimulate deeper thinking, taking into account the time and place.

This approach would, however, require careful consideration of the time required and the number of sources (for example two may be more than sufficient, rather than the four given). The item type -a long open response - is a common way to assess learner skills and knowledge in social studies assessments but alternative item types may also wish to be considered.

The second task selected for discussion in relation to DP history is one on military leaders, which comprises four items. In this case learners are required to read four sources on Genghis Khan's leadership. This is an example of an item that could be easily replicated in an on-screen environment without changing the functionality beyond a shift from hand-writing to typing. In the context of this topic, the inclusion of different source materials or different item types may not add any value to the task, although it could be considered.

The task itself is authentic in that for history such as this the main source of information for historians is written records. If this task were to be presented in an on-screen assessment, particular care would need to be taken about how the sources are presented, to allow learners to move backwards and forwards smoothly between their responses and the sources.

Again, long written responses are a common method for assessing learners on these kinds of tasks. One option that an on-screen environment would offer is the possibility of asking learners to use different formats for their responses, such as creating concept maps or short multimedia presentations.

If such response formats were to be introduced it would be critical to ensure that learners had gained prior experience of them in similar activities so that they were not disadvantaged in the summative assessment. This is indicative of the need for teaching, learning and assessment to be in close alignment, so that approaches to teaching and learning inform assessment, and approaches to assessment inform teaching and learning.

For the MYP, the on-screen assessment of Individuals and Societies presents learners with a series of tasks, each of which comprise one or more items. The first task selected for discussion concerns a director's action plan for a documentary on ideology in art, which comprises five items. This can be viewed in **Appendix 3**.

Task 5 requires learners to complete the steps of an action plan. This is a very interesting task that engages learners in applying their skills and knowledge in an authentic real-world context. The first thing to note is that the image used in this task is repeated from Task 4 which is an efficient use of stimulus material. The second feature that is noteworthy is that each item asks for a short written response task which is likely to result in relatively consistent and objective marking across markers.

The third element to note is that while the image is able to be displayed in a slightly more lively way than it could be on paper, the entire task is otherwise fully replicable on paper, hence has not really made use of the opportunities offered by an on-screen environment. The use of response boxes is the clear point of difference, allowing learners to type rather than write.

In a task of this kind, further thought could be given to presenting stimulus information in a more engaging way, for example with a drag and drop diagram, the possibility of adding information to existing boxes rather than inputting it separately, and the possibility of adding elements to an action plan and then explaining why these have been added,

The second task selected for discussion is one that asks learners to analyse the usefulness of two sources in relation to how changes in living conditions have prevented the spread of diseases. This can be viewed in **Appendix 3**.

This task utilises four photographs and learners are able to click on a number of points in each photograph to receive information. This is an interesting use of the potential of the on-screen system to make the stimulus material engaging and authentic for learners.

The task itself is a straightforward longresponse task. In this instance there could have been different ways of assessing the ability of learners to analyse, such as listing dot points of the advantages or disadvantages of each pair of sources, or utilising other functionality embedded within the on-screen system to enable alternative types of response such as concept mapping or the development of a slide-show of questions that could be asked to determine the usefulness of each source.

#### **Mathematics**

The review of mathematics specimen assessments looked at paper-based DP assessments and an MYP e-assessment:

 Diploma Programme – DRAFT Specimen Assessments – Mathematics: Application and Interpretation – Standard Level and Higher Level Papers I and 2, 2020;

- Diploma Programme DRAFT Specimen Assessments – Mathematics: Analysis and Approaches – Standard Level and Higher Level Papers I and 2, 2020; and
- Middle Years Programme Specimen Assessment – Extended Mathematics, May 2018.

In the DP, the expert reviewers looked at a number of papers and had similar comments for all of them. Overall, the reviewers felt that the papers were of high quality, using good and often rich stimuli which frequently referred to authentic scenarios. Moreover, many stimuli incorporated relevant graphs and diagrams which required learners to consider real-world applications of mathematics.

In terms of the possibility of transitioning DP assessment to on-screen delivery, the reviewers felt that there were both potential advantages and potential disadvantages. One advantage noted by reviewers was that an on-screen environment would enable the use of stimuli that were more authentic – such as an image (static or video) of an object rather than a pencil drawing.

Reviewers also felt there would be greater opportunities to create items that called for the use of mathematics in investigation in an on-screen environment, something that would stimulate more higher-order skills in responses. Reviewers also noted the need for problems or situations in which learners had the creativity to determine their own approach to finding a solution, rather than applying formulae, and wondered whether there would be greater scope for doing so in an on-screen environment.

For mathematics assessment experts, a barrier to on-screen assessment has until recently been the challenge of learners writing equations or showing mathematical workings. This issue was raised by reviewers as both a concern, and also as a case in which rapid developments are making this more and more possible. A particular cause for concern was the need to write equations. This is an issue that mathematics test items continue to grapple with. The example of item 2 from the Analysis and Approaches, Higher Level, Paper I (SPEC/5/MATAA/HPI/ENG/TZ0/XX) is an example of an item in which learners are required to show a mathematical proof.

In cases such as this, where learners are awarded marks for their proof, reviewers noted that there are a number of possible options if this were to be used in an onscreen assessment. First, learners could write their proof on paper, photograph it and upload it. This is relatively clumsy, however. Another option is to use an equation editor.

An example is one developed by Newcastle University – Numbas - in which mathematical expressions can be typed into a box in simple form and are automatically translated into mathematical formula. This is illustrated in **Appendix 3** and can be found at https://www.numbas.org.uk/demos/numbaswebsite-demo/). In this case learners can either write the answer (having done the workings elsewhere) or work through stepby-step. Wiris (http://www.wiris.com/en) is very similar.

The use of an approach such as that in Numbas or Wiris would require learners to be familiar with the annotation approach and this underscores the importance of consistency between approaches in teaching, learning and assessment.

For example, if ongoing assessment is used during teaching and learning it needs to utilise similar approaches to that in the examination. This does not mean that ongoing assessment should comprise simply practicing summative assessment, but simply that any specific tools used in summative examinations should also be used during coursework to ensure that no learners are disadvantaged during examinations.

In the Applications and Interpretation specimen papers, there are a number of items that could easily be digitised. These include items I, 4, and 6 in the Higher Level Paper I (SPEC/5/MATAI/HPI/ENG/TZ0/XX). For example Item 6 (shown in **Appendix 3**) could allow learners to provide a typed response rather than showing their workings. Equally, this type of item could easily be converted into a multiple-choice item for instant marking and in order to highlight misconceptions leading to incorrect answers in a way that the current item is unable to do.

Other items would be more challenging to digitise but some of these challenges can be overcome through clever item design. For example, one of the tasks in item 2 in the same paper calls on learners to draw a line on a graph. One way of doing this in a digital environment would be to use a line drawing tool, but this could be costly to develop. An alternative would be to provide learners with images of four possible lines on graphs as a multiple-choice response option. The choice of item format would, however, need to depend on the defined skill that the learners are being evaluated on.

An alternative to asking learners to show calculations could be used in some items, with item 12 in the same paper used as an example. In this case an alternative approach – one that would actually add to the difficulty level of the item – would be to have learners type a description rather than providing calculations. Again, however, the choice about whether this would be an appropriate format would need to be driven by the skill and knowledge that the item needs to measure.

Overall, the reviewers felt that quite a number of items would benefit from the ability to use more authentic stimuli if on screen assessment were to be used. At the same time, it was noted that careful thought would need to be given to layout on the screen in the case that:

 a number of items were attached to one stimulus, which could require learners to move up and down a screen;

- where stimuli were lengthy in nature (e.g. with a number of graphs and diagrams), requiring navigation between different elements; and
- where graphs were to be incorporated and learners were required to use particular graphing software that they may lack familiarity with.

Ultimately, the appetite of the IB to adopt a systematic approach to on-screen equations and mathematical proofs will be the key factor that determines the viability of moving to an on-screen assessment in DP mathematics. This is an area in which there are rapid digital innovations and hence determinations about this will need to evolve over time.

In the MYP e-Assessment, the expert reviewers liked the way in which the onscreen interface was used to provide learners with engaging and stimulating tasks. Overall, they found this to be a very interesting paper that provided learners with a range of stimulus material that contextualised the mathematics problems in real world scenarios.

In many cases, stimulating videos and images were used to engage learners in the tasks at hand. In some cases, however, reviewers felt that they were not entirely required for task response. For example, in Question 5, learners were able to watch an animation of a sailing boat in order to introduce the topic of velocity vectors. Reviewers felt that the animation was well made and contextualised the situation successfully, but that the presentation of an image of a triangle below provided the same explanation in a different form. This might mean that some learners choose to skip the video and just look at the image.

While the reviewers understood that the video may appeal more to some learners than the image, finding a way to bring the two together (for example overlaying the image towards the end of the video) would mean that all learners are required to watch the

video in order to respond to the items, resulting in none incurring a time penalty in relation to others.

In contrast, the animation in Question 6 - which is also very stimulating - <u>is</u> required in responding to the items and the image below complements rather than replicates the information that the animation contains. This is a good example of using the opportunities delivered by an on-screen environment for contextualising information about the items in a way that is meaningful and necessary for learners. Images of both questions are shown in **Appendix 3**.

The reviewers felt that question 8 is a great example of the additional functionality that an on-screen system can deliver not only in providing a stimulus for learners but also in enabling them to respond to items in a particular way. In this case, learners can use the slider in order to respond to the items. This is a great use of interactive elements in an onscreen environment and significantly adds value to the tasks that learners are expected to undertake.

Question 8 is illustrative of the future of onscreen tools for teaching, learning and assessment in which a range of advanced functionalities can be incorporated into a digital platform that enable learners to undertake activities, deepen their thinking and apply tasks in a real world environment in ways that are difficult to do on paper.

Overall, the mathematics assessment experts who reviewed the assessment material felt that in some places the possibilities offered by a digital platform had been used to really add value to items and to engage learners in stimulating and meaningful activities, while in other places they had been used less well, or did not add value.

In addition to the comments about exemplar items, the reviewers further recommended that there should be continuity between formative and summative assessment formats so that the functions on the platform were familiar to learners prior to an examination situation.

## Science

The review of science specimen assessments looked at paper-based DP assessments and an MYP e-assessment:

- Diploma Programme Chemistry, Higher and Standard Level, Specimen papers 1, 2 and 3, for first examinations in 2016;
- Diploma Programme Biology, Higher and Standard level, Specimen papers 1, 2 and 3, for first examinations in 2016;
- Middle Years Programme Specimen Assessment – Biology, May 2018; and
- Middle Years Programme Specimen Assessment Chemistry, May 2018.

In the DP, paper I in both the Biology and Chemistry assessments consists of multiplechoice items, all of which could easily be transformed into an on-screen mode. Doing so would both enable marking to be automated and also enable the stimuli to be static, video or animated images of real-world situations, thus enhancing authenticity. For example item 16 (paper SPEC/4/CHEMI/HPM/ENG/TZ0/XX) illustrates a chemical process.

In this example it would be possible to replicate the image on-screen in exactly the same format, or to illustrate the process in a video or animation. At present, there is a separate stimulus for each item. If investment is to be made into developing, for example, an animation, optimal value would be achieved if it was linked to multiple items.

Moving beyond simple MCQs, a further possibility would be to have learners use a drag and drop option to label diagrams, to order stages in a process or to construct equations by dragging and dropping different elements, with a number of other options also likely to be possible. All of these could be set up to enable automated marking, achieving the same efficiencies as the use of MCQs at present. For example item 20 presents images of jawed vertebrates organised by classification. This is an excellent example of an item which could be transformed by the use of on-screen delivery, for example by having actual photographs of the creatures and the opportunity to require learners both to order them as well as responding to a number of other items about them.

In both Biology and Chemistry, almost all items in papers 2 and 3 require learners to create long responses with few single-word answers. This means that careful consideration of appropriate item types would be required if there was a shift to an on-screen assessment in order to optimise the benefits that an on-screen environment would have to offer.

In some cases the approach to leveraging opportunities within an on-screen mode in order to change the item without altering the knowledge or skill assessment is quite obvious. For example Biology Higher Level Paper 3, Item I, involves learners being presented with an image of an onion cell and asked to (a) identify the phase of mitosis represented by a particular cell and (b) outline two distinctive features of cells undergoing mitosis in the micrograph. All mentioned items are illustrated in **Appendix 3**.

In this case the first part could be changed to ask learners to 'click on / select a cell in the image that is undergoing X phase of mitosis'. The second part could involve learners identifying and labelling cells going through different phases, or dragging and dropping labels to do the same. Again, these responses could be marked automatically. In an onscreen environment, a further affordance would be the ability to use a coloured photograph image to add authenticity to the task.

Similarly, Chemistry Higher Level, Paper 2, item 7 is an example of an item in which onscreen affordances would be useful. This is a labelling item and in an on-screen environment this could be presented in the same way – with learners entering text into a box – or by having learners choose from a set of labels (e.g. a drop down box of options for each one) and then placing them accurately. The latter option would allow for automatic scoring. These options leave the item in a similar format other approaches to the item could make even better use of on-screen features.

Overall, most elements of the DP Chemistry and Biology papers have the potential for shifting to an on-screen environment with a concurrent increase in the types of skills and knowledge that learners could be called on to use and greater authenticity of stimuli Where material. items are more mathematical in nature, and require the use of equations, similar approaches to those outlined in the section on mathematics above could be utilised to overcome perceived challenges.

In the MYP e-assessment, a number of items from the Chemistry assessment from May 2018 were selected for discussion in order to demonstrate the extent to which the digital environment and its associated functionality has been optimised, and also items in which it could have been further leveraged.

For example, question 6 relates to an oil spill and provides learners with an engaging animation that is partly interactive and provides greater context to aid their comprehension. This is illustrated in **Appendix 3**. It is a good example of how digital function can be used effectively to present learners with stimulus which is impossible in paper based testing.

Interestingly, however, the items do not necessarily require reference to the stimulus and could easily be replicated on paper. For item 6a, for example, learners need to recall the structure of methane and then link that to the production of gas at the top of the column. They could also respond to 6b without the need to refer to the diagram if they had previously learnt the process of distillation. If they had not previously learnt about distillation, they could refer to the diagram but the reviewer felt that it is doubtful that many learners who have not been taught the process would be able to construct it from the stimulus. Another consideration here is the value of asking learners to 'describe' a process that is shown in a diagram. This is a lower order skill and recasting the item would enable deeper thinking to be assessed using the same diagram.

In contrast, item 6c does tap into higher order skills in that it asks learners to both 'discuss' and 'evaluate'. In this case the stimulus is used quite effectively. The stimulus is animated on a loop and shows, for example, the plane dispersing an oil spill. This is a real world issue and learners would almost certainly be aware of the issue, even if they have no knowledge of the specific methods of removal. The item requires learners to engage with the information in the stimulus. There might be other ways of asking learners to consider this issue. For example the inclusion of data tools such a 'pro' and 'con' tables would allow learners to organise information in a way that is not just linear text.

An example of an item that could be exactly replicated on paper and does not make use of online functionality is question 4, also illustrated in **Appendix 3**. The items refer to static charts and tables that are provided but there is no interactivity. The inclusion of experimental errors in the item is good – although they do look a little strange given the accuracy of the other points.

While the graph does show the discrepancy, the stimulus provides little background on the experimental design used to gather the data, so the 'suggest' in item 4a would seem to relate to general principals of experimental design, rather than something specific in the stimulus. An alternative or additional item could have asked learners to estimate the 'true' values of the errors.

Item 4b includes the presentation of a table of data and learners have to interact with

both the graph in 4a and the table in 4b in order to respond. This is a good example of meaningful stimulus that is required in order to respond to an item. Learners are asked to both calculate and identify and since the answer is not immediately clear from the raw data this requires some careful consideration, meaning that the items are appropriately challenging and cannot be answered from prior knowledge.

In terms of biology, a number of items were selected for review in order to demonstrate the extent to which the digital environment and its associated functionality has been optimised, as were a number of items in which it could have been further leveraged. Again, images of the items selected for illustration are shown in **Appendix 3**.

The stimulus for question 2 is a diagram that is engaging, stimulating and provides a great deal of information about the carbon cycle. One question raised by the reviewers, however, was why it is shown after item 2a. Item 2a asks learners to 'outline how plants and animals are connected in the carbon cycle'.

The order means that if learners have moved ahead to 2b they can respond with reference to the diagram, while learners who have not moved ahead, and hence realised that the 2b diagram was there, could be disadvantaged. To overcome this, it may be better to place the diagram before 2a.

The other issue to consider when using such a detailed diagram (which is accompanied by a chart showing longitudinal data) is the cost vs benefit ratio. When detailed stimuli are used it is advisable to link them to a number of items so that the greatest benefit is drawn out for the resources required in creating the stimulus (a tension that test developers commonly have to deal with). One way to do this would be to transform the stimulus into one with draggable shapes and text boxes so that learners could introduce components into the carbon cycle. The repeated use of a stimulus from question 4 to question 5 is a good example of how the optimal use of stimuli can be achieved. In this case the stimulus is a video which helps define the context as the real world of scientific investigations, which is an excellent use of digital functionality.

The items within question five do raise some issues around the choice of item type. For example item 5a simply asks learners to 'state the name of the enzyme that breaks down lactose'. This could easily be replaced with a multiple-choice option which would save time and resources on marking.

Question 5 also includes the use of a table of data and a plot area onto which learners can drag and drop to plot the data from the table. This is a great example of using digital technology to place a learner assessment in a real world scientific activity and the items are all relevant to the stimulus provided. The use of digital technology here could also lead to both cost savings and more consistency in marking if the locations of the learner placed points are automatically marked.

The only drawback of a task such as this is that learners have to undertake the same function multiple times in order to complete the chart, which could take up a large amount of time. An alternative would be to mark some of the points in advance and then have learners complete others, which might be a more efficient way of collecting the same information about learner skills and knowledge.

The flow of stimulus – from experiment to table to data to plotting it on a chart – replicates the flow of a genuine scientific method to some degree, which the reviewers valued. In addition, a number of items are related to this stimulus and this provides another good example of how the cost of stimulus per item can be resolved.

In design terms, many of the items require learners to refer to the stimulus, which also makes the connection between the two logical and relevant. In general, learners often find graphing tasks challenging and hence scaffolding of such items may be required if they are to provide an optimally realistic assessment of their skills.

#### **Conclusion**

This section has identified a number of ways in which the DP assessment tools in the four exemplar subjects could be adapted to an onscreen format, and has discussed key considerations in doing so. It has also considered how MYP e-assessments have made use of the digital environment.

Overall, the reviewers felt that the DP assessment materials they reviewed were of high quality, using good and often rich stimuli which frequently referred to authentic scenarios. Moreover, many stimuli incorporated relevant materials which required learners to consider real-world applications of the subjects they were being assessed in.

The majority of assessment items from the paper-and-pen specimen assessments from the DP could easily be converted into a digital format with very little change to their function other than the obvious one of requiring learners to type rather than handwrite their responses. This would turn the papers into 'paper-on-screen', a format which is typical of most digital assessment around the world.

In mathematics and science, many items simply require learners to write a response, and these could either be left as they are or converted into multiple-choice items for automatic marking. A multiple choice format allows the level of difficulty to be controlled through the selection of plausible alternatives; it also allows for misconceptions leading to incorrect answers to be identified in a way that the current items are unable to do.

Perhaps the biggest challenge involved in the conversion of science and mathematics assessment instruments to an on-screen format relates to formulas and mathematical proofs. Until recently it has been very difficult for learners to type these on digital devices and much more straightforward to do it by hand. Fortunately, rapid developments such as Numbas and Wiris are making this more and more possible and new developments will be able to inform the evolution of IB practices over time.

A move from paper-and-pen to digital format often leads to concerns about disadvantaging learners who are less comfortable with typing than handwriting. Arguably, however, paperand-pen responses disadvantage those less comfortable with handwriting (and always have done).

Moreover, in the contemporary world typing – and, indeed, comfort with using digital devices in general – is a skill that is a requirement for the majority of professions while the need for handwriting is rapidly becoming restricted to signatures. Nevertheless, any move to a digital format will still need to sustain a full suite of inclusive technologies and to meet the needs of a variety of learners.'

Beyond a simple rendering of the current assessment tools in to a digital format, digitalisation could offer a number of additional benefits. In terms of item type, these include:

- In **language and literature**, learners could have the option of reading or listening to texts. An alternative would be to have learners view a video, for example of a poem being read or to compare and contrast a written text as well as a theatrical or screen adaptation.
- In history, learners could access different multi-media resources including historical videos and audio recordings in order to add authenticity to the stimulus materials. These would also be able to provide a number of aural and/or visual clues that can portray a great deal more of the situation than can be gleaned from a written text.
- In science, learners could see static, video or animated images of real-world

stimuli which would enhance authenticity beyond the current images used. For example, instead of static images a process could be illustrated in a video or animation.

 In mathematics, learners would be able to see stimuli that are much more authentic than the pencil drawings they are currently provided with, with the possibility of including a wide range of images, large data sets and objects that could be manipulated.

Other benefits would include more objective marking, instant feedback and the identification of misconceptions.

Common item types that have long been used in literature, history and other similar subjects are long-written tasks. These are a good way of allowing leaners to demonstrate their proficiency in developing and constructing an argument. The significant downside, however, is that it is very difficult to ensure these are marked consistently across a large number of markers, even with extremely explicit marking rubrics.

Moreover, automated marking of written responses continues to be costly, difficult to set up and lacking in face value. In its absence, long responses require an enormous amount of time and resources to mark. This remains true on digital platforms although the opportunities for managing the distribution of learner responses are greater and markers no longer have to contend with poor handwriting.

Due to these challenges, the IB might wish to consider the option of using a mixture of item types in assessments, allowing a portion of assessment to be automatically marked. This is certainly likely to be a contentious issue in the IB, in part due to its long history of a highly participatory model of assessment design with schools seeking authentic assessments of learners' abilities, but also because of misconceptions about the benefits of other types of items. The common argument, for example, that multiple-choice items can only be used to measure recall is simply unfounded. For example, medical assessments – which include measurement of the ability to make complex judgements – tend to be entirely comprised of such items.

Transcending the debate about item type means returning to purpose. Ultimately, item design should be driven by considerations about the skill that learners are required to demonstrate and the best possible way for them to demonstrate these, taking advantage of on-screen functionality, facilitating consistent marking and optimising validity, reliability and authenticity.

Digital environments enable a whole range of options for assessment. Optimising these requires both a high level of skill in test development as well as a deep understanding of the functionality possible in a given test system. In the context of the IB, there are likely to be a whole range of as-yet untapped opportunities to assess learners in ways that may be able to enhance assessment practices (although the determining factor will depend on the information that test developers want each item to collect). Examples may include:

- Literature shorter response items that focus on asking learners to extract particular sections of text and evaluate or critique them or to annotate pieces of text as well as a long open response. Learners could also be asked to present their responses in a different format to an essay, such as creating a presentation.
- **History** responses that call on learners to draw on a range of historical resources to create concept maps or multi-media presentations.
- Mathematics responses that give learners the opportunity to respond to even more authentic tasks that allow investigation and creativity in finding the best solution.
- Science responses that call on learners to complete a range of tasks such as ordering processes, labelling diagrams and

adjusting inputs to create different outputs.

In their review of the MYP e-Assessment for the same four subjects, reviewers found that the majority of assessment items from the MYP e-Assessment were good examples of digital items. They comprised both assessment tasks that could be termed paperon-screen as well as those that fully utilise the potential of the digital environment. In many cases the functionality exceeded that used in the examples of digital assessment detailed in the literature review.

In some cases, however, there is still scope to improve the functionality, for example, in the size and layout of stimuli, in the way in which the screen is split on order to enable learners to view stimuli and response boxes simultaneously, in the use of additional images to stimulate responses and in options such as drag-and-drop and the listing of pros and cons. Moreover, in some cases, reviewers felt that stimuli were not essential for task response or did not provide sufficient background information to enable learners who had not covered that particular topic to complete the task.

Finally, a key consideration in relation to any on-screen assessment is how to prepare learners. Any change to assessment – either in content or format – requires a process in which teachers and learners are fully familiarised with the functionality of the system in advance, for example where learners can become familiar with the annotation approach required to display formulae or equations.

Familiarisation does not just mean practice questions on the day of the assessment, rather it implies extended opportunities to practice using the system in advance. The use of items that have been previously used or those discarded during the test development phase is one option. More broadly, however, making the test delivery system available to teachers so that they can use it in their ongoing teaching and assessment activities would offer greater potential to ensure that no learners are disadvantaged in a summative examination. As data from the survey identifies, this option is extremely popular with teachers. Moreover, it would help to ensure that teaching, learning and assessment are in close alignment, whereby approaches to teaching and learning inform assessment, and approaches to assessment inform teaching and learning.

The reviewers suggested a series of considerations as the digital assessment environment continues to offer greater potential. These are made in a context in which the reviewers acknowledge that the IB already has a robust assessment development process in which items go through a number of quality assurance stages. Given that there is a lack of clear evidence on which digital assessment techniques are more effective than others, however (as the literature review makes clear), and that different approaches do not have a strong evidence base for validity or implementation, there are additional pressures in the development and implementation of digital assessment.

With this in mind, the following are considerations that the IB might wish to integrate into its existing practices if digital assessment is to be used more widely, particularly in the high stakes DP summative examination.

**First**, to start from a point of thinking 'what knowledge and/or skills do we want learners to demonstrate in the assessment and can digital tools enhance the measurement of these? This means starting with a consideration of the key constructs, learning outcomes or competencies that it is important to measure at a given level, time (during a course or at its end) and sophistication of thinking (from low level recall to high level synthesis).

Ideally, these considerations are defined in an assessment framework which is written in advance of any test development. This is a document which the IB likely already has and which acts as a blueprint for examination writers to follow, making all underlying assumptions about item formats, test form design and functionality explicit. In the light of the rapid changes in digital affordances, it is essential that assessment frameworks are regularly updated so that all those involved in the assessment process are able to keep abreast of the latest options available for item design.

**Second**, to then draw on the information included in the assessment frameworks to consider 'how can we leverage the functionality embedded in the mode of assessment to optimise the relevance, authenticity, validity and reliability of assessment items'. There are no fixed answers to this question and it should be kept in mind that sometimes the best answer is 'don't use a digital tool'.

The possible ways of responding to this question will be different depending on the mode of assessment – digital or paper – and purpose of the assessment (for example to provide input to teachers and learners to support improvements in learning and/or to rank learners in terms of their proficiency), as well as subject and class level.

Critically, in the case of digital assessment, this means that examination writers need to work closely with technical experts so that they are fully familiar with the current functionality of the mode of assessment *before* they draft items. Similarly, technical developers need to work closely with content experts in order to develop system functionality that meets the needs of the subjects, for example in terms of developing equation writing modality. In many cases, new functionality does not need to be developed from scratch but can leverage already existing technologies.

Third, the next area of focus should be on 'what item types are most appropriate to collect the information on learner proficiency identified'. While the IB's tradition of using authentic and engaging open-response tasks is acknowledged, it is unfortunately not one that lends itself to the strict item response theory (IRT) protocols and psychometric analysis that is used in much assessment, and which can generate additional benefits in terms of the value of the data that is generated.

Thus, the IB may wish to explore ways in which IRT and psychometrics can be effectively utilized within their context. This may include further research into how the authentic open responses that the IB uses in subjects such as literature and history can be balanced with other item types which better enable psychometric analysis to take place.

To facilitate this, it is essential that all those involved in assessment at the IB are able to access regular opportunities to enhance their skills and knowledge of the evolving range of item types that are possible, and their advantages and disadvantages. This means considering validity and reliability as well as characteristics such as efficiency, marking consistency, cost-effectiveness, assessment instrument balance and accessibility for learners with additional needs.

**Fourth**, involvement of learners in the item writing process is highly valuable and the IB may like to consider this becoming a systematic part of the item development process if it is not already. This could be as simple as having a small number of learners (for example the children of IB staff, learners from local schools or a selection of learners in IB schools across the world in a 'review group') to experience every item in development.

This would ideally be done in the form of a *'talk aloud'* or *'cognitive laboratory'* in which learners verbally explain their thinking and approaches to responding to items so that test developers are aware of any unexpected pitfalls, clues or other characteristics that need to be remedied in order to give all learners a fair chance of correctly responding to an item. This process is particularly critical in digital assessment as learners may utilise an entirely different approach to a task than assessment developers could predict.

A **fifth** step that is recommended for any new assessment items is a pilot. While this is

often interpreted as involving a separate assessment process, in fact it is common for pilot items to be included in a standard assessment and then for their data to be analysed separately (ensuring that no potentially mal-functioning items influence learner scores). Alternatively, items could be trialled on a sample of learners.

Piloting means that a certain number of items need to be given to learners so that sufficient data can be collected to enable psychometric analysis. The goal of the analysis would be for the response statistics for each item to be subject to review to check for issues such as variations in item difficulty between different groups of learners, enabling these to be remediated.

**Sixth**, after piloting, and after examinations, the IB may wish to consider the application of psychometric analysis of individual items as well as the overall data collected. For individual items, it is important to ensure that they are functioning in a way that meets technical requirements. For overall data, statistical measures such as determining whether items are functioning in a similar way across sub-groups of the learner population are important in ensuring fair comparisons between learners.

Psychometric analysis is not straightforward to do and requires a high degree of technical skill. It is often not used in assessment activities for these reasons and the IB would need to balance the purpose of assessments against the time and resources required to utilise this approach to data analysis.

If this was to be done, however, it would yield dividends in terms of being able to advise on test design and to identify how well test items and overall tests are functioning. Moreover, if psychometricians utilise item response theory then this would allow learner proficiency and the difficulty levels of individual items to be separated out. Consequently, the reporting of learner performance could be made more precise, utilising reporting scales with detailed descriptors which are able to identify what individual learners are currently able to do and the areas that they should address next.



# SUMMARY OF FOCUS GROUP AND INTERVIEW DATA

#### **Introduction**

One of the four pieces of research for this project was to undertake discussions with IB staff involved in the development of programme and subject guides and in the development and implementation of assessment materials. The goal of this component was to inform the development of survey tools for use with teachers in IB schools, and to also inform the expert review of curricula and assessment materials.

## **Methodology**

In October 2018, a series of interviews and focus groups was conducted with staff from the International Baccalaureate Organisation (IBO). Eight focus groups took place, including representatives from the four subject areas of history, science, mathematics and language and literature.

Four of these focus groups were conducted in The Hague and four were conducted with their counterparts in Cardiff. In addition, interviews were conducted with thirteen key staff across the two offices.

While parts of focus groups and interviews were scripted to ensure uniformity across different groups and themes, facilitators balanced this with allowing for natural discussions to develop with and among participants. Participants were asked about their own experience of digital assessment (if any) and their perceptions about the role that digitisation can play in enhancing learning (either in a particular subject or more specifically).

Participants were further asked about issues including impact on teachers, backwash, the digital divide, accessibility, learner inquiry and meeting learner needs. A list of interview questions can be found in **Appendix 1**.

All interviews were audio-recorded, transcribed and then subjected to qualitative analysis which involved marking up the transcriptions to highlight initial categories that arose from the data. This was followed by identifying sub-themes within the main categories, an iterative process in which conceptual categories emerged from the analysis.

These categories were then reviewed and refined, and prepared for reporting. This approach to qualitative analysis is informed by grounded theory which focuses on enabling themes to emerge from the perspectives of participants rather than the researchers imposing their pre-conceived themes (Holton, 2010).

In addition to the identification of themes, several quotations were extracted from the transcripts and are reproduced here to illustrate IB staff perspectives.

## **Overall findings**

Overall, the in-depth discussions that took place during interviews and focus groups conducted for this project painted a picture of an organisation endeavouring to find the right pathway into the future that balances a number of crucial demands.

On the one hand, a key IB principle is to ensure inclusivity and there is a strong desire to cater to the needs of the wide range of schools which take on IB programmes. There is a real concern among IB staff about moving ahead with digital assessment if it places undue demands on schools with limited resources. Many of the IB staff involved has been teachers, some until quite recently and this likely enhanced their focus on the needs of schools.

'There's a complementary thing that takes place. You learn digitally in the classroom. You are, therefore, more amiable to digital assessment. As you develop your digital assessment it feeds back to how you are using digital resources in the classroom'.

On the other hand, there is also a strong desire for the IB to be at the forefront of contemporary education, drawing on the best that technology has to offer to provide learners with a world class educational experience that best prepares them for the future.

In this context, IBO staff are keen to be innovative, forward looking and to leverage the opportunities provided by the incorporation of digital resources into learning, teaching and assessment in order to support learners to gain advanced competencies. At the same time, there are a number of tensions and conundrums that staff are grappling with, taking into account not only the perspectives of stakeholders but also the need to consider the best form of assessment to meet the needs of the programmes and subjects.

Staff emphasised a constant loop between teaching, learning and assessment



In general, discussions focused on five key topics – (1) a need to reflect the reality of the 21<sup>st</sup> century; (2) the importance of digitisation in stimulating deeper concepts; (3) the positive role of backwash; (4) ways in which the IBO could support stakeholders; and (5) the desirable form and function of both the existing MYP onscreen system and the potentials for digital assessment systems which can be harnessed by all IB programmes.

A number of sub-themes became apparent within each of these topics. In the sections below the key ideas expressed are summarised.

#### **Reflecting reality**

One of the key issues that was brought up by IB staff in discussions was the need for approaches to teaching, learning and assessment to reflect the reality of learners' lives, and the ways in which they are learning, and teachers are teaching.

As staff members noted, digital technology is ubiquitous in all aspects of life and it is important for the IB to be 'keeping up with the times'. As another staff member put it: 'it's where society is heading, it's how things are going, we cannot <u>not</u> do this'.

'You do digitisation because it brings interactivity, a model aspect, a scaffolding, and enriching, and enhanced experience'

Numerous references to learners being 'tech-savvy' were made, as were those to the realities of learners' lives in which the use of computer games, mobile phones and other technologies had normalised the use of technology for many learners, and where a 'flat text' world of, for example, newspapers and books, is rapidly becoming out of date.

'I think for me what is evident is that this has to happen, right, if we want to make what goes on in the classroom, in the teaching and learning context more representative of the learners' context that occurs, it has to happen ... we have to rise up to the challenge and find the ways in which to do it and to make the most out of these new tools so as to make the learning and teaching as significant and meaningful as possible'

Staff pointed to the need for learning, teaching and assessment to have 'contemporary relevance' and to reflect the fact that, for example, writing on paper had become an uncommon activity for many learners and many have got to a point with traditional methods that they 'will not tolerate being taught in this way'.

In relation to schools, many staff identified their understanding that the majority of schools were regularly using information technology, and that they are '**chomping at the bit**' to get on with a greater degree of digital integration within IB programmes and assessments.

In this context staff felt that it was important for the IBO to be using digital assessment as a way to encourage learning and teaching practices that draw on the benefits that digital technologies have to offer. In this sense the continued use of paper based assessment was regarded as a '**disconnect**' with contemporary educational practices.

Staff reported ways in which teachers were using a wide range of (often free) digital tools in teaching, including the use of visual texts in language and literature, videos in history, graphing tools in mathematics and simulation and animation in science.

'Digital technology allows the idea of personalised learning to really take off in ways that we can't perhaps imagine in a few years' time but we need to start to think about'

Staff further noted, however, that while many schools and teachers were using a range of devices and applications they were not necessarily doing so in a way that was fully integrated into their teaching, or that had transformed their approach to how learners actually learn. Instead technology was often used superficially to engage learners and increase their enjoyment of learning.

Hence staff identified the need for the IB to model and provide better guidance on how to integrate technology in a way to enhance learning and to improve formative assessment. One way to do this which IB staff identified was to inspire teachers through the use of digital technologies in assessment providing '*rich examples'* to help teachers become more creative. Another was to stimulate teachers to constantly expand their skills in digital technologies.

'We are going into this because we think it is the right thing to do. We really think that in mid-21<sup>st</sup> century we need to be using the tools and the, you know, just the channels and the media that are familiar for young people. I think we should also be, if we can, bridging across the formative and the teaching and learning space'

# Digitisation to stimulate deeper concepts

Many staff highlighted the possibility of assessing deeper concepts with digital assessment and equally emphasised that this should be regarded as an extension of what happens in the classroom, with the incorporation of digital technologies in teaching and learning activities enabling 'epistemological growth and more complex thinking'.

Some staff felt that digitisation was a phenomenon that was transforming education while others saw it as an extension to what they were doing already. In this context, questions were raised about how to move ahead within the IB. Staff reflected on the need for many of their colleagues, and indeed themselves, to expand their understanding and skills in some of the more forward-looking areas of education so that the IB can continue to best meet the needs of its stakeholders in the context of digitalisation.

Staff emphasised the need for the inclusion of digital technologies to be '**transformative**' in enabling learners to access much greater depth in the subjects they are studying, providing them with a richer and more interactive learning environment that is more meaningful than what is currently possible. They felt that this would reflect that the IB had always been regarded as a leader and risk taker in education and as one staff member commented 'that's where I think that they need to continue to be'.

Staff acknowledged that this could mean changes to the subjects and curriculum to the extent of almost re-defining them in some ways. For example, in literature they may read fewer literary works but also include multi-modal texts in order to make the approach to study more engaging and more akin to how literature is studied at the tertiary level. Meanwhile in history, it would involve taking 'a really radical look at how you present history altogether' and drawing on a range of resources to enhance the depth of the subject.

'It's the media that provides the richness, the information for the learner to build their answer on ... they have the ability almost to get smarter through what we provide them with in the exam and it is through that interaction that their answers get enhanced'

Staff noted that while they were, on the one hand, keen to revolutionise the learning experience of learners, they also recognised that there was a reluctance within the IBO to make drastic changes for fear of alienating stakeholders. Nonetheless, several staff noted that a number of the subjects taught in both the MYP and DP already either incorporated technology or at the very least recognised the opportunities it could bring, and that some subjects already had assessment papers that are 'screaming out to be onscreen'.

At the same time staff felt that the continued use of paper-based assessment in DP meant that it was neither contemporary nor classic, but instead traditional, and that it constrained what could be assessed, and hence how the curriculum could be designed. They further identified that some schools were frustrated, for example commenting that 'we are using at least really cool technologies in how we teach sciences and then I have got to sit down to do a paper based test'. 'If you can design the right test ... [then] I want them to teach to the test ... I don't care if the backwash is teaching to the test. Yay! That's exactly what I want'

In terms of assessment, staff suggested that a rich media environment of the sort that a digital platform could offer would provide learners with options of how they responded to questions, opening up a range of ways of interacting in the assessment situation and increasing their agency.

One concern expressed by a number of staff was for learners who have less access to digital technologies than their peers, which could disadvantage some learners over others, particularly if digital tools were used in assessment and learners were not familiar with them, which may create a discrepancy in achievement.

'You've got two competing forces, a world to be digital and relevant versus our prime directive which is to make an accessible curriculum anywhere in the world'

Other staff, however, considered that the most important element was to focus on the IB mission and to continuing the way in which IB programmes prepared learners for their lives ahead. As one said 'we need to jump straight to the end game ... doing the things we have always said we value'. Staff further felt that the incorporation of digital tools into teaching learning and assessment would help schools better meet the needs of learners with a range of needs and move further towards the personalisation of learning.

#### **Backwash**

Backwash is the term commonly used for the way in which changing the format of assessment leads to changes in teaching and learning. Staff expressed the understanding that using digital technologies in assessment would inevitably lead to changes in teaching and learning in that it would encourage schools to use more digital tools.

Some staff expressed concern that teachers would teach to the test and regarded this as a negative factor, narrowing the scope of what could be taught. These were in the minority, however, and other staff felt that teaching to the test was something that teachers inevitably did, regardless of the format, simply in order to maximise the grades that their learners could obtain.

'I've always thought that backwash was an ally of ours and not a challenge. I think that the only way that we can affect, we can make sure that we affect what's going on in the classrooms is through our tests that we design. So, I don't see the tests reflecting what is going on -1 see the tests as prompting something, and in that sense I think that we should show, you know, the teachers and the schools that belong in our organisation the way, what should be. We should be at the forefront of this and causing things and not just echoing them ... there are lots of things that are not happening in the classroom right now which we need to make happen'.

If this was the case, staff reported that it would be interesting to see how much the transition to digital assessment could drive innovation in order to 'truly reflect the intent of the courses'. Staff felt that by making the assessment digital, teachers would be pushed to include digital tools into their teaching in order to maximise learners' probability of success. Moreover, by designing rich, engaging assessments that assess skills and inquiry, staff felt that the IB would stimulate schools to make positive changes to teaching and learning that would enhance learning.

Those staff who have been directly involved in MYP onscreen assessments reported that they had seen a positive effect on teaching and learning, with teachers learning from the sample examinations and introducing an increasing amount of technologies into their teaching practice, and with learners engaged in more inquiry, with staff noting that 'when we do good assessment, backwash is a positive backwash'.

In these terms, the form of assessment becomes a 'guiding light' for teachers and schools, enhancing learners' learning experience. Staff had also found that there had been a positive impact on teachers, stimulating higher levels of collaboration since 'teachers felt that it was out of their comfort zones, so they have to gather for comfort'.

Staff nevertheless noted that they did not really know enough about the impact of changing the format of assessment on teaching and learning and that it would be really helpful to learn more about how schools are responding, and to track changes over time. One example was putting a question in the regular survey of schools as a way of 'taking the temperature of how these things are landing in schools'. For example, staff were interested in the changing role of teachers, perhaps moving towards more of a facilitation role in which learners are actively engaged in directing their own learning.

#### Support for stakeholders

While the majority of staff were in favour of the integration of more digital tools in assessment, in order to both reflect and drive their incorporation in teaching and learning, this was accompanied by significant concern to ensure that no learners, teachers or schools were disadvantaged.

Many staff referred to the IB commitment to inclusivity, stating 'we are supposed to be inclusive' and expressed wariness that the expansion of digital technologies could worsen existing inequalities. They addressed two key concerns. First, that a move to digital assessment would place expectations on schools in terms of the need to incorporate digital tools into learning and teaching resources that some of the less wealthy schools would not be able to bear. Second, that learners with limited access to digital tools in their learning - and in schools where access to the internet was challenging - would be disadvantaged if faced with assessments that required a degree of familiarity. This was something that staff wanted to make sure did not happen.

In addition to expressing their concerns, however, staff also highlighted ways to address these. In terms of financial barriers, staff referred to the varied sources of funding available to support digital tools in schools. Moreover, staff referred to the digital divide to be primarily **'attitudinal**'. This meant that it related more to the perceptions of schools than major contrasts in access to digital tools. Staff hence focused on the need of the IBO to **'provide much more support to schools to alleviate some of the fears they have'**.

'We then invest in taking teachers on a teaching and learning journey where we actually then showcase how technology can be integrated effectively in the classroom'

Staff emphasised the critical need to secure buy-in from schools and to give them as much information as possible in order to both reassure stakeholders but also for "**business continuity**". They interpreted the best approach that the IBO could use in a number of ways.

First, the speed of change. Staff identified the need to avoid a "**revolution**" or "**big bang**" but instead to move in a slow and steady way over a number of years in order to ensure that schools would have enough time to make the necessary adaptations. This meant adopting an approach imbued with pragmatism in which schools, principals, teachers, learners and parents were given sufficient information about why the IBO felt that this was the right way to go. Encourage 'kind of collaborative inquiry communities within the school for teachers who are fairly competent in using technology, supporting those who need maybe that additional mentorship'

Second, staff emphasised the need for the IBO to have a clear vision of the direction in which they were going, and why this was important. This meant going **'on a journey'** with schools and focusing on the IBO's educational vision, one that is forward thinking and incorporates the desire of the IBO to deliver the very best in new forms of assessment, and to encourage the very best in new forms of teaching and learning, all for the benefit of learners. Staff felt that a key function of the IBO was to **'inspire schools'** and to gain their confidence that the IBO was moving in a way that would better prepare learners for their future lives.

Third, staff felt that the move to digital assessment should be step by step, with a carefully planned roll out. This mean that the most future-forward, innovative tasks would need to be kept for a future iteration, with an initial focus on a relatively conservative model of digital assessment. Equally, staff felt that the first step needed to be taken, recognising that there would never be a perfect moment to get started and that 'we have got to get in the game'.

'It would be wonderful to see what schools actually generate once given the tools ... it would open things at school that the teachers should be more creative and find ways of, here is the platform, what can we actually do with this, and then speak back to use and share their results and share with other schools'

Some staff felt that this should be part of a broader discussion about the need to 'redefine assessment', with important questions to be asked about the continued use of individual summative examinations rather than a collaborative project-based approach. Other staff felt that this was a good opportunity to make it clear that the integration of digital tools in assessment, learning and teaching is not 'an add-on to the *IB mission*' but instead should be regarded as 'central to the *IB mission*'.

Beyond setting a direction, staff also felt that the IBO should provide practical support to schools in a number of ways. First, providing teachers with examples of what effective practice looks like, and how they can use it in their teaching, going as far as providing **'example lessons plans'**. The IBO could also encourage teachers to learn from each other within their schools.

Staff felt that the IBO should tailor its support to teachers with a range of perspectives. This could include those who are already on board in terms of understanding the value of digitisation but '*I need somebody to show me how it's done*'. On the other hand, other teachers may be afraid of technology and unsure of how to use it. In this case, the IBO needs to focus on how to encourage changes in teacher mind-sets.

For both groups, staff emphasised that existing professional development workshops can be used to address a range of ways to empower teachers and help them gain confidence as well as providing opportunities for them to showcase their experiences with each other. In addition, workshops can be used to reinforce the notion that in an inquiry-focused curriculum 'it would be irresponsible anyway for a school to be delivering those courses without the opportunity of using IT'.

"We need a really clear vision of where we want to go and how we want to get there ... if the vision is still learner centric, teacher supported, we need to define what that means in the digital age ... we need to say 'this is the future, this is where we want to get to and we want to lead' ... we are going to have to take schools with us' One area that staff emphasised as needing particular focus was the use of digitisation in formative assessment, which they reflected was often '**poorly understood**'. A key area of understanding was the need to develop formative assessment for formative purposes, rather than trying to use specimen summative assessment as a formative tool. Again, staff felt that the IBO should be providing teachers with examples of how to use digital tools to design their own formative assessments.

A further way in which staff feel that the IBO should support stakeholders is by ensuring that they are fully familiar with the assessment systems used for summative purposes. This was the case not only for learners but also for exam supervisors, programme coordinators and teachers.

Staff argued that the digital tools used in assessment 'must be part of the fabric of their teaching and learning' and that learners should gain the flexibility to deal with unfamiliar situations so that if they see a different calculator or spreadsheet, for example, than ones they are used to, they can figure out how to use it.

A number of staff felt that the ideal way to encourage schools to incorporate digitisation was to make a school based system available to them, with the same functionalities that were used in the assessments. This would allow teachers to create their own teaching resources and everyday formative assessments, resulting in the upskilling of teachers, enhancement of teaching and learning and familiarisation of learners with the system they will face in the exam.

Staff also suggested that it would be valuable to have a lot more feedback from, and interaction with, learners, suggesting that 'the learner perspective so often gets ignored'. For those designing assessments, staff argued that it was really important to be able to have contact with learners, teachers and schools in order to keep up with what they are doing, as well as to identify ways in which changes in the assessment are leading to changes in learning and teaching. 'Universities will "start asking for it and say 'these kids that have gone through this, they've got the skillset that's unsurpassed, that's amazing, that's what we are looking for and that's what we want'

# System form and function

In terms of current and potential digital assessment systems, staff were at pains to point out that this topic should be considered holistic terms, incorporating both in formative and summative assessment as well as different assessment elements, from onscreen examinations to e-portfolios and other elements. Key topics that were raised under this theme were the expectations of universities; the way in which the system should be designed; crowd-sourcing content; balancing system security and flexibility; the use of new functionalities; being forward looking and limitations.

Some staff identified a degree of uncertainty around what universities will accept from Diploma Programme learners. Staff pointed out that on the one hand learners need to be prepared for degree programmes in which a lot of digital technologies will be used, while on the other hand there is concern that if IB moves away from a traditional summative examination format then universities will be wary of recognising their qualifications.

But there is equally the hope that if the IB programmes are innovative in their use of digital pedagogy and assessment then universities will appreciate the skills that graduates of IB programmes bring with them.

Staff expressed enthusiasm about the value of data that could be collected from digital assessment systems at both the formative and summative level but equally noted that this potential is not currently being optimised. IB staff expressed a desire to have more analytic data that they can use in their development cycle, and also provide to schools for secondary analysis. At the development level, assessment designers do not currently know key indicators such as how much time is spent on different tasks and this information would help the design process enormously.

In formative assessment there is a desire to be able to track learners' work through multiple drafts and also through input from peers and teachers in order to chart the learners' progression. In both instances, staff expressed a need for data to be presented in a form that schools can interpret and use to inform their teaching and learning practices.

Approaches by staff to issues around system security can be regarded as being on a continuum, from locked down to curated resources to fully open, with different staff expressing contrasting perspectives.



Some staff believe that the system should be locked down (as it is for the MYP eassessment at present) to prevent learners from navigating elsewhere or potentially conferring with their peers, with some staff expressing a concern that otherwise the assessment will focus on how well they can search for information rather than other competencies.

The IB needs 'a really great platform which is somehow both dynamic and easy enough to use, right, that it doesn't become intrusive ... if we can make the assessment tool a thing that can also be used in an explorative, inquiry-based way then that would be great but if we don't get that right we've created almost like a cage in which learners have to work for their assessments'. In contrast, other staff feel that the system should be unlocked and that learners should be provided with a curated set of preapproved resources that they can refer to during the examination, for example links to libraries, encyclopaedias and subject-specific resources.

'The way that we use computers is not to have any lock down screen ... we google and we use a lot, we pull things from all over the place. So there's an argument against locking a screen and allowing learners to just go, and within their time limit, just figure it out'.

The third group of staff felt that limiting what learners can do is rather old-fashioned, and ignores the fact that digital assessment can be designed in such a way as to prevent cheating, for example such as randomising items from question banks. This group further felt that digital assessment should reflect how people use computers in the contemporary world.

In terms of the design of an on-screen assessment system for possible use in, for example, the Diploma Programme, IB staff raised a number of key considerations. First, there was a strong desire to avoid simply converting paper examinations to onscreen ones, with no improvement in function which one staff member suggested would "**be very disappointing for lots of people**".

Instead, staff noted the need to strike the right balance between having a dynamic platform that is also easy to use and is not a dramatic shift away from current practices. Several staff mentioned the need to ensure that familiarity with the assessment system did not interfere with the ability of learners to demonstrate their competency, with one stating that 'you are not learning how to use the system, you are learning and showing how you do something'.

Staff did note that one of the challenges they had with developing an assessment system to meet the needs of stakeholders was that they had little opportunity to have contact with those stakeholders, expressing the desire for user input into design, and of receiving user feedback after a system has been used.

One of the issues raised by staff was about the skill set required of assessment authors. Staff noted that if digital assessments are to be created then "**you need those people who can think onscreen**". In addition, it was felt that assessment authors should be able to work directly with the digital interface so that they know what it can and cannot do.

'It's interacting with new tools and technology that sort of allow you to do different things with assessment than you previously could and the same things too. I think it's making you more comfortable with the tools that you are using in the future ... it utilises the things that are available to you at all times now in a way that, to assist you in achieving your diploma"

An option that was raised in a number of discussions was the notion of "crowdsourcing" material for a digital assessment. This was regarded as something that would generate a number of mutually-beneficial solutions. First, ensuring that teachers have access to the online assessment system and are able to become familiar with it, hence being able to orientate their learners appropriately.

Second, this approach would tap into the likelihood that among the large numbers of teachers involved in IB programmes there will be those who create their own innovative ways of using the system to generate assessment materials, with one staff member noting that '[we are] *limited by our current imagination of what digital assessment is*'.

'You give the power of development out to the people and you listen to what they produce ... you need people closer to the content and you need to understand and listen to people out there, what they want'

Third, this approach would mean that those responsible for assessment development at the IBO would be in closer touch with endusers and would therefore have a better sense of their needs. Overall, this could result in 'a modular way of putting it together, a question bank having a variety of questions'. Some staff members also recommended that learners should also be encouraged to contribute their own assessment material.

## New functionalities

In terms of optimising the opportunities that digital assessment would offer, staff noted a range of advantages this would provide to learners, and in the assessment of learner competencies. These included:

- The ability to assess twenty-first century skills (also known as transversal or generic skills) such as problem solving, creativity and innovation;
- More open-ended questions that stimulate learner enquiry;
- Better connection with approaches that learners will need to use in the future;
- An insight into approaches that professionals use;
- Providing learners with a range of multimedia resources to stimulate their responses;
- Giving choice in how learners can respond to an item;
- Using modelling software or a computer simulation to bring systems to life;
- Stimulating higher order skills such as synthesising, evaluating and analysing;

- Removing the need to undertake mundane tasks;
- Making assessments more authentic;
- Broadening the constructs that can be assessed; and
- Utilising large data sets.

Staff further emphasised, however, that there was no need to use digital tools for the sake of it, noting that traditional question formats may be 'absolutely academically appropriate for those subjects'.

The IB should be 'horizon scanning, understanding what's coming down the track, filtering some of these big things and helping schools implement then in ways that are assessable, teachable, practicable ... we can do some of that filtering of what's going on'

Equally, they identified that certain subjects may 'lend themselves more to being assessed in a digital way' and they suggested that it would be beneficial to maintain a spectrum of types of assessment from traditional forms to those that are really advanced, such as 'an augmented reality exploration of a pyramid where they are working as a team'.

Staff also noted the need for the IBO to be thinking ahead to what is likely to become more common in the future, such as the impact of artificial intelligence, virtual reality and the use of avatars, in addition to personalisation.

Staff further emphasised that all of these benefits should flow through to the classroom in order to support the enrichment and deepening of learning.

Staff were also keen for teachers to be able to use digital tools in a way that would better help the IB ensure that learners achieve the traits in the IB learner profile. For example, connecting with their peers in other countries. As one noted, 'the prize is after we have digitised, is what potential

# transformational assessment we can get into the business of doing'.

Overall, the focus groups and interviews emphasised the efforts being made by IB staff competing balance а range of to responsibilities as they navigate a world in which digital technologies are increasingly impacting on teaching, learning and assessment. As the IB continues in its ongoing reforms to its curricula, programme design, subject guides and assessment, it is clear that the IBO will find the right balance between innovation, inclusion and support for its schools and teachers.

#### Key insights

The insights from the focus groups and interviews attested to an organisation that is committed to providing the best possible service and support to its stakeholders. This means both being inclusive and being forward looking. Within this, the biggest challenge that the IB faces is that schools with IB programmes vary considerably.

IB staff understand that schools are on a continuum from those where learners have access to digital technology in their studies only on an occasional basis to those where digital technology is embedded in everything that learners and teachers do. How, then, can the IB meet the needs of such a wide array of contexts? Moreover, how does the IB need to evolve internally to best meet these new demands?

One of the concerns of the IB is about the loss of schools, and again this is from two angles. First, the potential that if the IB forges ahead with wholescale digital assessment, linked to an inevitable increase in digitalisation of teaching and learning, that schools with limited resources will leave the programmes. In contrast, schools where educational practices are already highly digitised may become frustrated with an ongoing reliance on old-fashioned pen-andpaper based assessments and seek a more innovative educational programme. Adding to the complexity, the IB needs to both reflect the reality of the world in which learners are growing up but also needs to stay true to its philosophy and its fundamental approach to an inquiry based model of education. There is little agreement on what the 'best' solution is in this context, and indeed the solution may be different for each subject that the IB offers.

A further question that IB staff clearly grapple with is their responsibility towards schools. On the one hand the IB cannot be prescriptive and tell schools how to enact their programmes, and neither is this desired. On the other hand the IB has very little say beyond initial authorisation of schools and initial training of teachers in how their programmes are enacted in different sites.

With this in mind, what approach should the IB take to supporting schools, coordinators and teachers while also shying away from advocating set approaches that might not meet the needs of different contexts?

IB staff are also at odds over teacher agency, with some arguing that all IB teachers have the knowledge and skills to be able to work out what suits their context best while others feel that this is over-stating the capacity of staff to determine the best approach to use without at least examples and suggestions. Equally, not all IB staff themselves feel equipped to engage with the key contemporary educational movements and this implies a need for internal capacity development.

Returning to the theme running through this report, purpose needs to be the defining force at work in decisions about how to move ahead. What purpose is the IB aiming to achieve in its educational programmes, and to what extent should changes in the world around us inform this thinking? Should the preparation of learners for lives in a digitalised world drive approaches to teaching, learning and assessment or is there a more profound dynamic to acknowledge? What should be the pace of change within the IB and which trends should be incorporated? There are no set answers to any of these questions, and hence the IB needs to evolve an approach that synthesises the best possible approach for its forward direction. It is clear that the staff are deeply invested in finding the best possible direction and in making sure that the IB continues to provide the best possible educational programme that it can.



# INSIGHTS FROM IB EDUCATORS

#### **Introduction**

This section highlights key insights from teachers and programme and subject coordinators who responded to a series of surveys about the relationship between teaching, learning and digital assessment across the four IB programmes: PYP, MYP, DP and CP. These insights are important for contextualising other research components outlined in this study including: the literature review, expert review of materials and focus groups and interviews conducted with IB staff.

The key research question from the overall study which the surveys sought to answer is 'what is the backwash effect of digital assessments on teaching and learning'?

Significantly, the design of the survey instrumentation was strongly influenced by elements that arose from other components of this study, namely the literature review, the focus groups and interviews and the expert reviews of curriculum materials and specimen assessment materials. As such, this section should be read in conjunction with those parts of this report in order to provide a broader context for the issues it addresses.

It is important to note that this is an exploratory study that covered a number of different areas. This has innate limitations: first, its focus was necessarily broad and this meant that it was not possible to focus in on any of the elements in great depth. Second, that while the responses of respondents reflect their thoughts and feelings, there is no way of knowing the extent to which this reflects their actual practices. Third, there is no way of knowing what impact reported actions have had on learning.

#### **Research Methodology**

The research methodology for this study was designed in response to the overall research objective of this project - to evaluate the relationship between teaching, learning and digital assessment in the IB, as well as the specific research question for the surveys.

To capture this, four questionnaires were initially distributed by the IB to a sample of schools, selected across IB programme, region and school type.

#### Sample

In order to ensure that teachers from an adequate representation of schools had the opportunity to respond, a stratified sample was initially employed by region, school type and programme which ensured appropriate proportional representation of schools globally. This table can be found in **Appendix 5**. The initial distribution of the surveys by region is found in **Table I**.

Due to the relatively small size of the MYP and CP programmes, compared to DP and PYP, it was eventually decided a census was needed to ensure sufficient responses from these programmes. As a result, all schools offering MYP and CP were given the opportunity to participate.

One of the challenges of sampling for this research was that while the unit of measurement was individual teachers, the unit available for sampling were schools offering particular IB programmes.

Programme	PYP			MYP			DP			СР		
Region	Т	Ν	%	Т	N	%	Т	Ν	%	Т	Ν	%
IBA	615	127	21%	625	165	26%	1588	344	22%	99	27	27%
IBAEM	173	51	29%	102	42	41%	826	228	28%	61	16	26%
IBAP	320	67	21%	85	28	33%	489	133	27%	12	4	33%

Table I: Schools Sampled by Region and Programme (n=4 995)

T = Total, represents the number of authorised schools at the time of this research

N = Number, the number of schools initially sampled

% = Percentage, the percentage of schools initially sampled
There was no way of knowing how many teachers were in each school. This means that in some schools a single teacher may have responded to the survey while in other schools it may have been more than one.

Hence while a selection of schools was sampled, teachers could not be sampled. Consequently, while we are reasonably confident that the views expressed by respondents are reflective of those across a range of schools we are unable to specify the level of statistical representativeness at the teacher level.

#### Questionnaires

Respondent insights were collected using four online questionnaires based on each IB programme. The four questionnaires, were similar in many ways but were tailored to contextualise them to specific programmes. For example, references to the programme name were changed and a specific set of items were added to the MYP instrument to reflect the use of e-Assessment in the MYP.

Each questionnaire was disseminated in all three IB regions: the Americas (IBA); Asia-Pacific (IBAP); and Africa, Europe and the Middle East (IBAEM), and was provided in three languages, English, French and Spanish. Language translations were completed by the IB. Questionnaires were delivered using the Lime Survey tool, an excerpt of which is illustrated in **Figure 1**. The Lime Survey platform was selected due to its capacity to facilitate:

- Dynamic questioning;
- Automatic collation of responses internationally; and
- Language selection by respondents.

These features were important for ensuring the efficient and accurate collection of data while reducing the cost and time associated with a survey process.

The questionnaires were developed by ACER through an iterative review process in collaboration with the IB. Questionnaire items were informed by:

- Key insights from a review of the literature;
- Feedback from focus groups and interviews with IB staff; and
- Alignment with parameters set by the IB.

Questionnaire items were based on seven focus areas used to form a comprehensive evaluation of respondents' perspectives on digital tools and assessment:

- Prior experience using digital assessment;
- Respondent opinions about digital teaching, learning and assessment;
- Backwash from formative assessment;
- Backwash from summative assessment;
- The preferred format for digital assessment;
- Current use of digital pedagogy; and
- Estimation of learners' ICT skills.

### Figure I: Excerpt from online survey tool

	IB MYP Survey - The Relationship Between Teaching, Learning and Digital Assessment
	· · · · · · · · · · · · · · · · · · ·
	0% 100%
	English 🔻
	Nature of digital assessment
I think that for	mative e-Assessment in the MYP should be
Check any that ap	ply
🗌 A substitute f	or a paper based examination with no change to the type of tasks students are asked to complete
Very similar to embedded vid	o a paper based examination but with the inclusion of some new functions for students to use eg an leo or a digital calculator
Quite distinct test such as t	from a paper based examination with tasks for students that are different to those on a paper based he creation of multimedia elements to convey ideas and collaborative tasks
Very different a paper based conclusions.	from a paper based examination, including innovative tasks for students that would not be possible on I test, such as the use of a variety of multimedia to collect, communicate, and distribute findings and

Questionnaire items were designed to allow comparisons based on these themes across programmes, while highlighting contextually relevant information within each programme.

For the MYP, currently the only IB programme to offer e-Assessment, a focused set of items were developed to better understand how e-Assessment is currently being used in the MYP and respondent attitudes towards this.

Throughout the questionnaires, a balance of open and closed items were used to collect a mixture of quantitative and qualitative data. The survey tools can be found in **Appendix 4.** A summary of all quantitative data collected by programme can be found in **Appendix 5**.

#### Data analysis

All quantitative data was fed into SPSS, cleaned, recoded and analysed using a range of descriptive analyses including cross tabs of survey items against a range of respondent characteristics including programme, region, gender, respondent age and school type. In many cases there was no significant relationship between the variables examined.

One variable that was shown to be of significance in a large number of instances, however, was programme type. As such, programme type is the key variable against which data is reported here, and in **Appendix 5**. Against expectation, region appears not to produce as many statistically significant relationships. Where it does, however, it is mentioned in the text below.

The sections below focus on summarising the key insights emerging from the analysis in the context of the different IB programmes. Where there are statistically significant relationships (Chi square, P < 0.05) between other factors and the items in question, these are also mentioned.

All qualitative data was translated into English and then analysed on an individual item basis in an Excel spreadsheet. Thematic coding was used to identify the key themes arising from this data. This was followed by identifying sub-themes within the main categories, an iterative process in which conceptual categories emerged from the analysis.

These categories were then reviewed and refined, and prepared for reporting. This approach to qualitative analysis is informed by grounded theory which focuses on enabling themes to emerge from the perspectives of participants rather than the researchers imposing their pre-conceived themes (Holton, 2010).

With considerations of the length of this report in mind, it is not possible to include a summary of all qualitative data collected. Based on the research questions driving this study, it was therefore decided to focus on the qualitative data related to the key areas of backwash and digital pedagogy.

A selection of quotes from respondents has been included here to illustrate the different perspectives being expressed. All qualitative data has been provided to the IB for future secondary analysis.

#### **Respondent characteristics**

Overall, 2 775 educators responded to the questionnaires. Of these, the majority of responses were from the DP (I 864 responses), followed by PYP (584), CP (202) and MYP (125). Lower response numbers from the CP and MYP can be attributed both to the relative size of these programmes and to school year cycles. Initial responses from the CP were extremely low and the questionnaire period was hence extended specifically for this programme in order to increase responses.

Respondents were either teachers or programme coordinators at schools offering

one or more IB programmes. Their characteristics are summarised in **Table 2**. Overall, female respondents were a greater share of all respondents in the PYP than in the other programmes. The largest proportion of the youngest category of respondents were from the PYP and CP, and the CP also had the largest proportion of respondents from the oldest category.

### Table 2: Respondent Characteristics byProgramme (n=2 775)

individual backgrounds and experiences – is important in influencing attitudes to the topics addressed in the survey.

### Prior experience using digital assessment

The first part of the surveys asked respondents if they had prior experience using digital assessment in a programme other than IB.

ltem	Response	PYP	MYP	DP	СР
Gender	Female	83.5%	65.7%	59.3%	66.3%
Lam	30 or under	1 <b>9</b> .1%	9.9%	9.7%	18.8%
I dill	60 or over	3.0%	8.5%	5.1%	10.4%
Teaching Experience	Less than 5 years	15.1%	9.7%	8.5%	12.9%
	Private International	59.7%	63.9%	38.2%	29.5%
	Private National	1 <b>9</b> .1%	13. <b>9</b> %	20.0%	24.2%
School Type	Public (Rest of the world)	6.7%	13. <b>9</b> %	26.7%	9.5%
	Public (USA)	11.2%	4.2%	10.2%	33.7%
	Other	3.3%	4.2%	4.9%	3.2%
	Americas	37.4%	28.6%	50.4%	65.1%
Region	Africa, Europe the Middle East	22.4%	61.4%	28.5%	25.6%
	Asia Pacific	40.3%	10.0%	21.0%	9.3%

In the PYP and MYP more than half of respondents came from private international schools and this was also the case for more than a third of respondents in the DP. In the CP more than a third of respondents came from public schools in the USA.

More than half of respondents in the DP and CP came from the Americas, with more than half of respondents in the MYP from Africa, Europe and the Middle East. In the PYP around four-in-ten respondents came from the Americas and a similar proportion from the Asia Pacific.

These patterns are important as it is likely that a complex interplay of region, school type, age and gender – in addition to For each programme, only a small proportion of respondents reported having prior experience using digital assessment, with this least common in the MYP (7.4%), followed by the PYP (13.5%) and DP (16.5%), and most common in the CP (23.2%). Respondents from public schools were those most likely to have prior experience using digital assessment.

Of the 348 respondents that reported prior experience using digital assessment in programmes other than the IB, more than half reported that digital assessment was used for both formative and summative purposes. Examples of programmes in which respondents had taught include, IGCSE, ICSE, BTEC and national programmes in countries such as China, Sweden and Japan.

Around half of respondents from the PYP and DP reported that the use of digital assessment in those prior programmes had affected the way in which they taught either 'quite a lot' or 'a great deal', but this was only reported by a third of respondents from CP and just over a quarter of respondents from the MYP.

Respondents were also asked to report whether changes to learner learning as a consequence of digital assessment in previous programmes had been positive or negative. Around half of respondents from the PYP and DP, and almost two-thirds of respondents from the CP, reported that the impact had been mainly positive while this was the case for less than a third of respondents from the MYP (most of whom reported both positive and negative impacts).

Some responses given by respondents describing these changes include:

'The use of digital assessment allowed me to have fast access to graphical data that gave me an accurate picture of my class allowing me to adjust instruction'.

'Students develop a greater interest for the lessons and at the same time they are able to create a better picture of themselves as a learner. Teacher can also reflect about his/her own practices in class when analysing students' online assessments'.

#### Table 3: Digital Assessment and the IB (Strongly Agree / Agree) (n=2 076)

'Allowed me to provide more individualized curriculum and instruction to learners because I was able to determine specific skills and understanding that needed to be developed'.

'Students had to spend large amounts of time learning to use the computer, how to format images or documents, how to compress files, how to take digital photos of their work and upload or print to include into process journals, how to evaluate fonts for readability [and so on] ... Therefore, my teaching had to change drastically in order to teach students how to perform to at least a basic level'.

#### **Overall attitude to digital assessment**

The second part of the survey asked respondents about their overall attitude to digital assessment within the context of the IB and the IB programmes they taught in. Respondents were asked to report their opinions on a range of elements including the extent to which digital assessment aligns with the IB philosophy as well as both opportunities and support needs for learners, teachers and schools. They were also asked for their opinions on the relationship between digital assessment and a number of key external factors.

#### Alignment with IB philosophy

As **Table 3** illustrates, more than 70% respondents from the PYP and CP reported that digital assessment aligned with the IB philosophy and that digital assessment should be used in IB programmes.

Survey Item	ΡΥΡ	ΜΥΡ	DP	СР
Digital assessment aligns well with the IB philosophy	70.6%	57.3%	62.2%	70.2%
Digital assessment should be used in IB programmes	73.1%	35.4%	63.0%	72.5%
The amount of digital assessment that is used in the MYP is appropriate	-	47.9%	-	-
More digital assessment should be used in the MYP	-	35.4%	-	-

For MYP, where different items were used, around half reported that the current amount of digital assessment in the MYP is appropriate and a further third that there should be more.

Interestingly, those least in agreement with the alignment of digital assessment with the IB philosophy, and also the least in favour of digital assessment being used in the IB programme that they teach in, were from public schools in the USA and from the region of Africa, Europe and the Middle East.

# Table4: DigitalAssessmentandLearners(StronglyAgree/ Agree)(n=2 039)

More than two-thirds of respondents from the CP programme reported that digital assessment would support learners to better achieve the attributes of the IB learner profile, while this was agreed to by around half of respondents from the PYP and DP but by only around one-third of respondents from the MYP.

The majority of respondents in all programmes reported that most of the learners in their school would require training on how to use digital assessment tools, with this percentage highest among respondents from the MYP, perhaps reflecting the current availability of e-Assessment in the MYP.

Survey Item	PYP	MYP	DP	СР
The use of digital assessment can make a positive contribution to the quality of student learning	79.2%	58.2%	63.9%	80.3%
Most students in my school would require training on how to use digital assessment tools	69.4%	75.0%	64.7%	59.0%
If digital assessment was used, this would support students to better achieve the attributes in the IB learner profile	54.0%	35.9%	49.0%	67.5%

This finding is important for the IB if it decides to move ahead with the expansion of digital assessment. While this move appears to be largely supported by respondents, the variations in responses by programme, region and school type suggests that – as IB staff indicated in focus groups and interviews – there are differing levels of preparedness for, and interest in, digital assessment among schools, requiring a nuanced approach.

#### Impact of digital assessment on learners

In terms of the impact of digital assessment on learners, more than two-thirds of respondents from the PYP, DP and CP agreed that the use of digital assessment can make a positive contribution to the quality of learning, while this was also agreed to by more than half of respondents from the MYP. These patterns are shown in **Table 4**. Taking the responses to these three statements together, it appears that any move towards greater use of digital assessment in the IB would be well-received in terms of its impact on enhancing learning but with the caveat of sufficient support to ensure that learners are well-prepared to use any digital assessment tools.

#### Teacher professional practice

In terms of teaching, respondents reported that the possible future use of digital assessment would change the way in which they select and conduct learning activities, would enable teachers to better monitor learner progress, and would expand the scope of what could be assessed. These patterns can be seen in **Table 5**.

#### Table 5: Digital Assessment and Teaching (Strongly Agree / Agree) (n=1 983)

Survey Item		MYP	DP	СР
The use of digital assessment would change the way in which teachers select and conduct learning activities	71.9%	<b>76.</b> 1%	70.4%	77.4%
Most teachers in my school would require training and support in order to effectively use digital assessment	76.5%	77.3%	<b>79.</b> 1%	70.2%
The use of digital assessment would increase the ability of teachers to monitor student progress effectively	77.8%	53.4%	67.8%	84.3%
The use of digital assessment would expand the scope of what can be assessed	63.7%	48.8%	55.5%	64.3%
Digital assessment tools would be more suited for formative assessment than summative assessment	49.7%	22.7%	45.3%	34.8%

Respondents also reported that most teachers would need training and support in order to effectively use digital assessment. Respondents did not agree that digital assessment tools would be more suitable for formative than summative assessment.

Responses to these items are noteworthy since there is very little variation by programme and a very high proportion (in many cases more than three-quarters) of respondents either agree or strongly agree with three of these statements.

#### School environment

Exploring this topic further, respondents were asked about digital assessment in relation to their school and a summary of their responses is shown in **Table 6**.

#### Table 6: Digital Assessment and Schools (Strongly Agree / Agree) (n=1 951)

More than three-quarters of respondents from the PYP, DP and CP programmes reported that they either agreed or strongly agreed that schools should be able to use an IB digital assessment platform to build their own formative assessments.

For the MYP this item was worded slightly differently and in this case more than four-infive respondents reported that schools should have advance access to the digital assessment platform used for MYP summative assessment to enable learners to become familiar with it. These responses are noteworthy in that these are the two items with the highest level of agreement across all programmes in the entire survey.

Survey Item	ΡΥΡ	MYP	DP	СР
Schools should be able to use an IB digital assessment platform to build their own formative	76.0%		75.0%	<b>79</b> .1%
assessments				
Schools should have advance access to the digital				
assessment platform used for summative assessment	-	85.1%	-	-
to enable students to become familiar with it				
My school would require support from the IB to				
use digital assessment in learning and teaching	74.8%	64.0%	77.5%	<b>66.7</b> %
activities				

In response to the item about support, the majority of respondents agree that their schools would need support from the IB to use digital assessment in learning and teaching activities with the proportion of respondents in agreement lowest in MYP and highest for DP, perhaps reflecting the high stakes nature of DP assessments and the fact that e-Assessment already exists in the MYP.

#### External influences

In relation to external influences, respondents were asked to consider three key dynamics. **Table 7** summarises their responses. Interestingly only a minority of respondents report that parents would be influenced in their choice of IB programmes by the use of digital assessment, a concern that was raised by IB staff during focus groups and interviews.

#### Table 7: Digital Assessment and External Influences (Strongly Agree / Agree) (n=1 903)

just over two-in-five respondents from the MYP agreeing.

Overall, the data collected from respondents to survey items about their attitudes to digital assessment highlight a great deal of positivity towards digital assessment and an understanding that it is a good fit with the IB philosophy. Moreover, respondents reported that digital assessment would enhance learning and increase the ability of teachers to better monitor learning.

This suggests a supportive and fertile environment for the evolution of digital assessment within the IB but it does come with some important considerations. Most of all, respondents highlight the need for teachers and learners to receive support and training in digital technologies.

For the IB this poses some questions around how to best support schools, teachers and learners to use digital assessment.

Survey Item	ΡΥΡ	MYP	DP	СР
The IB should be seen to be innovative in its support of digital assessment in comparison with other international	72.9%	56.5%	62.9%	71.3%
education programmes				
The IB should reflect the increasing ubiquity of digital tools in daily life by supporting the use of digital assessment	68.3%	43.5%	64.5%	66.1%
The use of digital assessment would influence parents in their choice about whether or not to enrol their children in IB programmes	40.3%	32.9%	26.0%	21.7%

The majority of respondents in all programmes reported that the IB should be seen to be innovative in its use of digital assessment in comparison with other international education programmes. In addition, the majority of respondents in the PYP, DP and CP reported that the IB should reflect the increasing ubiquity of digital tools in daily life by supporting the use of digital assessment. Once again, respondents from the MYP were something of an outlier, with One approach is to provide some sample items at the start of an assessment that allow learners to practice how to respond to certain item types.

This approach is common in large scale international assessments with a limited number of item formats and would likely suffice for formative assessment practices. For the high-stakes summative assessment that the IB conducts, however, it is likely that a lack of prior exposure to the digital system used for assessment would add to learner stress and could unfairly disadvantage those learners who are least familiar or comfortable with picking up new digital tools in a short space of time.

An alternative, then, is to provide schools with access to the same assessment environment and tools that are used in summative examinations. This would mean that teachers could use these tools in building ongoing assessment and learners would have the opportunity to become fully familiar and comfortable with using a range of devices well in advance of any summative examination. This has important technical implications for the IB as it considers the best digital systems to use to deliver summative assessments.

Moreover, respondent feedback indicates that additional training beyond access to the system would be required. This means that the IB needs to consider how best to provide support to schools, teachers and learners that is flexible and accessible but also meets the specific needs in, for example, particular subjects within particular programmes.

# Table8:BackwashfromDigitalAssessment on Teaching (Quite a Lot /A Great Deal) (n=1 497)

Further research into the decision making that teachers use to design teaching materials and formative assessment using digital tools would help the IB to understand the elements in which most support is required. Similarly, research into the cognitive processes that learners use when they adapt to new digital tools in their learning activities would help the IB to better understand the key points at which intervention would be helpful.

### Backwash from digital formative and summative assessment

In the third part of the survey, respondents were asked to indicate their perception of the impact of digital formative and digital summative assessment on aspects including learners, teaching, their subject, assessment and their professional role. Detailed results by programme can be viewed in **Appendix 5**.

In many of the aspects, formative assessments were judged by respondents to be more influential on learning than summative assessments (or at least to have a similar impact).

The two areas in which this pattern was reversed were the strategies that learners use to prepare for assessment and respondents' participation in the IB Educator Network, in which summative assessments were regarded as more influential than formative assessments.

Response	Formative	Summative
The way in which I monitor student learning	71.4%	64.8%
The way in which I select activities and tools for use in teaching	71.4%	64.3%
My ability to use data insights to inform my teaching	64.7%	59.5%
The way in which I plan my teaching	64.7%	59.4%
The homework that I set	63.7%	59.8%
The teaching strategies I use	63.5%	57.4%
My approach to content	58.2%	52.2%
The way in which I manage my classrooms	58.4%	50.9%

The largest proportions of respondents that reported impact that particularly related to data analytics. This was true for data analytics to inform their teaching and to plan interventions. It was also true for the use of data analytics by learners to monitor their own progress and help them to plan their own work.

In relation to teaching, more than three-infive respondents reported that digital summative assessment would impact the way in which they monitor learning and the way in which they select activities and tools for use in their teaching. These patterns can be seen in **Table 8**.

Interestingly, more than 60% of respondents reported that digital formative assessment would have an impact on almost all of the listed teaching activities, suggesting that respondents anticipate greater backwash from formative than from summative digital assessment into teaching.

#### Table 9: Backwash from Digital Assessment on Learners (Quite a Lot / A Great Deal) (n=1 459)

in-five reporting this for formative assessment.

Similarly, more than seven-in-ten respondents reported that digital formative assessment would enhance the ability of learners to monitor their own progress. Just over half of respondents reported that digital assessment would impact the priority that learners place on certain topics or skills and the likelihood that learners will become more independent learners. These patterns can be seen in **Table 9**.

In relation to assessment, more than threein-five respondents reported that digital assessment would impact their ability to use data to inform adjustments to their teaching (with a greater proportion of respondents reporting this for formative than summative assessment). Around half reported that digital assessment, whether formative or summative, would impact the reliability and validity of assessments or the security of assessments.

Response	Formative	Summative
The strategies that learners use to prepare for assessment	61.5%	76.3%
The ability of learners to monitor their own progress	<b>72.9</b> %	63.8%
The skills that learners use	66.7%	58.5%
The strategies that learners use in planning, monitoring and evaluating their learning	60.7%	60.8%
The motivation and engagement of learners	63.8%	54.0%
The likelihood that learners will become more independent learners	63.0%	56.3%
The priority that learners place on certain topics or skills	53.9%	55.9%

In relation to learners, more than threequarters of respondents reported that the use of digital summative assessment would impact the strategies that learners use to prepare for assessment (with just over three-

In relation to their professional role, more than three-fifths of respondents reported that digital assessment would impact their understanding of the role of technology in education. Around half reported other factors including that digital assessment would influence their collaboration with other teachers in their school and their participation in the IB Educator Network.

This may indicate a desire to contribute – through, for example, sharing assessment materials with colleagues, and/or a desire to gain, for example through using examples and materials developed by other teachers. Finally, in relation to subjects, only around one-in-three respondents reported that digital assessment would impact the nature, objectives and content of their subjects.

Respondents were also asked to express their opinions on the impact of digital assessment. When considering the influence of **digital formative assessment** on learning, a high proportion of teachers in both PYP and MYP, identify motivation and engagement of their learners as the largest effect.

Teachers in DP and CP, however, regard digital formative assessment as having the largest influence on the ability of learners to monitor their own progress and the skills that learners use in the classroom. This has important implications for how the IB positions its approaches to teaching and learning within digital assessment design with regards to metacognitive skills.

### Impact of digital assessment on learning

When asked to qualify the ways in which the use of digital formative assessment influences changes to learning, using examples, respondents provided a mixture of positive, negative and neutral responses. In positive terms, respondents identified gains such as greater learner independence, enhanced learner motivation, learners taking greater ownership of their learning and the fact that learners feel at home in a digital environment. The following quotes illustrate some of these themes: 'They know where they are at, and what they need to do to close any gaps in their learning'.

'They are given more ownership of their learning and so can be more motivated, independent and proactive - taking the necessary steps to get extra support if needed'.

'These learners were raised in a digital environment and so feel 'at home' in it. Immediate anonymous feedback helps them to evaluate their performance in the context of their peer cohort'.

'My personal experience suggests that learners respond more to my digital formative assessments because they are more personal and tailored to their needs ... the use of digital assessment has had a real buy-in from the learner body, concerned as they are about paper consumption'.

Other respondents were able to see both positive and negative impacts of digital formative assessment or no impact at all, as these quotes indicate:

'It's simply another tool ... assessment should be a seamless part of the learning process'.

'Technology makes the teachers lives easier for sure but it doesn't always benefit the learner ... when it is on paper they tend to take [feedback] more seriously and will go over every detail to observe the information being written'.

The final group of respondents felt that digital formative assessment was negative, both in terms of the focus of learning and potential de-skilling of learners as well as learner preferences or wellbeing. The following quotes illustrate some of these themes: 'If an assessment is a written piece of work, doing this digitally can make things worse. Having the easy ability to change things means that learners don't always plan / think before they start'.

'Recognition of the dangers is needed, and that the technology can have a negative impact on a learner's personal skills, time management and a range of wellbeing issues'.

'I feel that digital accessibility fails to make learners more responsible and may make them less independent. It certainly contributes to them viewing themselves from the lens of a number'

When asked to identify ways in which the current or possible use of **digital summative assessment** did or would influence changes in learning, the majority of comments from teachers were positive. There was a great deal of reference to the ability of learners to monitor their own performance, an increase in learner motivation, shifting greater responsibility for their learning on to learners, an improvement in learner skills and a better reflection of learners' contemporary lives. Comments included:

'If appropriate formative opportunities, which are in good alignment with summative assessment, the learners take more control over their preparation and performance on the summative items'.

'They would have access to information about related to learning profile, such as strength and weaknesses, their level of achievement based on intellectual standards, and also strengthen their awareness on what to do in order to improve as a learner'.

'If they know that their final assessment will be similar in style to what they do every day, they are more likely to value the classrooms and homework tasks'. 'Many learners are familiar with using technology in their everyday lives. In ways, we are putting them at a disadvantage when we give them pencil and paper because for them it is obsolete'.

Other teachers reported that they were cognisant of both positive and negative aspects. For example, they were delighted by the thought of a reduced marking load but concerned whether digital assessment would still be able to assess higher order skills.

Teachers also reported the potential for different impact on different learners while others reported that they did not have enough information to make up their minds. These quotes illustrate some of the themes:

'They still have to do the reading and the planning and learning. Writing something online isn't going to change that. An essay is an essay whether written or done on a computer. Not everyone has the typing skills to complete the work in a specific set of time. That creates inequality for the learners'.

'Everything would depend on the nature of the summative evaluation and the platform used.'

In addition one teacher suggested 'instead of using a survey to complete a crystal ball prediction we should conduct some trials'. This indicates the need to pilot any innovative approaches.

Finally, a minority of teachers expressed negative perspectives about digital assessment. Some of the reasons given related to the format, some to learner attitudes and skills and some to learner welfare, as these exemplar quotes illustrate:

'Learners would be more concerned with matching the format for digital assessment than mathematics understanding'. 'Learners are becoming LESS independent with a reliance on immediate feedback rather than reflecting on processes'.

With too much digital stuff they forget how to use their brains. And too much screen time. They spend too much of their free time in front of the screen anyway'.

'This would inhibit the skills that we want learners to develop and would make them more reliant on technology rather than developing independence'.

Overall, taking together the feedback from respondents on backwash from both formative and summative digital assessment, it is clear that the ongoing nature of formative assessment is regarded by respondents as exerting greater power over their teaching, as well as learners' behaviour, than summative assessment does. This is not surprising as formative assessment tends to be more closely embedded in teaching and learning activities.

#### Table 10: Nature of Digital Assessment by Programme (n = 2 733)

more comfortable in a digital environment than using paper and pens.

At the same time, respondents also note downsides such as inequalities that disadvantage those learners with least access to digital devices, the tendency for learners to expect instant feedback and the possibility that the use of digital devices inhibits some of the skills that learners need to gain.

Balancing the strengths and weaknesses in order to create a positive environment in which all learners and teachers can benefit from digital assessment ultimately comes down to how it is designed, and this is a major question for the IB to address.

#### Nature of Digital Assessment

In the fourth part of the survey, respondents were asked to comment on the format of current or future digital assessment. They were prompted to consider the following statements in the context of both formative and summative assessment – in order to link these to the data summary below these have been summarised into a two-word reference:

 e-Assessment should be a substitute for a paper based examination with no change to the type of tasks learners are asked to complete (No Change);

	Fo	Formative (n=2 733) Su				ative (n=	=2   53)
Survey item	PYP	MYP	DP	СР	MYP	DP	СР
No Change	13.8%	10.6%	15.9%	13.0%	8.9%	13.0%	13.0%
Very Similar	19.5%	27.6%	30.9%	26.0%	26.8%	25.8%	23.7%
Quite distinct	29.5%	19.5%	19.6%	24.9%	23.6%	22.0%	22.6%
Very different	37.1%	24.4%	23.7%	26.0%	22.0%	27.4%	22.0%

Qualitative data highlights the pros and cons of digital assessment. On the positive side respondents identify that it can enhance the extent to which learners take responsibility for their own learning and the ability of teachers to monitor learner progress and to personalise their teaching. Moreover, respondents note that many learners feel

- e-Assessment should be very similar to a paper based examination but with the inclusion of some new functions for learners to use e.g. an embedded video or a digital calculator (Very Similar);
- e-Assessment should be quite distinct from a paper based examination with tasks for learners that are different to

those on a paper based test such as the creation of multimedia elements to convey ideas (**Quite Distinct**); and

 e-Assessment should be very different from a paper based examination, including innovative tasks for learners that would not be possible on a paper based test, such as the use of a variety of multimedia to collect, communicate and distribute findings and conclusions (Very Different).

Respondents were given the option to select all statements that applied. As a result, only instances in which the respondent has selected the statement has been reported in **Table 10**. Respondents teaching in PYP were not presented with the item on summative assessment as summative assessment does not exist in the PYP programme (although the exhibition may be regarded by some as a capstone-like project)

Table 10highlights some interestingpatterns.The most commonly chosenoptions for formative assessment were 'verysimilar' (MYP, CP) and 'very different' (PYP,DP, CP).

For summative assessment, the highest selected response across programmes was that the format should be very similar to a paper-based examination. 'No change' was the least selected option in any category and this indicates the desire of respondents to see more than 'paper-on-screen' in a digital assessment.

#### Digital pedagogy

This section focuses on digital pedagogy, which is considered in this study as the thoughtful use of technologies in teaching and learning, including an awareness of their impact on learning. Technologies can be used in online, blended and face-to-face environments and include a range of elements from using PowerPoint to flipped classrooms, blogging, assignments, the use of social media in the classroom and getting learners to use digital tools to test ideas.

Based on this shared understanding of digital pedagogy, respondents identified the frequency in which they integrated digital pedagogy into their teaching. **Table 11** shows that a much higher proportion of respondents in the CP reported integrating digital pedagogy into their teaching in most or all lessons compared to the other programmes.

### TableI I:IntegrationofDigitalPedagogy (n=1 646)

Response	PYP	MYP	DP	СР
Never	6.7%	2.7%	3.4%	2.0%
In some lessons	62.3%	58.7%	53.5%	35.7%
In most lessons	26.6%	32.0%	35.1%	50.0%
In all lessons	4.4%	6.7%	8.0%	12.2%

Those respondents who reported integrating digital pedagogy in their teaching in at least some lessons were asked about the impact on a range of elements of their teaching. The proportion of respondents who reported that digital pedagogy impacted on these either quite a lot or a great deal is shown in **Table 12**.

Unsurprisingly, the most common factors mentioned were the selection of teaching resources and classroom activities, both of which were selected by more than two-thirds of respondents across all programmes. Interestingly, respondents from the CP reported a greater impact of digital pedagogy on their collection of evidence on learner learning, the use of data on learning to inform their teaching, the way in which they provide feedback to learners and the homework that they set than respondents from other programmes. In contrast, respondents from Africa, Europe and the Middle East reported a lesser impact of digital pedagogy on all of the elements.

### Table 12: Impact of Digital Pedagogy(Quite a Lot / A Great Deal) (n=1 480)

Response		MYP	DP	СР
The way I select teaching resources	<b>77.9</b> %	75.0%	71.1%	67.4%
The way I select activities classroom activities	71.5%	67.6%	65.1%	72.4%
The way I collect evidence of student learning	69.4%	66.7%	58.5%	<b>75.9</b> %
The way I plan lessons	65.2%	68.1%	58.4%	55.8%
The way I provide feedback to students	60.6%	50.0%	57.9%	73.6%
The way I use data to inform teaching	62.6%	55.1%	53.5%	74.4%
The way I set homework	44.8%	52.2%	56.6%	61.6%
The way I manage my classrooms	61.3%	53.7%	50.7%	58.8%
The way I define learning outcomes for my students	54.8%	44.1%	43.6%	52.3%

Respondents were asked to indicate the most significant ways in which the integration of digital pedagogy has changed their teaching. The majority of responses to this item were largely positive. They touched on the motivation and engagement of learners, the ability to plan, instant feedback, improved learner skills, more learner centred learning and more collaborative learning.

The following quotes illustrate some of these themes:

'Allows for easier collaboration between learners and easier to give feedback and for learners to be more independent in doing further research'.

'It has become indispensable for me to deliver dynamic, effective and personalized learning'.

'The learner is at the center of everything. The teacher is mainly a planner and facilitator'. Negative comments touched on issues such as distraction when learners are on digital devices, greater time spent in preparing for classes and concerns about a loss of focus on the subject itself. These three quotes illustrate these themes:

'Learners need to be monitored more closely as they are more likely to go off task when digital technology is in their hands'.

'More planning is needed to prepare digital pedagogy'.

'My teaching has become less about subject knowledge and more about helping learners learn, use, and manage the digital technology'.

In addition to reflecting on the ways in which digital pedagogy had impacted their own practice, respondents were also asked to identify ways in which it could support teachers in general. **Table 13** illustrates the percentage of respondents who reported that digital pedagogy could support each of the listed components either quite a lot or a great deal, indicating that it is already embedded in their practices.

#### Table 13: Digital Pedagogy Help for Teachers (Quite a Lot / A Great Deal) (n=1 100)

Response	Per Cent
To cater to a range of learning styles	72.3%
To support learners to become independent	<b>68.8</b> %
To stimulate enquiry based learning	<b>68.6</b> %
To motivate and engage learners	<b>68.5</b> %
To facilitate effective small group work	62.2%
To improve their direct instruction	61.8%
To identify learners' strengths and needs	61.0%
To increase their collaboration with other teachers	60.4%
To support learners in their metacognition	58.4%
To enhance the quality of learner interaction	55.8%
To encourage effective peer tutoring	55.5%

Respondents from the MYP were those who reported the least impact of digital pedagogy on most of these factors while those from the PYP and CP reported the most. Respondents from Africa, the Middle East and Europe reported less impact of digital pedagogy on most factors than those from other regions.

#### Table 14: Impact of Digital Pedagogy on Learners (Quite a Bit or a Great Deal) (n=1 037)

elements from the IB learner profile. As **Table 14** illustrates, the largest proportion of respondents felt that digital pedagogy would support learners to become more inquiring and knowledgeable while the smallest proportion of respondents felt that it would support learners to become more principled and more caring.

In relation to learners, respondents were

asked to indicate the extent to which digital

pedagogy would help learners to enhance

Response	Per Cent
To become more inquiring	67.8%
To become more knowledgeable	67.2%
To become deeper thinkers	60.2%
To become better communicators	59.8%
To become more principled	56.4%
To become more open-minded	55.8%
To become more caring	54.0%
To take more risks	45.3%
To be more balanced	42.7%
To be more reflective	36.3%

For every element from the IB learner profile, a greater proportion of respondents from the Americas reported an impact from the use of digital pedagogy, with the smallest proportion of respondents from Africa, the Middle East and Europe reporting the impact of digital pedagogy on all elements. A greater proportion of respondents from the PYP also reported an impact from the use of digital pedagogy on every element in comparison to those from other programmes.

Respondents were asked to list the digital pedagogies they used and by far the most commonly mentioned was Google Classroom, with a range of other tools also mentioned including: YouTube, Kahoot, Geogebra, Khan Academy, Kognity, Padlet, Edmodo, Edpuzzle and Class Dojo. More broadly, respondents also mentioned online quizzes and videos, PowerPoint, blogs, apps, simulations, Smartboards and multimedia as well as references in general to social media and the internet.

Respondents were asked to comment on the most significant way that the integration of digital pedagogy impacted learners. Comments were predominantly positive in nature. Respondents reported that the integration of digital pedagogy enhances understanding learners' of concepts, improves inquiry, provides access to better resources, enhances learner motivation and supports both collaborative and independent learning. These quotes illustrate some themes:

'I believe digital tools can help learners because more reflective, inquiring, and knowledgeable, since there are a lot of great digital resources available to learners. They also have to become better critical thinkers in order to evaluate those knowledge tools'.

'Access to authentic recent resources from around the world'.

The limited number of negative comments, generally focused on a lack of real impact of digital pedagogy, distraction of learners, less in-person interaction, a reliance on digital resources and a concern for learners with the least access to digital resources. These quotes illustrate some of these themes:

'Digital tools are stunting the development of my learners. They talk less, go off task easily, and generally waste more lesson time'.

'They become more knowledgeable about digital technology. But they are less knowledgeable about the subject, content, terminology, and concepts ... Other forms of communication are retarded, while digital, quickie communication is "improved", or at least practiced'.

#### Challenges in using digital pedagogy

When asked to identify the challenges they faced in integrating digital pedagogy into their teaching, most respondents unsurprisingly focused on three key issues: a lack of resources, time management (both in terms of preparation, and in the classroom) and the need for more training. Other issues mentioned included the digital literacy of learners and concerns about academic honesty. The following quotes illustrate these themes:

'Bad internet connections, finding high quality resources, having to train learners in effective online research and added classroom management aspects of keeping learners on task (not doing work for another class, or going down a rabbit hole of bait click links on an assigned topic, for example)'.

'The availability of the correct/appropriate resources. It can be difficult to find what suits the needs of your own instruction. Creating media which serve your own needs is a significant commitment and not everyone is in a position to take such a task on'.

'The number of learners' Knowledge of computer programs and online platforms. The availability of resources in the school, in our homes or in those of the learners'.

### Table 15: Supporting Digital Pedagogy(Quite a Lot / A Great Deal) (n=1 074)

'Training beyond 'how to' - they need to understand it is not enhanced learning, it is different learning. It is complimentary'.

'To learn about new technologies. To master computer tools. To adopt a new pedagogy based on digital technology'.

'Finding the time to learn how to use them; figuring out how to use them effectively; having administrations that understand that learning new technology for teaching takes time and cannot be instantly switched to with mastery level'.

'Academic honesty disturbances. The lack of technology skills for both teachers and learners. More work for teachers'.

When asked to identify what factors would help to overcome the challenges in order to encourage greater use of digital pedagogy, the greatest proportion of respondents reported that access to relevant professional development would help while the least proportion of respondents noted the influence of greater confidence in their technological skills. These responses are shown in **Table 15**.

A greater proportion of respondents from the PYP reported that all but one of these factors would encourage greater use of digital pedagogy than respondents from all other programmes. Equally, a greater proportion of respondents from the Americas reported that all of these factors would encourage greater use of digital pedagogy than respondents from other regions.

Response	Per Cent
Access to relevant professional development (inside or outside my school)	70.4%
Online modules to teach me how to use different digital applications in teaching	66.4%
The inclusion of digital assessment in the IB programme	63.2%
Being able to learn from other teachers in my school	63.0%
More confidence in my technological skills	59.5%

#### Learner's ICT skills

This section summarises respondents' perspectives on the ability of learners to use digital technologies to do each of the following:

- participate in digital networks for learning
- manage digital reputation and online identity
- adopt, adapt and use digital devices, applications and services
- study and learn effectively in technology rich environments
- find, interpret, evaluate, manage and share information
- critically read and creatively produce communications in a range of media
- participate in emerging educational practices that depend on digital systems

The patterns are summarised in **Table 16**. At least seven-in-ten respondents from the CP reported that learners could adopt, adapt and use digital devices, applications and services, participate in digital networks for learning, find, interpret, evaluate, manage and share information and study and learn effectively in technology rich environments.

### Table 16: Learners' ICT Skills (Most / All) (n=1 558)

More than three-in five respondents from the DP reported that learners could do the first three of these, while more than three-in-five respondents from the MYP reported that learners could find, interpret, evaluate, manage and share information.

Interestingly, respondents expressed less certainty about the ability of learners to participate in emerging educational practices that depend on digital systems; manage digital reputation and online identity and critically read and creatively produce communications in a range of media. These are areas that the expert reviewers noted were largely missing from programme and subject documents.

### Summary of insights from survey research

Returning to the key research question which guided this element of the study, what can the data tell us? The goal was to discover the impact of the backwash from digital formative and summative assessment on teaching and learning. For most IB programmes – in which there is currently no digital assessment – the latter was theoretical in nature – what they thought it would be.

I estimate that of my students can use digital technologies to do the following	ΡΥΡ	MYP	DP	СР
Adopt, adapt and use digital devices, applications and services	50.5%	48.6%	68.8%	79.6%
Participate in digital networks for learning	45.4%	50.0%	64.2%	<b>80.9</b> %
Find, interpret, evaluate, manage and share information	45.4%	62.5%	60.8%	<b>69.9</b> %
Study and learn effectively in technology rich environments	55.6%	38.9%	58.3%	74.5%
Participate in emerging educational practices that depend on digital systems	44.7%	45.1%	52.4%	60.2%
Manage digital reputation and online identity	34.1%	29.2%	53.1%	64.9%
Critically read and creatively produce communications in a range of media	36.3%	33.3%	48.3%	58.5%

The focus was expanded to include the extent to which respondents were using digital pedagogy since the literature review emphasised the importance of both backwash (in which the form of assessment influences teaching and learning) and forewash (in which the form of teaching and learning influences the form of assessment).

Key findings from the data collected from respondents is that they are generally positive towards the idea of digital assessment, reporting that it aligns well with the IB philosophy and that the IB should be innovative in relation to other educational programmes. Respondents felt that digital assessment would contribute positively to the quality of learning and to their ability to monitor learner progress. They also reported it as unlikely that parents would be influenced in their choice of IB programmes by the use of digital assessment.

Crucially, respondents emphasised the need for both teachers and learners to receive sufficient training and support to use digital assessment, with significant support for the possibility of using an IB digital assessment platform to build their own formative assessments.

In terms of the impact of formative and summative digital assessment on teaching and learning, respondents judged that digital formative assessment would have a greater influence than digital summative assessment. Particular areas of backwash highlighted by respondents include the ability of learner analytics to inform their teaching and to help them plan interventions. Respondents also felt that digital assessment would support learners to better monitor their own progress and help them to plan their own work.

Beyond data analytics, respondents made clear that digital assessment does, or would, influence their selection of tools and activities for teaching as well as planning and their management of classrooms. This indicates the importance for the IB of considering backwash in the design of digital assessment. Respondents also indicated areas in which the IB needs to take particular care, including the potential negative impact of digital technology and tools on learner welfare, skills and independence.

With regards to the format of current or potential digital assessment respondents were relatively split across the options of something similar to (but not the same as) the paper-and-pen assessment tools currently used versus something that is quite different.

Additionally, in relation to forewash, the majority of respondents reported using digital pedagogy in their teaching – for around a third this is in most lessons. Respondents also reflected on the extent to which this changes the role of teachers – with a focus on planning and facilitating personalised learning opportunities. They reported that digital pedagogy helps learners to gain a number of the characteristics in the IB learner profile, particularly to be more inquiring and more knowledgeable.

Respondents also noted downsides and challenges. These included aspects such as learner distraction and the focus of learners on how to use tools rather than knowledge or skills as well as practical issues around poor internet connectivity and the lack of skills of teachers and learners. Respondents pointed to a need for more professional development to overcome some of this but noted that structural issues also need to be addressed.

Overall the survey results provide the IB with a series of very interesting insights which can help to inform their thinking about the role of digital assessment within IB programmes. The surveys reveal that this space is in a state of flux, not only in regards to teacher experience with, and effective use of, digital assessment to promote positive backwash but also in regards to the ability of digital affordances within systems to adequately respond to forewash from the selection of resources and activities based on learning outcomes. The IB should be mindful of the interplay of these relationships as they move forward in considering assessment purpose.

While any survey has limitations, and some of these were addressed at the start of this summary, an important one to note here is that few respondents from schools that have opted in to MYP e-Assessment participated. This is unfortunate as their insights into the impact of backwash from digital assessment would be particularly valuable. This indicates the need to undertake more narrowlyfocused research specifically on the use and impact of MYP e-Assessment, something that would likely need to involve a detailed review of what is happening in classrooms in order to clearly define the nature of backwash and forewash.

Finally, since digital assessment and digital pedagogy exist in such a fluid context, continual monitoring and research to track backwash from assessment on IB stakeholders, as well as to identify key trends in the tools that teachers are using in their teaching and assessment practices will be essential for the IB to remain abreast of contemporary teaching practices across their programmes.



# SYNTHESIS OF RESEARCH FINDINGS

#### **Introduction**

The IB suite of programmes is underlain by a unique set of principles that define the fundamental purpose and objectives of an IB education. As part of 'education for a better world', the IB looks to support the development of a broad range of human capacities and responsibilities that go beyond academic success. Each IB programme is committed to the development of learners who are: inquirers, knowledgeable, thinkers, communicators, principled, open-minded, caring, risk-takers, balanced and reflective.

Close to the third decade of the 21st century, the challenge for the IB lies in how to stay true to these principles in a context in which the world is being rapidly reshaped, particularly by the two forces of globalisation and digitalisation. What does learning look like in this context? How can the IB best develop programmes that prepare learners for their future lives with these dynamics in mind? And how can the IB best support its schools to deliver appropriate education to learners?

The report has brought together findings from a number of research activities to respond to four key research questions:

- What is the current state of the art understanding of digital assessment use within the future educational landscape?
- How do IB curricula and digital assessment affordances reflect the state of the art in digital assessment use?
- What is the backwash effect of digital assessments on teaching and learning?
- How can the IB innovate future versions of digital assessment task design and development?

The study has collated data from a number of different sources to consider how the IB can approach new understandings of education, and particularly digital assessment, and move forward in a way that best balances technological advances with an approach that stays true to the philosophy of the IB and its programmes. This requires the IB to carefully consider new opportunities and navigate ways to accommodate these within its unique focus on inquiry- and concept- based, contextualised, collaborative, differentiated and assessment-informed teaching and learning.

The amount of data collected during this study has been considerable, comprising insights from more than 300 items of literature; reviews of more than 50 IB documents and specimen assessments; transcriptions of more than 24 hours of discussions; and survey data which comprises more than 700,000 cells of quantitative data and more than 300,000 words of respondent comments.

It would be tempting to hope that all of these insights combined are able to chart out a clear and definitive roadmap ahead for the IB in terms of teaching, learning and digital assessment. As with any detailed review of this kind, however, the more something is investigated, the more the complexities that lie within it become apparent.

Synthesising all of the data, however, has revealed the key contexts that are important for the IB to consider in determining its forward path. Among these are clear directions of travel that seem like they would be widely supported by IB staff, IB educators and that are backed by the review of literature and global best practice.

This section draws on insights from all of the elements of the research undertaken in this project in order to highlight the important factors that inform answers to the question 'how can the IB innovate future versions of digital assessment task design and development?' and to put forward key considerations for the IB.

#### Learning Progressions

Educational practices are being reshaped around the world by a growing understanding that all learners are on a learning pathway, with stages delineated along that pathway in the form of learning progressions. Moving away from the idea that all learners in a particular grade level should be at the same level of learning, this understanding instead focuses attention on the importance of individual learning journeys in which every learner can, and should, make progress.

This theme came out strongly from the literature review and was also echoed by respondents to the survey of teachers and programme coordinators. Using the term 'personalised learning' to reflect the individual pathways of learners, one respondent stated that digital pedagogy 'has become indispensable for me to deliver dynamic, effective and personalised learning'. In addition, IB staff talked about the idea that the contemporary context for education 'allows the idea of personalised learning to really take off in ways that we can't perhaps imagine'.

The notion of individual learning pathways delineated by learning progressions has significant implications for the idea of curriculum and for the role of assessment. It emphasises the need for learning and teaching activities to have sufficient flexibility to cater to learners with a range of competencies and who are at different stages in their learning journeys. Within this, the role of assessment becomes that of monitoring progress and providing insights to learners and teachers on next steps.

Learning progressions are definitions in which the important ideas, principles, and skills of a domain are laid out in a sequence that represents how learner competence in that domain develops. While learning progressions can be defined based on knowledge of subjects and academic research, to be as robust and reliable as possible they do need to be psychometrically validated. Assessment hence has a further important function in generating the data required to build and validate learning progressions.

The topic of learning progressions poses an exciting challenge for the IB, in that while at a global level learning progressions have been defined for a small number of subjects, they do not yet exist for the cross-disciplinary themes that characterise IB programmes. This places the IB in a unique position to contribute to a new understanding of learning progressions that sits outside of set subject boundaries.

At the same time, the definition of learning progressions within the IB could leverage the existing interconnectivity of programmes to further enable a flexible and evolutionary nature of learning in which learners move through the curriculum at different speeds, increasing competences in different areas of learning as they advance.

The development and validation of learning progressions is neither a straightforward nor rapid process but there is already interest among staff within the IB in working towards their definition. If the IB is able to reach a stage where it has defined learning progressions for all of its cross-cutting themes, this would certainly contribute to the IB's continued recognition as a trailblazer in educational practice.

**CONSIDERATION I** – The IB should seek to define appropriate learning progressions in all IB programmes and cross-disciplinary themes. Built into this process, the IB needs to explore validation methodologies for their learning progression approach.

#### Ongoing Assessment

One of the key assumptions of learning progressions is that regular data is available to shed light on learner progress. This points to a need for ongoing assessment – not in terms of regular formal examinations (although this is one possible approach) but

more in terms of assessment being an everyday part of teaching and learning.

For a long time educators have thought of formative assessment as a relatively informal, internal activity and summative assessment as a formal, external activity that has the goal of certifying learner achievement at the end of a programme or course. These notions are increasingly being challenged by a focus on ongoing assessment in which a holistic picture is built of a learner's proficiency across a wide range of relevant competencies, incorporating both formative and summative approaches.

Achieving this requires moving beyond the distinction between formative and summative assessment to an understanding of ongoing assessment which has the goal of identifying where learners are in their learning at different points in time, and giving teachers and learners data to enhance their teaching and learning practices.

The IB already has formative assessment in its programmes but this is currently relatively separate from the summative assessment in the MYP and DP. Moreover, formative assessments are developed by teachers and schools while the summative assessment instruments are developed by the IB. At present the two processes are quite distinct from each other and one consideration would be to work towards greater alignment.

IB staff identified the need to not only be leading innovation by integrating digital tools in summative assessment but also 'bridging across the formative and the teaching and learning space'. The survey of teachers and programme coordinators also highlighted the importance of connectivity between and formative summative assessment. Respondents reported that the backwash from formative and summative assessment to teaching and learning practices is significant but that the backwash from formative assessment tends to be more pronounced than the backwash from summative assessment.

In terms of considerations of backwash, IB staff noted that backwash could be 'regarded as an ally of ours and not a challenge' if good quality assessment tools are used, with one stating 'if you can design the right test then I want them to teach to the test'. At the same time, reviewers noted a number of opportunities to highlight digital approaches to classroom-based assessment in subject guides and programme documents.

In this context, finding ways to bring the range of assessment activities together is something that the IB could consider. One way that IB staff suggested this might work is by giving schools access to the same digital platform as that used for the formal assessments used by the IB, so that they could use it in teaching and learning activities throughout programmes. Interestingly, when this option was included in the survey of teachers and programme coordinators it received greater agreement from respondents than any other survey item.

Licensing or developing a digital assessment delivery system that is both suitable for the IB to use to develop summative assessment and for schools and teachers to use to develop formative assessments would help to bring the two into greater alignment. It would also support teachers and learners to gain the confidence to use similar digital approaches to assessment as those that would be used in the summative assessment. In addition, this would be a useful way to try out innovative approaches to assessment, using formative assessment as a testbed for items designed by the IB as well as encouraging teachers to trial innovative ideas that may be adopted by the IB in future.

The ultimate goal for ongoing assessment is to move beyond the duality of formative and summative assessment to practices that are ongoing in nature. This would include moving away from so much weight being placed on summative examinations, such as is the case in the DP and for other educational programmes such as A Levels. This already happens in the IB to a degree, with the inclusion of portfolios, but there remains a great deal of emphasis on the final examinations.

To counteract this, the IB could consider moving to a model where a greater proportion of the final grade comes from assessment throughout the course. This would, of course, need to be carefully considered in relation to tertiary entrance but it is likely that tertiary institutions may be amenable to this approach. In determining tertiary entrance, such an approach would provide a more holistic picture of learner' skills and knowledge – and hence a better prediction of likely success on tertiary courses – which institutions may appreciate.

**CONSIDERATION 2** – The IB should consider moving away from a which model in summative examinations contribute most of the final grade to an approach in which data from ongoing assessment contributes their to overall performance. Naturally such a consideration would need to take into account the multiple purposes of assessment and the needs of schools in their contexts.

#### **Data Analytics**

A third major trend highlighted in the literature review was data analytics, an area that the global education sector has yet to fully optimise. Using digital devices and opportunities for data analytics opens up an increased ability to collect evidence on learning. This information can be used to inform approaches to teaching and learning. At the same time, a number of ethical considerations arise.

In the survey of teachers and programme coordinators, the elements that they reported were most influenced by digital assessment (both summative and formative, but particularly formative) were those that related to data analytics. Respondents reported that digital assessment strongly impacted their ability to use learner analytics to inform their teaching and plan interventions. In addition, respondents noted that digital assessment enabled learners to monitor their own progress and to plan their own work, hence enhancing learner ownership over their own development.

In this, as in the other key themes, the IB is uniquely well placed to leverage the value offered by data analytics. Arguably, the network of schools around the world that offer IB programmes form an enormous ecosystem. There are many opportunities to draw on this ecosystem in order to generate dynamic insights into teaching, learning and assessment that could support improvements in learning and teaching across IB schools.

**CONSIDERATION 3** – The IB should develop an integrated system that can be linked to platforms for ongoing assessment across schools, data collected within schools and that can enable benchmarking to better support learning. This would also enhance the reporting on learner progress that could be provided to learners, teachers and parents. Ideally, this should be linked to any platforms used for digital summative assessment.

IB schools already collect a great deal of data on their learners and if this could be combined with data collected by the IB on MYP and DP summative assessment then it would strengthen the capacity of schools to identify how best to support learner progress.

For example, if IB teachers had clarity on typical benchmarks that learners in different schools around the world were achieving at different stages in their programmes then it would enhance the ability of educational activities within IB programmes to set high expectations for learners and to foster and nurture a growth-mindset, while supporting forward-looking curricula that enable personalisation and the enhancement of 21st century skills. Ideally data collected and made available from digital assessment systems would include not only information on learner performance but also on how they approached the tasks. This could include tracking data that can be automatically collected and synthesised by assessment systems such as time-on-task, number of attempts at a correct response, the order in which learners respond to assessment items and so on.

CONSIDERATION 4 - The IB should explore the applicability of psychometric approaches that might fit in their context to strengthen future assessment practice driven by effective pedagogy and be inclusive of the ways in which IB marking is quality assured. Psychometrics analysis does not need to be used in all assessment activities but will add value to the assessment practices of the IB and will be essential if the IB wishes to validate progressions learning (see consideration 1).

This can be a rich seam of insight into learner behaviour that sheds light on more than their overall performance alone.

This potential does, however, have to be couched with a degree of caution about ethical issues. There are inevitably concerns around the extent to which it is socially desirable to be measuring and collecting data on everything that learners do and the potential for this to drive undesirable impacts for learners. Ultimately, the benefits of data analytics need to be weighed against these important considerations.

In addition, making data analytics available to schools and ensuring that teachers have the skills to utilise them are not the same. There is significant research evidence to suggest that many teachers struggle to assimilate and navigate data in order to utilise the insights it can give them and this points to a need for relevant professional learning opportunities when required. A final consideration in relation to data analytics is the use of psychometric analysis within the IB. This would have resource implications and it would certainly not need to be used in all IB assessment activities. Nevertheless, the inclusion of psychometric skills within the IB would add value to the data that can be extracted from assessment activities. Moreover, it would enable the statistical validation of learning progressions in a way that is otherwise difficult to achieve.

#### **Reflecting a Digital World**

The three key trends of learning progressions, ongoing assessment and data analytics are almost impossible to achieve in a non-digital environment. As the literature review highlighted, digital assessment has much potential to offer. There is rapid evolution in possibilities for digital assessment such as adaptive testing, avatars, virtual worlds, gamification and attempts to assess 21<sup>st</sup> century skills.

In reality, however, most digital assessment around the world has not progressed much beyond 'paper on screen', largely due to the cost of developing digital technologies for assessment as well as concerns about undermining the rigour of assessment practices by using innovations that do not work. This tension could equally be said to apply to digital teaching and learning practices.

Moreover, this tension is illustrative of a tricky balance for the IB. As IB staff noted during focus groups and interviews, there is a need to balance the notion that digitalisation 'has to happen' if teaching and learning is to better reflect the reality of learners' lives. Equally, however, as one IB staff member noted, 'you've got two competing forces, a world to be digital and relevant versus our prime directive which is to make an accessible curriculum'.

This tension was equally marked among teachers and programme coordinators who responded to the survey. On the one hand a very large proportion agreed that the IB

should be 'seen to be innovative in its use of digital assessment' and that it should 'reflect the increasing ubiquity of digital tools in daily life'. Equally, however, teachers expressed concerns about the negative impact of digital technology on learners' skills and welfare and particularly for the unequal opportunities that learners had in terms of their access to digital tools.

**CONSIDERATION 5** – The IB should establish a coherent policy for the incorporation of digital tools across learning, teaching and assessment as and when required and support schools with resource restrictions to find sponsorship to supply required technology. Policies will need to strike a careful balance given the potential for intervention in largely school based processes.

There are no easy answers here, but what is clear is that teachers and IB staff expect the IB to move ahead with digitalisation, particularly in assessment. Moreover, setting this as a clear direction is an important step to take, with IB staff noting 'we need a really clear vision of where we want to go and how we want to get there'.

This inevitably means finding the ideal balance between forward-looking digital approaches and accommodations for schools with limited resources. It further highlights the need for the IB to find the best possible ways to support teachers and schools in incorporating greater digitalisation of education.

#### Support for teachers

A significant issue that arose from the literature review was the pressure that digitalisation can place on teachers, many of whom lack experience and confidence in using digital resources in the classroom. Despite the common assumptions about 'digital natives', just because someone has grown up in a digital age it does not mean that they are necessarily any better at adapting to

digital technology than their older peers. This applies to both teachers and learners.

Many teachers are very competent at using social media and browsing on the internet (indeed learner distraction was one of the downsides voiced by survey respondents about digital pedagogy). There is no evidence that this translates into using digital devices to undertake more complex activities, however. Survey respondents clearly identified that teachers in their schools would need support and training to use digital tools more widely, whether in assessment or in teaching and learning activities.

Inevitably the role of teachers is essential in mediating digital approaches and hence the knowledge and skills that teachers require is critical. Technological Pedagogical Content Knowledge (TPACK) requires teachers to be able to create interactions between the three bodies of knowledge of pedagogy, content and technology. Most teachers are unlikely to be able to do this without significant opportunities for professional learning.

The training that the IB currently offers to IB teachers is highly valuable but, beyond the initial training that teachers have to do, many teachers do not have the opportunity to engage in further IB-led training. This then raises questions about how the IB can best support teachers to gain confidence in utilising digital tools to enhance learner progress.

**CONSIDERATION 6** - IB staff should seek to identify relevant TPACK knowledge in their subjects as part of curriculum review. This understanding should seek to drive the development of a suite of support materials that can provide teachers subjects across and across with suggestions, programmes recommendations, good practice guides and case-studies from other teachers in IB programmes to support the enhancement of TPACK among teachers.

There are clearly divergent views among IB staff about the responsibility of the IB towards supporting teachers in IB programmes. Some feel that this is not their responsibility – that providing programme and subject guides and some initial training to teachers is enough and that thereafter teachers should apply their own knowledge and skills to establish the best approaches to teaching.

Yet other IB staff reported the need to provide sufficient support to teachers and schools to ensure that the IB is 'taking teachers on a teaching and learning journey where we ... showcase how technology can be integrated effectively'. Reviewers noted that at present the subject guides and programme documents provide very limited advice and support to teachers on digitalisation (although some point users to the teacher support materials for more information).

IB staff expressed concern about being too prescriptive about digitalisation in subject and programme guides and yet they equally identified the need for the IB to 'provide much more support to schools to alleviate some of the fears they have'. Finding a way to balance this is a key challenge for the IB.

One approach may be to support the enhancement of understanding of and skills in assessment design across IB stakeholders, including IB staff, teachers and subject and programme coordinators. The IB may wish to focus on leveraging the IB educator network to support teachers in swapping examples of good practices in the use of digital tools in the classroom. As IB staff noted, it would be useful to encourage supportive relationships between teachers both within schools and across schools in which 'teachers who are fairly competent in using technology, supporting those who need maybe that additional mentorship'.

#### Learner skills

In the same way that digital native teachers may not be able to adopt all digital technologies seamlessly, there is little evidence that learners can either. Survey respondents strongly supported the notion that learners in their classroom, would need support and training to use digital tools in learning and assessment activities.

The expert review of subject and programme documents found varied degrees of reference to the need for learners to have the skills to navigate digital contexts. The most extensive reference is found in the three PYP 'From Principles into Practice' documents, with reference for the need for learners to 'learn technology, learn about technology and learn through technology'.

One area that the reviewers noted was relatively under-emphasised in the documentation was reference to ethical uses of digital tools and to critical digital literacy. Interestingly, respondents in the survey also identified that these were among the weakest ICT skills of learners, which may indicate the value of focusing on both of these issues in future subject and programme guides.

A further key dimension in terms of digitalisation is the opportunity it opens up for connected classrooms across countries, something that would support the IB's goal of learners enhancing their international mindedness. Again, this received little mention in the subject and programme documents and the IB may wish to consider whether it is relevant to incorporate mention of this in future versions.

#### **Digital Assessment Innovations**

As the literature review highlighted, there are pockets of innovation in digital assessment around the world but this remains an evolving space where nothing can be definitively concluded about what works and what does not.

Insights can be gleaned from looking at the examples of international assessments such as PISA, as well as national practices in countries such as Norway, New Zealand and Scotland and English language assessments such as IELTS. In all cases, a clear decision has been made by those in charge of assessment to move towards wholescale digital assessment but the steps taken along the way have varied.

When digital assessment was first introduced into PISA, for example, countries could opt to stay with paper-based assessment. Then this opt-out was removed so that in 2022, all learners participating in PISA will have to use digital tools. In Norway, criticism that digital assessment was being used for accountability purposes led to a revision so that it focused instead on providing information to teachers (as it does in Scotland).

These examples illustrate the way in which educational bodies have plotted their forward course in a gradual and step-wise fashion, working to support stakeholders to adopt digital assessment if necessary.

**CONSIDERATION 7** - The IB should license or develop a digital assessment delivery system that is able to support a wide range of item types and to collect and make available detailed data on both student performance as well as the way in which students navigate the assessment tools. This system should be made available to schools to enable them to build their own formative assessment tools and to familiarise students with the functionality used in examinations

In the survey, a high proportion of respondents suggested that digital assessment 'aligns well with the IB philosophy' and that digital assessment 'should be used in IB programmes'. Patterns within these responses are interesting however. Only a minority of respondents in the MYP agreed that digital assessment should be used in all IB programmes and respondents from public schools in the USA and from the region of Africa, Europe and the Middle East were least in favour of digital assessment being using within the IB.

This indicates the need for the IB to work closely with different stakeholders on how best to expand digital technologies, and to identify how they respond. IB staff suggested that one approach to measuring the impact of innovation on schools was to include relevant questions in regular surveys of schools as a way of 'taking the temperature of how these things are landing in schools'.

### Digital teaching, learning and assessment

The literature review also identified that digital assessment is ideally used in contexts in which there are close parallels with digitalisation in teaching and learning. This was echoed by IB staff and teachers. For example, IB staff noted 'you learn digitally in the classroom, you are therefore more amiable to digital assessment. As you develop your digital assessment it feeds back to how you are using digital resources in the classroom'.

In the survey, very few respondents reported never using digital pedagogy and between a quarter and a half of respondents in each programme reported using it in *'most lessons'*. Moreover, respondents reported that digital pedagogy had a positive impact on learner engagement and learning, particularly supporting learners to become more inquiring and knowledgeable.

This indicates fertile ground in the IB for digital assessment but caution should be taken as this may not equally be the case across all programme/subject combinations.

**CONSIDERATION 8** – IB staff responsible for each subjectprogramme combination should strive to identify and justify the optimal approaches to learning, teaching and ensuring sufficient assessment, consistency (but not necessarily replication) across programmes and across subjects.

The IB may wish to reflect on where best to integrate digital assessment by following the

approach used in New Zealand in which the decision has been made not to proceed with digital assessment *'if the teaching and learning is not typically digitally enabled*'. This means that where there is an obvious need for digital tools in particular subjects this would be the best place to consider starting the introduction of digital assessment in the DP.

#### Good Assessment Design

There is nothing intrinsically good about digital assessment. In the same way that poor teaching with digital pedagogy is still poor teaching, poor assessment delivered digitally is still poor assessment. In some ways, what digital assessment does, however, is make the notion of what 'best practice' is in assessment even more difficult to identify.

In the expert review of specimen assessments the reviewers noted a number of areas in which e-Assessment in the MYP is ahead of global good practice in terms of functionality. Building on this means identifying the most effective method of collecting data on learners' skills and knowledge in a way that generates useful insights to inform improvements.

Technology is a means to an end not an end in itself and deciding when it should be used or not is made complex by the lack of empirical evidence about what forms of assessment are more effective than others. Without first considering the wider purpose it is not possible to say that digital is a better format than paper-and-pen in all cases, nor that particular item types are better than others.

IB staff noted that the goal is to have a high quality assessment platform which 'can be used in an explorative, inquiry-based way' suggesting that 'we are limited by our current imagination of what digital assessment is'. In the survey, respondents were asked to indicate their preferred format for digital assessment and there was a clear divide between around a quarter who reported that digital assessment should be 'very similar' to paper based examination and a further quarter who wanted it to be 'very different' from a paperbased examination.

These diverse opinions suggest that IB stakeholders would be open to a range of different types of assessment, as long as it remains high quality. Assessment design has to consider a whole series of elements, from efficiency and cost effectiveness to validity, reliability, innovation, scalability, timescales, accessibility, and so on.

**CONSIDERATION 9** – The IB should ensure that global best practice in assessment design is applied to assessment activities. This should include: clear definitions of the purpose of each assessment tool in an assessment framework; involving students in testing (through cognitive laboratories and/or piloting) during development of assessment the materials; and using psychometric analysis where possible and appropriate identify to item performance as well as any differences in performance between students of different characteristics.

For those involved in assessment development, decisions about when and when not to use digital tools, how best to utilise them, when it is worth adopting the most innovative approaches and how to ensure that digital tools enable better assessment than their paper alternatives additional requirements creates for assessment developers that go beyond previous assessment skills requirements.

This indicates that the IB needs to focus its continuous improvements in assessment on enhancing the skills of all those involved in assessment in order to ensure that as new possibilities come into focus they are able to make informed decisions about how best to measure learner skills using the functionalities available to them. This may mean building on already good skills to deepen their understanding of what is, and what is not, possible within the current and any future digital platforms. It also means that assessment staff need to be able to work closely with technical developers to design an assessment system that best meets their needs.

#### Subject and programme resources

An aspect that reviewers noted in subject guides was that they were inconsistent in the extent to which they address how the nature of subjects had changed as a result of digitalisation. The history guides, for example, made very little reference to any aspect of digitalisation and yet this is a subject in which the study of historical artefacts has been transformed by digital tools and resources. In contrast, the chemistry guide for DP makes explicit mention of 'digital technology skills which are essential in 21<sup>st</sup> century scientific endeavour'.

Further suggestions about the impact of digital assessment on subjects came from IB staff who commented 'you do digitisation because it brings interactivity, a model aspect, a scaffolding, and enriching, and enhanced Interestingly, experience'. only small proportions of survey respondents reported that backwash from digital assessment had any impact on the nature of the subjects that they taught. This may suggest that if digital assessment increases across the IB explicit links between transformations in subjects and ways in which to assess learners' skills may need to be made.

The expert review of programme and subject guides that was undertaken highlighted how little advice is provided to teachers in the area of digitalisation. With a few exceptions, many of the guides barely touched on the topic at all. While more detail may be available in other resources, it is not known how skilled teachers are at assimilating insights from a range of documents in order to determine approaches to teaching, and it is likely that this varies across schools.

An alternative to the current approach – and something that is already underway – is the conversion of subject guides and programme From Principles into Practice documents from static into dynamic resources. The IB may wish to consider taking this further, building a repository of searchable online resources on a series of topics that teachers and other users can navigate as they need and that can be updated, amended, removed and added to in order to reflect the dynamic changes in the education context around them.

**CONSIDERATION 10** – The IB should transform programme and subject guides into a searchable digital repository of a series of topics that teachers and other users can navigate as they need and that can be updated, amended, removed and added to as the context in which education takes place changes.

Moving ahead, it is important to note that this research has taken a necessarily broad scope in order to identify answers to the four research questions that informed it. This has inevitably meant that not all of the elements that arose from data collection were able to be considered in the depth that they deserve.

As such, the IB can consider many areas of further research with regards to the relationship between teaching, learning, and digital assessment. These areas can include further understanding of teacher and examiner practices with assessment; utilizing the considerable contributions of the learning sciences to specific designs and digital approaches affordances of in digital assessment design, data analytics, Al, and ongoing assessment that are reflective of appropriate pedagogical forewash.

## APPENDIX I: FOCUS GROUP AND INTERVIEW QUESTIONS

#### **Introductory question**

We understand that the IBO has embarked on digitization initiatives which have been informed by studies prior to this one. For example, digital assessment is currently being used in some subjects in MYP if schools have opted for eAssessment. We further understand that a possible different format of digital assessments is being considered for the Diploma Program (DP) in the future.

In this focus group, we would like to ask you about the current and potential digital affordances available. To get us started, I would like to ask you to:

- Introduce yourselves;
- Provide a brief overview of your role at the IBO; and
- Explain how you think the digitization initiatives we described above impact (or could impact) on your work.

#### Focus Group Questions – Part A

- I. In what ways does digital assessment form part of an explicit improvement agenda for your subject?
- 2. Have you developed or used any digital assessments, digital course material or digital support? If so, what is your experience of doing so?
- 3. Do you believe that digitization initiatives will assist with improving students' learning and their results? [Prompt student inquiry, meeting student needs]
- a) **[MYP only]** What affordances can you see the digitization initiative offering to students enrolled in your subject? Can you give any examples?
- b) **[DP and PYP]** What affordances do you think that digitization initiative would offer to students enrolled in your subject? Can you give any examples?
- 4. Have you seen progress towards digitisation in your subject?

YES

- To what extent do you think that it has had an impact on your subject?
- Do you think that there has been an impact on student learning? What evidence do you have to support this?

NO

- What impact do you think that digitisation would have on your subject?
- What impact do you think that this would have on student learning? (Why?)

#### Focus Group Questions – Part B

I am now going to mention six common issues that are often raised in relation to digitisation of assessment. I realise that these may not seem to be directly connected to your work but they are likely to be issues being raised by colleagues across the IB. I would like to know what your thoughts are about each of these, and how you think these issues can be managed in the context of IB.

The issues are: [These will be written on a flipchart]

- Impact on teachers this means that digitisation of assessment can either support teachers or place extra demands on them;
- **Backwash** this means digitisation of assessment can lead to changes in learning and teaching and can constrain or support teacher and student agency;
- **Digital divide** this means that digitisation of assessment may advantage some students and disadvantage others;
- Accessibility this means that digitisation of assessment may help or hinder efforts to meet the needs of students with a range of abilities;
- **Student inquiry** this means that digitisation of assessment may support or limit student inquiry;
- **Student needs** this means that digitisation of assessment may support or limit the ability of teachers and schools to adapt to meet the needs of students.
- 5. The first thing that I would like to ask you to do is to rank these issues in terms of how important you think they are for the IBO to consider in relation to digital assessment. Please write a number against each of these issues on the flipchart, where I indicates the issue that you think is **most** important and 6 indicates the issue that you think is **least** important.
- 6. Now I would like to discuss each of these issues in turn, in the order of priority that you have indicated.

I would like to know what you think about each of these issues in relation to digital assessment. In addition, I would like to know if you have any ideas about how the potential disadvantages of each of these could be minimised.

Let's start with ... [Issue # 1]

What about ... [Issue # 2]

[And so on to include all six issues if possible]

- 7. I have mentioned some issues that are commonly raised in relation to the digitisation of assessment and learning, but this is certainly not a comprehensive list. Are there any other issues that you think it would be important for this study to consider?
- 8. We are now reaching the end of this discussion. Is there anything else that you would like to add?

Thank you for your time and thoughts today. Your input has been most valuable to this study.

#### **Interview Questions**

(These were slightly differently worded for each participant to reflect their professional role)

So to get us started, could I ask that you please provide a brief overview of what your role as [job title] entails at the IBO?

- Provide a brief overview of your role at the IBO;
- Explain how the digitization initiatives at the IBO have impacted on your work; and
- Explain how you would like to see advances in digital pedagogy and digital assessment evolving across the DP.
- 1. Any mention of digitisation of assessment tends to raise a number of issues: These include the impact on educators; backwash from the assessment; the digital divide; accessibility; the impact on student enquiry and the ability to meet student needs. What are your thought about these which of these do you think are most important in the context of the IB? How do you think any disadvantages (perceived or real) can be ameliorated?
- 2. What has been the response of teachers, school principals and colleagues at the IBO to the digitisation of assessment and pedagogy?
- 3. What affordances have you seen in the digitisation of assessment and digital pedagogy that has been used?
- 4. To what extent do you think that these affordances would be replicated if digitisation of assessment were to be used more broadly, including in other IB programmes?
- 5. What sources of evidence would you like to see available for continuous improvement in your work such that you'd feel confident you were evidencing the digitisation of assessment and pedagogy of IB has assisted in improving student learning?
- 6. What change management (including professional development) has been required to alleviate their concerns? Do you anticipate that similar approaches would be required if the digitisation strategies were to be expanded? Would you want to do anything differently?
- 7. Can you think of any else other issues that you think we should be considering?
- 8. We are now reaching the end of this discussion. Is there anything else that you would like to add?

## APPENDIX 2: EXPERT REVIEW OF SUBJECT AND PROGRAMME GUIDES

ACER's experts undertook a review of IB programme and subject documentation and specimen assessments to identify a number of key elements. All experts had at least three of the following:

- Expertise in the subject in question;
- Expertise in test development;
- Expertise in digital assessment;
- Prior experience teaching in an IB programme; and
- Prior experience teaching in a school (non-IB programme).

In programme and subject documentation, ACER focused on the extent to which programme coordinators and teachers were provided with indications about the incorporation of digitalisation in teaching and learning, specifically: approaches to doing so; examples of how to do so; when it may or may not be appropriate; reference to research underpinning the use of digitalisation to enhance teaching and learning and learning outcomes; the ethics involved in digitalisation; the use of digitalisation to enhance international mindedness; critical digital literacy; the use of digitalisation to enhance equality between students; the impact of technology in general, and digitalisation in particular, on subject topics; and any obvious opportunities for mention of digitalisation to be incorporated where it is not currently referenced.

#### **Review of Programme Documents**

ACER acknowledges that there are a number of other documents that are of reference to those leading programmes, including but not limited to Assessment principles and practices—Quality assessments in a digital age, MYP Programme Standards and Practices, MYP Assessment Procedures, MYP Projects Guide, Fostering interdisciplinary teaching and learning in the MYP, Diploma Programme assessment: Principles and practice; and The role of technology in IB programmes;

Nevertheless, as the main anchor document for each programme, the programme *Principles to Practice* document is likely to be the key guiding resource for programme coordinators and also of great significance in giving teachers a sense of the expectations of their programme(s) beyond the subject-specific guidance contained in subject guides.

Since it cannot be assumed that programme coordinators and teachers refer to other documentation with reference to programme-specific information beyond programme guides, the expert reviewers viewed the programme guides as 'setting the scene' for the programme as a whole and they were reviewed with this consideration in mind. It is important to note that the MYP and DP programme guides are both from 2015 while the PYP programme guides are from 2018, and would therefore be expected to more up-to-date in terms of contemporary movements in education.

It is important to note that when the expert reviewers report an absence of something this should not be interpreted as a criticism unless this is specifically stated – it may simply mean that we note its absence but do not necessarily consider this to be problematic in that context.

	DP Programme	MYP Programme	PYP Programme
Documents reviewed	Diploma Programme: From Principles into Practice - For use from August 2015	MYP: From Principles into Practice - For use from September 2014/January 2015	<ul> <li>PYP Enhanced: Principles into Practice – Learning and Teaching, October 2018</li> <li>PYP Enhanced: Principles into Practice – The Learner, October 2018</li> <li>PYP Enhanced: Principles into Practice – The Learning Community, October 2018</li> </ul>
Does the document inc	lude:		
Does the document inc			
Approaches to digitalisation	Specific note that 'effective use of technology has the potential to enable teachers and learners to engage in tasks and opportunities that would otherwise be impossible or inconceivable, such as tasks requiring communication and collaboration between learners on different sides of the world', with additional reference to "digital citizenship". No reference as to how this could be incorporated in practice, however, which would be useful.	The structure of on-screen examinations is referred to, outlining the common features of on-screen examinations but despite the use of e-assessment in the MYP, there are only limited references on how to incorporate digital elements into teaching and learning and what specific digital elements to include. Appendix 5 states that 'Learners need to develop technology literacy in order to thrive in an increasingly digital world'. This places digital literacy within the broader context in which learners are learning. Appendix 5 makes reference to how technology literacy 'is an important way to empower learners and teachers to develop and use a wide range of ATL skills'.	'Learning and Teaching' highlights digital literacy skills and opportunities to use technology that are embedded in ATL, particularly Research, Communication and Self-management skills as well as the importance of 'understanding and applying social and ethical technology'.
	Reference to importance of enabling	[As per DP] and	Learning and Teaching emphasises the importance of
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	learners to function in highly connected		considering technology as one of a range of
	local, national and global communities but	Guidance on planning for service as action.	resources to 'extend learners' thinking, research and
	digitalisation in mode of connection	lechnology affords a myriad of	communication skills during the inquiry process.
	digitalisation in mode of connection.	initiatives partnerships and impact' No	'The Learner' explains the particular need for early
	There are no references to digital elements	guidance is given as to how to incorporate	learners to engage with technology – both digital and
Polovanco of	and connection with career and or the	digital elements, however, and this would be	non-digital – in order to develop their thinking skills
digitalisation	workplace. There is a section relating the	useful to add.	and make connections.
0	DP to CP but purely from a structural point		
	of view. It is advisable to enhance the focus	Example explorations in reference to	The Learning Community has some brief references
	indeed, university studies) and the need to	include digital life, virtual environments and	teacher collaboration. In relation to the structure of
	prepare learners for this reality.	the information age but digitalisation is not	the learning environment, it states 'Digital and non-
		mentioned specifically under any of the other	digital technology literacies are considered when
		global contexts for teaching and learning.	designing learning spaces as they extend when,
			where and now learning and teaching takes place.
 	No – The one mention of use of	The ATL Skills Framework in Appendix I	'The Learning Community' includes a lengthy section
	technology is in the context of peer	gives a number of examples including:	on technology in the PYP which includes that:
	assessment, and the guide also makes		
	work for assessment in a variety of media	<ul> <li>Participate in, and contribute to, digital social media networks</li> </ul>	<ul> <li>It facilitates and expand learning possibilities:</li> </ul>
		social media networks	possibilities,
	It would seem appropriate to give teachers	• Collaborate with peers and experts	<ul> <li>Schools should provide learners with</li> </ul>
How to incorporate	examples of how to incorporate those	using a variety of digital environments	opportunities to learn technology, learn
digitalisation	elements into learning and teaching.	and media	about technology and learn through
	viewing and or creating video, interactive	Find information for disciplinary and	technology,
	maps and data analysis. This need not be	interdisciplinary inquiries, using a variety	• The learning community supports learners
	prescriptive but would help teachers	of media	to be responsible and ethical digital citizens;
	become aware of the possibilities that exist		
	about).	<ul> <li>Select and use technology effectively and productively</li> </ul>	Definitions are given of learning technology, learning
		productively	each of which includes suggestions for use of digital

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		<ul> <li>Locate, organize, analyse, evaluate, synthesize and ethically use information from a variety of sources and media (including digital social media and online networks).</li> <li>Section on MYP eAssessment provides justification for digital model but these do not include enhancing authenticity and/or calling on higher order thinking.</li> </ul>	technology, particularly in the realm of approaches to learning and conceptual understanding across the curriculum.
When digitalisation may or may not be appropriate	No	ATL Skills Framework includes 'evaluate and select information sources and digital tools based on their appropriateness to specific tasks' but this does not specifically refer to situations in which digitalisation may or may not be appropriate.	'The Learner' makes reference to teachers making appropriate technological devices available in order to appeal to learners' natural curiosity although this is not a direct reference to digital technology.
Reference to research on using digitalisation to enhance teaching and learning and outcomes	No - Examples of evidence of research underpinning the use of digital elements in teaching and learning could be included in an updated document.	[Same comment as for DP]	[Same comment as for DP]
Ethical considerations around digitalisation	In discussion of digital citizenship there is mention of the need to consider how individuals act and behave online as 'encouraging and expecting learners to act in an ethical manner to be respectful of themselves, other people and intellectual property'. There is also a specific note that 'With the pace of developments in communication and the availability of information through the internet it is important that the	There is reference to the need to 'understand and implement intellectual property rights' under the ATL Skills Framework but not specifically in relation to digital sources.	One of the specific research skills mentioned in Learning and Teaching is 'the ethical use of media/information (understanding and applying social and ethical technology)'. The Learning Community notes that 'technology offers unlimited opportunities for learners to enter worlds far removed from their own Through these connections learners learn what it means to be a participant in a global community. They learn to use technologies in ways that are socially and

	academic honesty policy is reviewed		ethically responsible and that contribute to the
	regularly and learners might be a part of		global learning community'.
	that review process'.		
	Ethical considerations in the use of digital elements in learning and teaching could be addressed, at least to some extent in the section dealing with academic honesty.		
	Ethics are also considered elsewhere, for example when referring to the concept of 'digital citizenship', the document states that 'developing digital citizenship is a set of values that provides a framework for online action and behaviour. It is about encouraging and expecting learners to act in an ethical manner to be respectful of themselves, other people and intellectual property'. Beyond this, it would seem that a statement regarding critical literacy would be useful.		
Digitalisation to enhance international mindedness	No - International mindedness and the development of international mindedness lies at the heart of the IB mission statement and the Learner Profile. In the section on 'Education for intercultural understanding' it would be appropriate to expand on how digital technologies could be used to enhance international mindedness.	Reference to the need to develop international-mindedness through global engagement, multilingualism and intercultural understanding but no explicit reference to digitalisation in this context. It could be regarded as implicitly included in the ATL Skills Framework but this is unclear.	[See comment in cell above on ethics]
Critical digital literacy	No – see response in above cell on international mindedness	The ATL Skills Framework includes reference to the need to use critical-literacy skills to analyse and interpret media communications and the need to	The Learning Community refers to multiliteracies including 'critical literacy: critical thinking through

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		demonstrate awareness of media interpretations of events and ideas (including digital social media).	digital technologies, questioning and comparing what aids, extends and hinders learning'.
Using digitalisation to enhance learner equality	No	The need for inclusive implementation of the MYP is highlighted but this does not make any explicit mention to how digitalisation can enhance this beyond reference to 'differing formats and modes' and this would be a good place to explore how digital elements including technologies can assist learners with specific learning needs.	The Learning Community includes reference to the need to ensure inclusivity by 'identifying and removing barriers to learning relating to resources' and this would be a good place to identify how digitalisation can assist with this.
Are there opportunitie	s to incorporate mention of digitalisatio	n where it is not currently referenced	
	Emphasis on the need for independent learner thinking leading to considered individual responses; on the development of 21 <sup>st</sup> century skills; on collaborative learning activities; effective dialogue and feedback; assessment for learning; etc. – all of these are areas in which it would be valuable to reference digitalisation and the opportunities that it can offer to deepen or enhance each of these.	<ul> <li>The six global contexts for teaching and learning and at least three of the five MYP skill categories for teaching and learning are impossible to separate from the digital world. In all of these examples there is opportunity to reference digitalisation.</li> <li>The section on resources does mention classroom technologies, educational games and simulations and digital resources, including the internet but could be expanded to consider the range of digital tools now available.</li> <li>The section on approaches to teaching does not make specific reference to digital tools and this could be a useful addition.</li> </ul>	There is already good mention of digitalisation but it is important that all references are updated as the field evolves. It would also be worth considering the inclusion of more guidance on how teachers and programme coordinators can incorporate digitalisation into their professional practice.

<ul> <li>The section on teaching academic honesty could usefully be revised to make explicit reference to the use of online resources.</li> </ul>
<ul> <li>The section on the development of an academic honesty policy would be a good place to include a statement regarding ethical considerations in the use of digital technologies.</li> </ul>
<ul> <li>The sections on assessment in general and formative assessment specifically could usefully be revised to identify how the use of digital tools can support the approach to assessment to one that is ongoing, and to give greater illustration of the value of peer- and self-assessment.</li> </ul>

# **Review of Subject Documents – Language and Literacy**

In reviewing these four documents the language and literacy experts involved noted their dates of publication, which in the case of PYP was more than a decade ago. The experts considered these documents as the fundamental subject guides but also noted that additional information for subject coordinators and teachers would be available in other documentation, including teacher support materials (TSM).

	DP Programme	MYP Programme	PYP Programme
Documents reviewed	Language A: Language and Literature Guide – First exams 2015	Language and Literature Guide - For use from September 2014/January 2015	Language Scope and Sequence (2009)
Does the document inc	clude:		
Approaches to digitalisation	The only mention of digital components are under the definition of texts which include electronic texts such as video- sharing websites, web pages, SMS messages, blogs, wikis and tweets.	There is reference is to the use of information and communication technology to expand learners' knowledge of the world, gain access to language resources and to develop skills. There is also reference to the aim of exploring language through a variety of media and modes.	In the section on learning continuums it is stated that 'acquiring skills related to information and communication technology and visual texts is significant because of their persuasive influence in society'. Moreover, under the learning continuum for written language there is the inclusion of learners creating outputs in a digital format, blogs and wikis are included under text types and there is reference to cyber safety.
How to incorporate digitalisation	No	There is a reference to the value of including texts such social networking sites and blogs.	No
When digitalisation may or may not be appropriate	No	No	No
Reference to research on using digitalisation to	No	No	No

enhance teaching and learning and outcomes			
Ethical considerations	No	No	No, other than a reference to cyber safety
around digitalisation			
The increase of	NI-	Defense to multimedia and the impact of	NI-
I ne Impact of	INO	Reference to multimedia and the impact of modia such as tolovicion, the internet and	INO
content		computer and digital technology	
Digitalisation to enhance	No	No	No
international			
mindedness			
	No	Reference to the need for teachers to teach	No
		learners to use electronic media critically and	
Critical digital literacy		to question, challenge and evaluate the	
		meanings and purposes of texts (including	
		multimedia).	
Using digitalisation to	No	No	No
enhance learner equality			
Are there opportunitie	s to incorporate mention of digitalisation	on where it is not currently referenced	
	Considering the demainant rate that	Considering the deminent value that	This suide is means them a decode ald and
	digitalisation plays in contemporary	digitalisation plays in contemporary	when it is revised there is clearly scope for
	engagement in language and literature.	engagement in language and literature, there	reflecting the dominant role that
	there are a number of ways in which the	are a number of ways in which the next	digitalisation plays in contemporary
	next version of the document could be	version of the document could be revised,	engagement in language and literature,
	revised, including:	including:	including:
	• Nature of the Subject - there is	Nature of language and literature –	
	scope here to explicitly mention the	there is scope here to explicitly mention	

	impact of digital communications on the nature of language, literature and communication – particularly in terms of critical digital literacy -; the affordances that digitalisation com		the impact of digital communications and multimedia developments on the nature of language and literature.	•	Introduction – it would be worth referencing the evolution of language and literature as a result of digitalisation.
•	affordances that digitalisation can create for teaching and learning; and the ways in which digital tools can facilitate cross-country collaboration to enhance international understanding. Assessment Objectives in Practice – there is clear scope to	•	<b>Objectives</b> – there is no mention of digital in this section but there is scope to emphasise the wide variety of texts that teachers might select (e.g. including blogs and wikis) and the use of digital tools to deconstruct texts, demonstrate their understanding, produce texts and so on.	•	Learning continuums (visual language) – multimedia is mentioned under visual language and examples include computer games and programs, websites. This list could be added to in order to incorporate a wider range of digital elements, including the need for learners to gain skills in presenting in a range of media
	consider digital affordances in order to measure each of the four assessment objectives and – if digital assessment were to be included in the DP – this section would need to be revised accordingly.	•	Planning a progression of learning / interdisciplinary learning / MYP projects – some reference to affordances from the use of digital tools would be useful here, particularly in terms of facilitating collaboration and the production of outputs.	•	Learning continuums (written language) – There is scope here to broaden the explicit references to books and illustrated materials to include the range of digital forms of reading that learners are likely to be exposed to.
•	Approaches to teaching – while the definition of text does include blogs, SMS messages etc., it would be worth emphasising that the nature of language and literacy is shifting and hence a variety of forms of digital communication have now become vital for learners within their study of language and literature.	•	<b>Planning the curriculum</b> – there is scope here to specifically reference digital affordances, particularly around written and visual communication, including the need to critically evaluate the source of texts and their authenticity.		
•	<b>Skills</b> – while critical evaluation is included within the skill of textual analysis, it would be worth considering		<b>learning</b> – it would be useful to include how collaborative tools can facilitate collaborative learning between learners e.g. in different countries.		

<ul> <li>an explicit mention of critical digital literacy.</li> <li>Syllabus content – it would be useful to include more examples here of a range of digital media</li> <li>Assessment – this section is primarily focused on summative assessment but it would be worth including information about the value of ongoing assessment and the digital tools that can facilitate this. Again, if the format for summative assessment is changed then this section will need to be revised accordingly.</li> </ul>	<ul> <li>Statements of inquiry – this table needs to be updated to include the multiplicity of forms of digital media.</li> <li>Teaching and learning through enquiry – while critical literacy is implied, its importance in an era of digital communication means that a more explicit reference would be valuable.</li> <li>Assessment criteria – there is no mention of critically evaluating text under analysing and this would be useful to add. Moreover, to help teachers evaluate how learners produce text it would be useful to provide some guidance on how to relatively evaluate texts in a range of different formats and media.</li> <li>MYP E-assessment – it would be advisable to increase the examples of digital texts provided and to identify the affordances of digital assessment, not only in terms of stimulus but also in terms of item types that are possible.</li> </ul>
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#### **Review of Subject Documents – Science (Biology and Chemistry)**

In reviewing these four documents the science experts involved noted their dates of publication, which in the case of PYP was more than a decade ago. The experts considered these documents as the fundamental subject guides but also noted that additional information for subject coordinators and teachers would be available in other documentation, including teachers support materials (TSM).

	DP Programme	MYP Programme	PYP Programme
Documents reviewed	Biology Guide (First Assessment 2016) Chemistry Guide (First Assessment 2016)	Sciences Guide - For use from September 2014/January 2015	Science Scope and Sequence (2008)
Does the document inclu	de:		
Approaches to digitalisation	Yes – 'approaches to chemistry' identifies that learners can develop 'digital technology skills, which are essential in 21st century scientific endeavour' (not mentioned in relation to biology)	Only in relation to the MYP e-assessment	No
How to incorporate digitalisation	Not really other than to state that 'the use of information communication technology (ICT) is encouraged throughout all aspects of the course in relation to both the practical programme and day-to-day classroom activities', with teachers directed to the TSM for more information.	No	No
When digitalisation may or may not be appropriate	No	No	No

Reference to research on using digitalisation to enhance teaching and learning and outcomes	No	No	No
Ethical considerations around digitalisation	No	No	No
The impact of digitalisation on subject content	No	No	No
Digitalisation to enhance international mindedness	No	No	No
Critical digital literacy	No	No	No
Using digitalisation to enhance learner equality	No	No	No
Are there opportunities	to incorporate mention of digitalisatio	n where it is not currently referenced	
	Considering further studies and careers in science are increasingly influenced by digital tools and technology it would be useful to position the subject of science within this context, explaining how the core elements of inquiry based learning – independent and collaborative investigation through research, observation and experimentation – can be enhanced and facilitated through digital tools and technology, including guidance on how to incorporate digital	Considering further studies and careers in science are increasingly influenced by digital tools and technology it would be useful to position the subject of science within this context, explaining how the core elements of inquiry based learning – independent and collaborative investigation through research, observation and experimentation – can be enhanced and facilitated through digital tools and technology, including guidance on how to incorporate digital pedagogy tools, skills and contexts into teaching and learning. This includes:	<ul> <li>Due to the age of this document it is not surprising that there is no mention of digital technologies or tools. When the document is revised there are ample opportunities to mention digitalisation since it has had such an important influence on how science is conducted, and is hence relevant to the PYP emphasis on the need to learn science in context. These include:</li> <li>Developing a school's science scope and sequence – Digitalisation can offer affordances to many of the skills listed and</li> </ul>

pedagogy tools, skills and contexts into teaching and learning. This includes:

- Nature of science as science becomes more and more dependent on digital / technological solutions, it would seem appropriate to increase mention of these areas, so that this section more closely resembles the nature of science in the world.
- Nature of biology / chemistry again, both subjects have been strongly influenced by digital developments and this would be useful to elaborate here.
- Aims there are clear opportunities for digital affordances to be developed in Group 4 subjects and this could be brought out more, particularly in relation to methods and techniques, analysis, collaboration, 21<sup>st</sup> century communication skills and the use of current technologies.
- Assessment objectives there are clear opportunities for digital affordances to be mentioned here, particularly in relation to demonstrating knowledge and understanding of / analysing / formulating and evaluating / methodologies and techniques,

**Knowing and understanding** – it would be useful to add examples of how to use technology to provide explanations.

- Inquiring and designing it would be useful to reflect the current nature of real science such as the use of data logging equipment in investigations; the use of simulations to enable the manipulation of systems and use of large scale data sets.
- Processing and evaluating it would be useful to discuss the common use of digital packages to collect, process and interpret data such as the use of technology to create graphical displays and to evaluate experimental designs.
- **Reflect on the impact of science** it would be useful to refer to the use of digital tools to provide authentic areas for investigation such as video footage and historical records.
- Interdisciplinary learning it would be useful to suggest how this could be enhanced through digital technologies in order to make learners more future ready.
- **MYP projects** it would be useful to add reference to digital tools that can enhance collaboration, organisation and

it would be worth indicating here how it can deepen and extend the learning of science skills, and provide examples such as time lapse photography of changing weather, plant growth, animal behaviour; use of video material to record rapidly occurring events; direct use of data logging materials to record data (time, temperature force etc.); digital measuring devices such as temperature probes, stop clocks, laser measurement tools, balances, light meters; annotation of digital pictures; examine real data sets for patterns: interpret or manipulate data with spreadsheet / table / graphing packages.

- **Teaching and learning** while recognising that the use of digital technologies would be constrained by the contexts in which there are taught, there are ample opportunities for digital tools to be used and it may be valuable to provide examples to teachers of how and when this could be done.
- Assessment Methodologies there is almost no mention of assessment but it would be useful to include reference to the use of digital technologies in ongoing assessment as part of teaching and learning.

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primary and secondary data and methods of communicating scientific information.	the ability to work on real life projects in real time.	
• Approaches to teaching and learning – teachers are currently directed to TSM for details on how to use ICT but there is no specific mention of digital technologies and	<ul> <li>Global contexts for T and L – two of these (scientific and technical innovation and globalisation and sustainability) have a clear digital aspect which it would be worth mentioning.</li> </ul>	
their affordances which would be useful here.	<ul> <li>Approaches to learning – it would be useful to add critical digital literacy to this list of skills in order to keep abreast of</li> </ul>	
<ul> <li>Assessment – There is scope for reference to the use of digital technologies for both ongoing assessment as well as for inclusive assessment.</li> </ul>	<ul> <li>today's demands.</li> <li>Mathematical requirements – a mention of digital affordances would be useful here.</li> </ul>	

# **Review of Subject Documents – History**

In reviewing these four documents the history expert involved noted their dates of publication, which in the case of PYP was more than a decade ago. The expert considered these documents as the fundamental subject guides but also noted that additional information for subject coordinators and teachers would be available in other documentation, including teacher support materials (TSM).

	DP Programme	MYP Programme	PYP Programme
Documents reviewed	History Guide - First exams 2020	Individuals and Societies Guide - For use from September 2014/January 2015	Social Studies Scope and Sequence (2008)
Does the document inclu	ıde:		
Approaches to digitalisation	No	<ul> <li>Technology is mentioned in the definition of globalisation in terms of its impact on interconnectedness but there is no reference to digital artefacts or to digitalisation.</li> <li>One of the statements of inquiry references advances in communication technology including social media, and technology is also included in the definition of culture.</li> <li>Multimedia is referred to as a form of an assessment task.</li> </ul>	No
How to incorporate digitalisation	No	No	No
When digitalisation may or may not be appropriate	No	No	No

Reference to research on	No	No	No
using digitalisation to			
enhance teaching and			
learning and outcomes			
Ethical considerations	Na	No	No
around digitalisation	INO	INO	INO
al outile digitalisation			
The impact of	No	No	No
digitalisation on subject			
content			
Digitalisation to enhance	No	No	No
international mindedness			
Critical digital literacy	No	No	No
	NI	N1	NI
Using digitalisation to	No	No	NO
ennance learner equality			
Are there opportunities	to incorporate mention of digitalisation	where it is not currently referenced	
Are there opportunities	to meet por ace mention of digitalisation	where it is not carrently referenced	
	While the nature of history itself is not	Since human expression, communication and	The focus of social studies is on a deeper
	influenced by digitalisation, human ability to	collaboration has been so deeply influenced	understanding of people and place and there
	investigate and interpret it has been	by digitalisation it would be valuable to	have been rapid advances on the basis of
	profoundly impact by the array of digital	include greater reference to both the impact	digital technology leading to new insights into
	tools and approaches now available. As	of digitalisation on the topics of study as well	and expressions of both. Hence, when the
	such there are opportunities to reflect this	as to how advances in digital tools can	next version of this document is created it
	in this guide, including:	enhance the approach to study of this	would be worth including the following:
		subject. This could include:	
	• Nature of the subject – It would be		• Social organisation and culture – it
	useful to reference how the study of	• Aims – It would be useful to include	would be useful to include a revised
	nistory has been transformed by the use	reference to an understanding of the ways	definition to reflect the impact of
		in which digitalisation have impacted	

of digital tools as well as the digitisation of historical artefacts.	individuals and societies and our understanding of them.	digitalisation on human culture and organisation.
<ul> <li>History and International Mindedness – It would be useful to include reference to the ways in which the digitalisation of resources have made it easier than in the past to engage with history from other parts of the world and – indeed – to engage in collaborative learning with learners in other countries.</li> <li>History and TOK – Some of the key discussion questions here – including around the methods that historians use to gain knowledge and the impact of the context within which historians live on historical knowledge could usefully include reference to the ways in which the digital tools have impacted on contemporary approaches to history.</li> <li>History Aims – There is scope for inclusion of the importance of using</li> </ul>	<ul> <li>Progression of learning – It would be useful to include reference to the use of digital tools with respect to both investigating and communicating.</li> <li>MYP projects – It would be valuable to include explicit reference to digitalisation and its implications for both topic choice and approach, and particularly the affordances this provides for collaboration.</li> <li>Teaching and learning through inquiry – Despite the optional use of e-assessment in the MYP, there are clear opportunities to include information on the affordances that digitalisation can offer in teaching and learning, particularly when some of the key concepts such as networks, identity, power, innovation, globalisation and culture have been so strongly impact by digitalisation</li> </ul>	<ul> <li>Skills – it would be worth including reference to critical digital literacy.</li> <li>Expectations – it would be useful to update these to include greater reference to the use of digital tools in both how communities are organised and how human systems and activities have been influenced by digitalisation.</li> </ul>
<ul> <li>digital tools in relation to historical skills.</li> <li>Assessment objectives – It would be useful to link these to the skills required by historians in the real world in order to emphasise the authentic nature of the assessment, and this would include the ability to work with a range of digital tools.</li> </ul>	<ul> <li>Approaches to learning – It would be useful to include reference to the way in which digitalisation can enhance communication and research skills.</li> <li>Assessment – The focus on what learners should have achieved by the end of each year could include suggestions on digital tools for ongoing assessment.</li> </ul>	

#### **Review of Subject Documents – Mathematics**

In reviewing these four documents the mathematics experts involved noted their dates of publication, which in the case of PYP was more than a decade ago, as seen against the two DP mathematics guides which are the most recent ones reviewed, with the first assessment of these only in 2021. The experts considered these documents as the fundamental subject guides but also noted that additional information for subject coordinators and teachers would be available in other documentation, including teacher support materials (TSM).

	DP Programme	MYP Programme	PYP Programme
Documents reviewed	Mathematics: analysis and approaches guide - first assessment 2021 and Mathematics: applications and interpretation guide - first assessment 2021	Mathematics Guide For use from September 2014/January 2015	Mathematics Scope and Sequence (2009)
Does the document inclu	ıde:		
Approaches to digitalisation	Both guides have a specific section on the 'use of technology' which identifies that this 'is an integral part of DP mathematics courses'. The section references both how to use technology and the ways in which technology has 'supported and advanced the teaching and learning of mathematics'. The guides identify that a suitable environment for learning mathematics at the diploma level includes one where the use of technology is 'prominent'. Moreover, the introductory section in both guides identifies that 'fluency in relevant mathematical software and hand-held	There is a section on the use of Effective use of information and communication technology in mathematics which encourages this to be used whenever appropriate, including to develop concepts and skills and to communicate. The section further identifies a range of ways in which such resources can enhance teaching and learning including 'as a tool to perform complicated calculations, solve problems, draw graphs, and interpret and analyse data'. Teachers are provided with a list of the ways in which ICT can help teaching and learning.	Under the learning continua a number of digital tools are listed including creating and manipulating electronic databases; use of living graphs and web based applications; use of technology to generate results for real world events; use of web-based measuring tools; and computer based modelling applications.

	technology' to be an important mathematical skill, with the ability to 'use technology, accurately, appropriately and efficiently both to explore new ideas and to solve problems' an assessment objective. With reference to applications and interpretation the guide states that 'This course recognizes the increasing role that mathematics and technology play in a diverse range of fields in a data rich world' while the guide for analysis and approaches states that 'the course allows the use of technology', indicating a different focus.		
How to incorporate digitalisation	The guides both list ways in which learners can use technology, such as through searching for patterns, testing conjectures, justifying interpretations, analysing data and collaborating with peers. The guide further lists the use of graphical calculators, dynamic graphing software, spreadsheets, simulations, apps, dynamic geometry software and interactive whiteboard software as examples of digital tools that can support the teaching and learning of mathematics.	<ul> <li>Yes – teachers are encouraged to use ICT 'whenever possible and appropriate as a means of enhancing learning', including:</li> <li>databases and spreadsheets;</li> <li>graph-plotter software;</li> <li>dynamic geometry software;</li> <li>mathematics content-specific software;</li> <li>graphic display calculators;</li> <li>internet search engines;</li> <li>CD-ROMs;</li> <li>word processing or desktop publishing;</li> </ul>	Νο

		<ul> <li>graphic organizers; and</li> </ul>	
		• computer algebra system.	
When digitalisation may or may not be appropriate	The guide notes that there is a fine balance between the way in which teachers and learners use technology and that the 'carefully chosen use of technology to support the understanding and the communication of the mathematics itself' is critical.	The guide notes that learners need to know what ICT resources and applications are available and when it is appropriate to use them, noting 'it is important that teachers show learners how to use these resources effectively'.	No
Reference to research on using digitalisation to enhance teaching and learning and outcomes	No	No	No
Ethical considerations around digitalisation	No	No	No
The impact of digitalisation on subject content		No	No
Digitalisation to enhance international mindedness	Both guides mention the 'recent development of information and communication technologies' but note that mathematics has always been international in nature. They go on to identify that international-mindedness can be fostered through access to mathematical resources provided by international organisations.	No	No
Critical digital literacy	No	No	No

Using digitalisation to enhance learner equality <b>Are there opportunities</b>	The 'use of technology' section mentions the use of technology to make mathematics more accessible and motivating, including through aiding visualisation and enhancing understanding. to incorporate mention of digitalisation	The guide references the value of ICT in supporting learners with special educational needs as well as providing gifted learners with additional challenge. Explicit reference is made to the use of adaptive technologies to 'enable learners with severe learning disabilities to become active learners in the classroom alongside their peers'. where it is not currently referenced	No
	These are the most recent of all of the	While this document does provide more	This document is now a decade old and in
	<ul> <li>Indee are the most recent of an of the guides reviewed for this project and are also the ones in which digitalisation is a core part of the approach to the subject of mathematics at the diploma level. In future iterations of the guide, however, there are a few areas in which greater reference to digitalisation could be considered. These include:</li> <li>Aims – one of the aims listed is to 'appreciate how developments in technology and mathematics influence each other'. Given the focus on technology throughout the guide, it would be worth considering whether a further aim should refer to a degree of confidence in using an array of digital mathematical tools, although this would depend on the nature of the assessment shifting from paper-based to the use of a digital interface.</li> </ul>	<ul> <li>detail on the use of digital tools than most other guides, there remain areas in which this could be enhanced. These include:</li> <li>Nature of mathematics – this provides a vision of mathematics as a means of developing problem solving and inquiry skills and with a focus on authenticity. While there is mention of the recommended use of ICT tools, it would also be worth mentioning the ways in which digitalisation has transformed the nature of the subject of mathematics and of mathematical inquiry.</li> <li>Aims – there is mention here of the ways in which developments in technology and mathematics have influenced each other and it would be useful to highlight the need for learners to understand the transformation of approaches to mathematics as a result of digitalisation.</li> </ul>	<ul> <li>that time the nature of mathematics and the ways in which it is applied and taught have been transformed by digitalisation. In the light of this, any future versions of this guide need to take account of how digitalisation impacts on the way in which mathematics is taught. Suggestions for doing so include:</li> <li>Introduction – the emphasis on mathematics as a tool for use in relevant, real world and realistic situations suggests that it would be useful to consider the way that mathematics is done in the real world, heavily influenced by, and implemented through, the application of digital tools.</li> <li>Applying with understanding – the emphasis on the need for learners to engage in authentic activities in which they can demonstrate mathematical thinking would benefit from mention of the types of</li> </ul>

• Assessment – there is mention of	• Objectives – under each of the objectives	authentic activities they can engage in, and
formative assessment but not in any	listed there is scope to include explicit	the digital tools that they can use to do so.
detail and it would be worth considering	reference to the use of digital tools and the	
ways in which this section could be	affordances that this can lead to in	• Learning continuums – the learning
boosted to encourage the use of ongoing	ennancing the authenticity of this line of	continuums of data handling,
assessment in teaching and learning so	inquiry.	measurement, shape and space, pattern
that learners are able to monitor their	Diamaina a na ana si an diata diata d	and function, and number are all areas in
own progress and to receive timely input	• Planning a progression – since digital	which significant digital affordances are
from teachers on skills that require	tools are already mentioned as important	possible and it would be useful to include
ennancement.	in the guide, it would be worth suggesting	explicit reference to these accordingly.
	the kind of approaches using digital tools	
	that could be used at different levels of	• Assessment – there is currently no
	learning.	mention of ongoing assessment in this
	MYD music sta theme is seen a home to	guide and this would be worth including in
	• MYP projects – there is scope here to	a future version, identifying the range of
	digital to all within the projects	ways in which digital tools can support
	digital tools within the projects.	ongoing monitoring and evaluation,
	• Assessment it would be useful to	including by both teachers and by learners
	• Assessment – It would be useful to	themselves.
	assessment could be incorporated within	
	teaching and learning activities through the	
	use of digital tools to enable both self-	
	peer- and teacher- led monitoring and	
	evaluation	
	Cvaluation.	
	• Assessment criteria – since the overall	
	goal is for authentic contexts for	
	mathematics then for each of these it	
	would be useful to consider whether	
	explicit mention should be made of the use	
	of digital tools to support the solution of	
	mathematical problems.	
	·	

MYP e Assessment – there is scope	to
expand the number of ways in wh	ch
mathematics can be assessed, for exam	ble
to include mention of the manipulation	of
digital data sets.	

# APPENDIX 3: EXPERT REVIEW OF SPECIMEN ASSESSMENTS

# **Methodology**

The expert review of specimen assessments involved subject/assessment/teaching experts undertaking an in-depth review of the most recently available assessment tools in four subject areas:

- Mathematics;
- History / Individuals and Societies;
- Science (Chemistry and Biology); and
- Language and Literature.

Both MYP e-assessments tools and paperbased DP assessments tools were reviewed. The review looked at one example of a DP paper-based and one example of an on-screen MYP assessment per subject.

It is important to note that – while several members of the review team were former IB teachers – it is very difficult for those who are external to the IB to have full visibility of its assessment practices. For example, reviewers did not have:

- Access to the assessment frameworks that underpin the development of the assessment tools;
- The opportunity to engage in item panelling with test developers in which they could interrogate underlying assumptions behind tasks and items;
- Access to detailed statistics on the functioning of each assessment item; or
- The opportunity to engage in cognitive testing with students.

These are standard ways in which assessment experts would normally evaluate the quality and functioning of assessment items and, in their absence, the assessment tasks which experts reviewed had to be taken at face value.

With these limitations in mind, it is also important to note the background of the

reviewers themselves. The team was predominantly comprised of assessment experts who not only have advanced qualifications and teaching experience (several in IB programmes) in their particular subject areas but whose work involves them in developing assessment materials on a daily basis.

Team members have extensive experience developing assessment tools across multiple curricula, class levels and countries and are frequently called on to train teams of test developers at national and sub-national levels on how to write assessment items and build assessment instruments.

Team members are also all highly familiar with digital assessment and skilled at drafting items for use in both static, pen-and-paper assessments as well as in dynamic, adaptive and digital assessments for use on computers and tablets.

In their review of the assessment instruments, the reviewers drew on their expertise to ask a series of questions of each item – these are the standard questions that any assessment expert would ask of any assessment item:

- What skill and/or knowledge does this item measure?
- Is this skill and/or knowledge relevant to the subject and level of study?
- Is the item well written, likely to be clear to students and does it have appropriate response options?
- Is this the most appropriate or efficient way of measuring this skill and/or knowledge?
- Could this skill or knowledge be measured in a different way which would enhance the efficiency and/or quality of the assessment tool?
- Does the item make good use of information presented in the stimulus?

- Does the item fit with others items in the same task (if any)?
- To what extent does the item transform traditional ways of assessment?

In addition to these fundamental questions, the reviewers focused on digital functionality. For items in the MYP e-Assessment this meant considering how well the digital functionality been used enhance had to the quality/relevance/authenticity of the item and/or engage students. For items in the DP assessment, this meant considering how well the item could be transferred to a digital environment, and any advantages or disadvantages this would generate in the measurement of student learning. Since it is common for a single stimulus to be used for more than one item, the interrelationship between the stimulus and items was a further area of focus.

It is important to note that since all expert reviewers were experienced assessment developers, they are all familiar with the challenges and limitations faced by those tasked with designing assessment materials. This includes the tightness of timelines, budgetary limitations, the need to optimise validity and reliability and the complexity of assessment workflows. The comments made were from this standpoint rather than from a consideration of what might be possible in an (unrealistic) ideal situation.

The reviewers worked through all papers individually and then discussed their findings with similarly expert colleagues. Since many of the comments about items were similar – making the review somewhat repetitive, it was decided that the most useful approach would be select exemplar items that could be discussed in a way that summarised experts' insights about the papers as whole.

For the DP papers, this meant focus on items that could usefully illustrate the considerations that would come into focus were they to be converted to an on-screen mode. For MYP tools, reviewers considered exemplar items that made the most of the on-screen environment and exemplar items with scope for improvement. Screenshots of items are included to add clarity to the discussion and to make the findings accessible to those who may not be intimately familiar with the assessment materials.

Since the reviewers drew on the specimen assessment materials that were available at the time of the review, these may now have been replaced with more recent ones. As such, some of the aspects of the assessment materials noted by reviewers may now have been altered following feedback from schools and the ongoing review of best-practice approaches to assessment that takes place across the IB.

# Language and Literature

The review of language and literature specimen assessments looked at paper-based DP assessments and MYP e-assessment:

- Diploma Programme Specimen Assessment - Group I - English A: Language and Literature, Higher level and Standard Level, Specimen papers I and 2, for first examinations in 2013; and
- Middle Years Programme Specimen Assessment – Language and Literature, May 2018.

#### Diploma Programme

The item selected for discussion in relation to DP language and literature is the HL DP literature paper (paper code SPEC/I/AIENG/HPI/ENG/TZ0/XX) which asks learners to 'write a literary commentary on one of the following' and provides an excerpt from Don't Let's Go To The Dogs Tonight by Alexandra Fuller as well as the Margaret Avison poem The Dumbfounding.

The texts are printed on separate pages to the response sheet to allow learners to read and respond simultaneously. **Figure 2** illustrates an excerpt from this item.

Items of this kind can easily be converted to an on-screen format. Advantages include the option of both reading and listening to the texts as well as enabling learners to type (and hence edit) their responses, which some may find more familiar than handwriting. This does, of course, raise the debate of the extent to which typing favours some learners over others or, alternatively, handwriting favours some learners over others.

An important consideration if this item was to be converted to an on-screen format would be the placement of the display and response sections on the screen. Ideally the screen would be split horizontally to allow learners to scroll up and down in the text at the same time as, and independently from, typing their responses. Something that is often missing from on- screen assessment is a place to write a plan for the response, and this would also need to be included. A further consideration here is how an onscreen environment could be used to enhance the accessibility of this item. Beyond the option of listening or reading the text, an on-screen environment should be able to allow learners to change the size of the font, to utilise a digital dictionary and/or thesaurus to look up unfamiliar words and the option of using a text editor to support their writing. An alternative would be to have learners view a video, for example of a poem being read or, for example, to compare and contrast a written text as well as a theatrical or screen adaptation

The item type – a long open response – is a common way to assess learner skills and knowledge in literature but alternative item types may also wish to be considered. These could include some shorter response items that focus on asking learners to extract particular sections of text and evaluate or critique them as well as a long open response. This would enhance speed, accuracy and efficiency of marking while also providing learners who may be less competent in

### Figure 2: DP Literature Paper Exemplar

and Baccalauter International	-1- SPECIALENO/REPLENO/TZI
Bachillerano Emerinacionei	Write a literary commentary on one of the following:
	L
ENGLISH A: LITERATURE - HIGHER LEVEL - PAPER 1 ANGLASS A: LITTERATURE - NIVERA/SUPERIUM - ÉPREUVE 1 INGLES A: LITERATURE - NIVES SUPERION - PAUERS 1	The buyen wilk the line of our twisses. Mana tiphona her check. She whitever, "Here dary come." Ded nonchalardy stands, resting or one ke, like a horse at end. He looks swry, es i
SPECIMEN PAPER	buyers are a common, bland species of bud on an otherwise more enciding rafter. 1 Manu haines, "Try and look hampy, bland, and open any ayes as wide as they will go that then will same budlene and anoth. Manusca sinch has there are an other default.
2 hours / 2 hours / 2 hours	ant exuating-to-be-here. Must turns a factor, dired, terrifying unile on the buyers. Her look usys, "Give us a p
INSTRUCTIONS TO CANDIDATES	10 price and you will be remarked with try lives for all time. Please give us a good price. Plea Wives of the maintery sink down into any belly and chara with the two-grany encous of secart breakfunt.
<ul> <li>Do not open this examination paper until instructed to do so.</li> </ul>	Jitutag serves ever their bales.
<ul> <li>Write a literary commentary on one passage only.</li> </ul>	15 The bales are term open, leaves are pulled up and unailed; the thats veined crop is not
INSTRUCTIONS DESTINEES AUX CANDIDATS	between their largers (nagers instanting wine pool bands, which are sound the many though buil the howers from the formers to former 1 have were ristig). A price is scrawled on a fo Dad waim ugoil the breyers are out of earther and their whispers to 35mm in a soft, warning or
<ul> <li>N'ouvrez pas cette épreuve avant d'y être autorisélei.</li> </ul>	"Inwady Hald II," in the way he would talk to a fiveful minut. New Man, Measure and I would find's hands as he malks the line. If he arrang with
<ul> <li>Rédigue un commentaire littéraire sur un seul des passages.</li> </ul>	price we have been affered for each bale, he heutistes, flagers hovering briefly above the to-
INSTITUCCIONES PARA LOS ALUMNOS	and then wells, on, leaving the ticket intert. That tobacco will be taken away to cigaratta factor famous, well-travelled Electrical barley of the way from our barley form.
<ul> <li>No abra esta prueba basta que se la autorizan.</li> </ul>	If Dud dragmen with the price the buyer has offered, he inset the ticket. These bales
Escrita un comentario Iterato sobre un solo pasajo	25 for everypped, inside onto iterties, and transgib back to unitacly Edward. Ded will want to them heat in the session, when picknyst the hyperwise will be amore heatry for motion. Throw by will sit in the gending shed, upon to the air, where blasts of steam will heap the hereic in s
	spand hears, until her fagers burn with the sticky yellowing residue of the heave, resisting
	30 reltaling the better in the operations belief that a new presentation might bring a healthier pr
	If Dad varis instring relations and his fact becomes folded and down, we feel ourse become quiet and withing we-seem's here. But if he is welking quickly over the line of both hereing the tricket proting, benefited while sectualizes of wellow, we are added
	I stort to run between the bales, exuberant, uily, loud, and Mum doesn't say, "Shihh p
	31 Behava yourselves?" And then Dud has walked the line and, without looking at the other farm he takes Mum by the hand and he care, "Come on Tub." Vaneys and I full into line behind 3
	and Ded. His fingers are wrapped round hers. By the end of today Dad will have gone to see
	fat man with the wet has from Taben and Mum will have her stags back, and when we get hom Robandi the will polith them in Silvo to remove the tarnish of theme and disting.
	40 Dud doesn't unile, or concede any kind of victory in front of the buyers. He waits until are in the car and then he varys to Mum, "Fair price."
	Don't Lett Go Ib The Dogs Bonght, Alexandra Poller, Pon Macraillan, Lo
	Copyright C. Asternator Prate Press, Den 1 Let 1 Go 7b The Deg: Despfrit V Advansable Platter, copyright C. 2016 (10 V Advansable Platter Used by Permission of Random Hones, Sac. For on-line information above often Passloon Hones, books and andbers, use that have new to sho with a boots were randomloaned to the start of the start of the start of the
Jangentologenes	
# International Decoding and Congenization, 2011	

writing lengthy texts to demonstrate their skills.

The final consideration noted by experts for any literature paper - whether on-screen or paper based – is the source of literary excerpts. The complexity and cost of gaining appropriate permissions for using literary texts means that increasingly common approach an for literature test developers is to contract a freelance writer to develop these. While this does mean that classic texts cannot be included, it offers the advantage of a text that is equally unfamiliar to all learners and can also be tailored to promote the use of particular skills.

The marking rubric was viewed and considered to have the potential of being interpreted in different ways by different markers. The reviewers also wondered it if would be possible for the two options to be assessed consistently.

#### Figure 3: MYP Language and Literature Paper Task 2

1 (Dirruhe) . Task 2 (20 marks) × a containe 1.8.00 Timing recommendation: 35 minutes Using one of the images, create . This task is assessed according to criteria C (Producing text) and D screenplay for one key scene in a mystery wie. You might consider any of the (Using language). - This task is worth 20 marks (C - 10 following literary features: point of view marks, D - 10 marks). characterization, mood, audience, and/or purpose. Look at the images below and respond to the prompt. Select the image you are using » Image 1 Image 2 (Approximately 358 words) 4 1 + − | y ×, \* | 2 ≡ | Ω Σ

This could be addressed by providing exemplar responses at different levels (these may also be available but were not seen by reviewers) as well as by making it clearer how to differentiate responses at different levels of competence.

The reviewers were not sure if the marking process involved double-marking of a percentage of responses but recommended that this should certainly be part of the approach to marking. If learners were to take this paper in an on-screen format, this would enable a linked marking portal which could facilitate marking as well as double-marking to review consistency.

#### Middle Years Programme

Two tasks are included here as part of the MYP review - task two and task three. Task two comprises one item that asks learners to write a screenplay on the basis of a choice between two images. Figure 3 illustrates the item.

The reviewers felt that this was a stimulating and interesting task for learners to complete

> but were concerned about the assumption that all learners would know how to do so. They felt that it would be useful to include an example excerpt from a screenplay as a way of illustrating the requirements to learners who may be less familiar with the format.

> The reviewers did feel that functionality was rather problematic in this item. The two images presented to learners are quite small and particularly in relation to the second one - it is difficult to see what this shows. This means that details that would be useful in inspiring the screen play are very difficult to see.



The image can be expanded to a large size but doing so covers up the response box, meaning that it not possible to both view the large image and type in the response box at the same time. This could be irritating for learners who need to see some of the detail while writing, requiring them to open and close the image while responding. This could be solved by using a vertically split screen which would allow the large size image to be seen at the same time as the response box.

The reviewers felt that task 3 – which again comprises one item - is again a very stimulating and interesting item that would be challenging for learners. This item asks learners to write a proposal for an outdoor learning space. **Figure 4** illustrates this item

The reviewers noted that this item is presented exactly as it would be on paper, with the only benefit of the on-screen version lying in the ability of learners to type rather than handwrite their responses. While this may be the most appropriate task to measure the skills in question, meaning that a change to task type is not essential, consideration could be given to adding some images in order to stimulate learner responses, for example of an old-fashioned classroom and a forest or field.

Alternatively, a different way of measuring this skill such as providing learners with the possibility of dragging and dropping a few design items into a plan and then explaining their rationale for doing so might help make this item more stimulating and authentic for learners, although this functionality would need to be balanced against the cost of creating a stimulus like this.

Items of this kind can easily be enhanced by using an on-screen format. Possibilities include the option of both reading and listening to the texts as well as enabling learners to type (and hence edit) their responses, which some may find more familiar than handwriting. This does, of course, raise the debate of the extent to which typing favours some learners over others although in paper and pen assessment, writing by hand favours some learners over others.

# Figure 4: MYP Language and Literature Paper Task 3

Task 3 (30 marks)	X
	2 (0) marks)
Timing recommendation: 35 minutes	a (0) mate
<ul> <li>Global context focus - Orientation in space and time: natural and human landscapes and resources.</li> <li>This task is assessed according to criteria B (Organizing), C (Producing text) and D (Using language).</li> <li>This task is worth 30 marks (B - 10 marks, C - 10 marks, D - 10 marks).</li> </ul>	
A local architectural firm is running a competition for students to share their vision for an innovative, outdoor learning space. Create a written proposal to the chief architect that outlines the importance of such a space and its potential impact.	
(Approximately 350 words)	
A L A A A A A A A A A A A A A A A A A A	

#### **History**

The review of history specimen assessments looked at paper-based DP assessments and MYP e-assessment:

- Diploma Programme Specimen Assessment – History, Higher level and standard level, Paper I, 2016; and
- Middle Years Programme Specimen Assessment – Individuals and Societies, May 2018.

#### **Diploma Programme**

The examination paper (paper code SPEC/3/HISTS/BPI/ENG/TZ0/XX/Q) asks learners to answer all questions from one section, with a choice of: military leaders; conquest and its impact; the move to global war; rights and protest; and conflict and intervention. The first task selected for discussion in relation to DP history is the one on rights and protest, which comprises four items. **Figure 5** illustrates this task.

#### Figure 5: DP History Paper Section 4

This is an example of a set of items where the Sources M, O, N and P, which are currently in written form, could be replaced with video or audio resources (with subtitles if necessary to aid comprehension). This would add authenticity to the task and would help to contextualise the task for learners with a number of aural and/or visual clues that can portray a great deal more of the situation than can be gleaned from a written text.

This would support learners, for example in responding to item 14, by providing them more information on the value and limitations of a particular source. Using audio or visual resources would help the task to become more like something that a contemporary historian would be likely to engage with. It would support a more in-depth evaluation of the perspective of a source and hence stimulate deeper thinking, taking into account the time and place.

This approach would, however, require careful consideration of the time required and the number of sources (for example two may be more than sufficient, rather than the four given). A further consideration in conversion to on-screen is that it would advantage learners who are more comfortable and/or faster with typing over those who are not (although

		Section 4: Rights and protest	
Read ques and Free	d sou stions action dom	rces M to P in the source booklet and answer questions 13 to 16 below. The sources and relate to case study 1: the civil rights movement in the United States (1954–1965) – Prote n: non-violent protests; Montgomery bus boycott (1955–1956); Freedom Rides (1961); Summer (1964).	sts
13.	(a)	Why, according to Source M, was there resentment towards the civil rights workers?	[3]
	(b)	What is the message conveyed by Source O?	[2]
14.	With Sou	reference to its origin, purpose and content, analyse the value and limitations of rce N for an historian studying the civil rights movement in the United States.	[4]
15.	Con Free	npare and contrast what Sources N and P reveal about the consequences of the adom Summer.	[6]
16.	Usir in fu	ng the sources and your own knowledge, evaluate the success of the Freedom Summer rthering the cause of black civil rights in the United States.	[9]

hand-written papers similarly advantage people with more fluent hand-writing over those who are less skilled in writing by hand).

The item type – a long open response – is a common way to assess learner skills and knowledge in literature but alternative item types may also wish to be considered. These could include some shorter response items that focus on asking learner to extract particular sections of text and evaluate or critique them as well as a long open response. This would enhance speed, accuracy and efficiency of marking while also providing learners who may be less competent in writing lengthy texts to demonstrate their skills.

The second task is selected for discussion in relation to DP history is the one on military leaders, which comprises four items. **Figure 6** illustrates this task.

In this case learners are required to read four sources on Genghis Khan's leadership. This is an example of an item that could be easily replicated in an on-screen environment without changing the functionality beyond a shift from hand-writing to typing. In the context of this topic, the inclusion of different source materials or different item types may not add any value to the task, although could be considered. The task itself is authentic in that for history such as this the main source of information for historians is written records. If this task were to be presented in an on-screen assessment, particular care would need to be taken about how the sources are presented, to allow learners to move backwards and forwards smoothly between their responses and the sources.

Again, long response tasks are a common way to assess learners on these kinds of questions. One option that an on-screen environment would offer is the possibility of asking learners to use different formats in their responses. This could include tasks such as creating concept maps or short multimedia presentations. If such response formats were to be introduced it would be critical to ensure that learners had gained prior experience in such activities so that they were not disadvantaged in the summative examination. This is indicative of the need for teaching, learning and assessment to be in close alignment, so that approaches to teaching and learning inform assessment, and approaches to assessment inform teaching and learning.

#### Figure 6: DP History Paper Section I

		Section 1: Military leaders				
Rea que suc	d sour stions cess in	rces A to D in the source booklet and answer questions 1 to 4 below. The sources and relate to case study 1: Genghis Khan (c1200–1227) – Leadership: motives and objectives; a achieving those objectives and importance of Genghis Khan's leadership to Mongol succe	ess.			
1.	(a)	What, according to Source C, were the factors that motivated the Mongol conquests?	[3]			
	(b)	What is the message conveyed by Source D?	[2]			
2.	With Sou	reference to its origin, purpose and content, analyse the value and limitations of rce B for an historian studying the Mongol Empire.	[4]			
3.	Con Gen	pare and contrast what Sources B and C reveal about the Mongol conquests under ghis Khan.	[6]			
4.	Usin	Using the sources and your own knowledge, evaluate the role of Genghis Khan in the launch and success of the Mongol conquests.				

#### Middle Years Programme

The on-screen assessment of Individuals and Societies presents learners with a series of tasks, each of which comprise one or more items. The first task selected for discussion is the one on a director's action plan for a documentary on ideology in art, which comprises five items. **Figure 7** illustrates this task.

Task 5 requires learners to complete the steps of an action plan. This is a very interesting task that engages learners in applying their skills and knowledge in an authentic real-world context.

Four of the five items are shown here. The first thing to note is that the image used in this task is repeated from Task 4 which is an efficient use of stimulus material. The second is that each item asks for a short response task which means that marking learner responses is more likely to result in consistent and objective marking across markers. The second element to note is that while the image is able to be displayed in a slightly more lively way than it could be on paper, the entire task is otherwise fully replicable on paper, hence has not really made use of the opportunities offered by an on-screen environment. The use of response boxes is the clear point of difference, allowing learners to type rather than write, which will advantage some in relation to handwriting but disadvantage others.

#### Figure 7: MYP On-Screen Task 5



In a task of this kind further thought could be given to presenting stimulus information in a more engaging way, for example with a drag and drop diagram, the possibility of adding information to existing boxes rather than inputting this separately, and so on.

# Figure 8: MYP On-Screen Examination Task 8





The second task selected for discussion is the one that asks learners to analyse the usefulness of both Source C and Source D to an MYP learner studying how changes in living conditions have prevented the spread of diseases. **Figure 8** illustrates this task. This task utilises four photographs and learners are able to click on a number of points in each photograph to receive information (as shown in the boxes within the images above). This is an interesting use of the potential of the onscreen system to make the stimulus material engaging and authentic for learners.

The task itself is a straightforward essay task. This is a traditional approach to assessment and in an on-screen environment learners are able to type rather than handwrite responses. While there are benefits of using a long open response tasks, the downsides are that ensuring that marking is consistent across a large number of markers becomes increasingly difficult the more open the task.

In this instance there could have been different ways of assessing the ability of learners to analyse, such as listing dot points of the advantages or disadvantages of each pair of sources, or utilising other functionality embedded within the on-screen system to enable alternative types of response such as concept mapping or the development of a slide-show of questions that could be asked to determine the usefulness of each source.

Ultimately, item design should be driven by purpose, in this case what is the skill that learners are required to demonstrate and what is the best possible way for them to demonstrate this, making advantage of onscreen functionality, facilitating consistent marking and optimising validity, reliability and authenticity.

# **Mathematics**

The review of mathematics specimen assessments looked at paper-based DP assessments and an MYP e-assessment:

- Diploma Programme DRAFT Specimen Assessments – Mathematics: Application and Interpretation – Standard Level and Higher Level Papers I and 2, 2020;
- Diploma Programme DRAFT Specimen Assessments – Mathematics: Analysis and Approaches – Standard Level and Higher Level Papers I and 2, 2020; and
- Middle Years Programme Specimen Assessment – Extended Mathematics, May 2018.

# Diploma Programme

In this case the expert reviewers looked at a number of papers and had similar comments for all of them. Overall, the reviewers felt that the papers were of high quality with good and often rich stimuli used which frequently referred to authentic scenarios. Moreover, many stimuli incorporated relevant graphs and diagrams which required learners to consider real-world applications of mathematics.

# Figure 9: Analysis and Approaches, HL, Paper I, item 2

A particular cause for concern was the need to write equations. This is an issue that mathematics test items continue to grapple with. The example of item 2 from the Analysis and Approaches, Higher Level, Paper I (SPEC/5/MATAA/HPI/ENG/TZ0/XX) is shown in **Figure 9**.

In cases such as this, where learners are awarded marks for their proof, reviewers noted that there are a number of possible options if this were to be used in an on-screen assessment. First, learners could write their proof on paper, photograph it and upload it.

- 2. [Maximum mark: 5]
  - (a) Show that  $(2n-1)^2 + (2n+1)^2 = 8n^2 + 2$ , where  $n \in \mathbb{Z}$ .
  - (b) Hence, or otherwise, prove that the sum of the squares of any two consecutive odd integers is even.

In terms of the possibility of transitioning DP assessment to on-screen delivery, the reviewers felt that there were both potential advantages and potential disadvantages in doing so. One advantage noted by reviewers was that an on-screen environment would enable the use of stimuli that were more authentic – such as an image (static or video) of an object rather than a pencil drawing.

Reviewers also felt there would be greater opportunities to create items that called for the use of mathematics in investigation in an on-screen environment, something that would higher-order stimulate more skills in responses. Reviewers also noted the need to present problems or situations in which learners had the creativity to determine their own approach to finding a solution, rather than applying formulae, and wondered whether there would be greater scope for doing so in an on-screen environment.

For mathematics assessment experts, a barrier to on-screen assessment has until recently been the challenge of learners writing equations or showing mathematical workings. This issue was raised by reviewers as both a concern, and also as a case in which rapid developments are making this more and more possible. This is relatively clumsy, however. Another option is to use an equation editor.

[2]

[3]

An example is one developed by Newcastle University – Numbas - in which mathematical expressions can be typed into a box in simple form and are automatically translated into mathematical formula, as illustrated in Figure 10 found (this can be at https://www.numbas.org.uk/demos/numbaswebsite-demo/). In this case learners can either write the answer (having done the workings elsewhere) or work through step. A similar Wiris addroach is that used by (http://www.wiris.com/en).

The use of an approach such as that in Numbas would require learners to be familiar with the annotation approach and this underscores the importance of consistency between approaches in teaching, learning and assessment.

For example, if ongoing assessment is used during teaching and learning it needs to utilise similar approaches to that in the examination. is incorrect but their workings are largely correct).

Again, however, use of technology such as that shown in **Figure 10** could help solve the challenge of using such items in an on-screen format.

#### Figure 10: Example of Numbas equation writer



This does not mean that ongoing assessment should comprise simply practicing summative assessment papers, but simply that any specific tools used in summative examinations should also be used during coursework to ensure that no learners are disadvantaged during examinations.

# Figure 11: Analysis and Approaches, HL, paper 1, item 7

7. [Maximum mark: 7]

A continuous random variable X has the probability density function f given by

$$f(x) = \begin{cases} \frac{\pi x}{36} \sin\left(\frac{\pi x}{6}\right), & 0 \le x \le 6\\ 0, & \text{otherwise} \end{cases}$$

Find 
$$P(0 \le X \le 3)$$
.

In items where it is not necessary to show a proof, such as item 7 on the same Analysis and Approaches specimen paper (illustrated in **Figure 11**) it would be possible for learners to just give a numerical response, but this would not give them the opportunity to show their workings (and gain partial credit if their response

In the Applications and Interpretation specimen papers, there are a number of items that could easily be digitised. These include items I, 4, and 6 in the Higher Level Paper I (SPEC/5/MATAI/HPI/ENG/TZ0/XX). Item 6 is shown in illustration in **Figure 12**.

In this case one option would be to have learners provide their response rather than show their workings. This type of item could easily be converted into a multiple-choice item for instant marking and in order to highlight misconceptions leading to incorrect answers in a way that the current item is unable to do.

Figure 12: Applications and Interpretation, HL, paper 1, item 6

Other items would be more challenging to

	Jae Hee plays a game involving a biased six-sided die.									
	The score for the game, X, is the number which lands face up after the die is rolled.									
	The following table shows the probability distribution for $X$ .									
	Г									
		Score x	-3	-1	0	1	2	5		
		D/V->	$\frac{1}{18}$	р	3	1	2	7		
		r(A = x)			18	18	18	18		
	(a) Find the exact v	alue of p.								[1]
	los llos plans the same energy									
	sae nee plays the game once.									
	(b) Calculate the ex	pected so	ore.							[2]
	Jae Hee plays the game twice and adds the two scores together.									
	Jae Hee plays the gar	ne twice a	ind add	is the t	NO SCO	es logi	ourior.			

digitise but some of these challenges can be overcome through clever item design. For example, one of the tasks in item 2 in the same paper calls on learners to draw a line on a graph, as shown in **Figure 13** 

One way of doing this in a digital environment would be to use a line drawing tool, but this could be costly to develop. An alternative

would be to provide learners with images of four possible lines on graphs as a multiplechoice response option.



#### Figure 13: Applications and Interpretation, HL, paper 1, item 2

An alternative to asking learners to show calculations could be used in some items, with item 12 in the same paper used as an example. This is illustrated in Figure 14 In this case an alternative approach – one that would actually add to the difficulty level of the item - would be to have learners type a description rather than providing calculations.

**Figure** 14: **Applications** and Interpretation, HL, paper 1, item 12

Ultimately, the appetite of the IB to adopt a systematic approach to on-screen equations and mathematical proofs will be the key factor that determines the viability of moving to an on-screen assessment. This is an area in which there are rapid innovations and hence determinations about this are likely to evolve over time.

The

expert

# Middle Years Programme

12.	[Maximum mark: 7]					reviewers liked the way in which the on-
	Product research lead at a price (p) can be n	screen interface was used to provide				
		learners with engaging and				
	There are two competent	d. stimulating tasks in				
	Model A has $c = 3$ , d	this assessment				
		Overall, they found				
	The company experim and the results are sh	nents by selling own in the follow	the goods at thre wing table.	ee different prices	s in three similar ar	this to be a very
		Area	Price (p)	Revenue (R)	]	that provided
		1	1	1.5	]	learners with a range
		2	2	1.8	]	of stimulus materia
		3	3	1.5	]	that contextualised
	The company will cho	in real work				
	Determine which mod	er the company	01050.			scenarios.

Overall, the reviewers felt that guite a number of items would benefit from the ability to use more authentic stimuli in which to apply their mathematics skills if on screen assessment were to be used. At the same time, it was noted that careful thought would need to be given to layout on screen in the case that:

- a number of items were attached on one stimulus, which could require learners to move up and down a screen;
- where stimuli were lengthy in nature (e.g. with a number of graphs and diagrams), requiring navigation between different elements; and
- where graphs were to be incorporated and learners were required to use particular graphing software that they may lack familiarity with.

In many cases, stimulating videos and images were used to engage learners in the tasks at hand. In some cases, however, reviewers felt that these were not entirely required for task response. For example, in Question 5, learners were able to watch an animation of a sailing boat in order to introduce the topic of velocity vectors. This is illustrated in Figure 15.

#### Figure 15: MYP Mathematics, May 2018, Question 5



Reviewers felt that the animation was well made and contextualised the situation successfully, but that the presentation of an image of a triangle below provides the same explanation in a different form. This means that some learners may choose to skip the video and just look at the image.

While the reviewers understood that the video may appeal more to some learners than the image, finding a way to bring the two together (for example overlaying the image towards the end of the video) would mean that all learners are required to watch the video in order to respond to the items, resulting in none incurring a time penalty in relation to others.

In contrast, the animation in Question 6 - which is also very stimulating -is required in responding to the items and the image below complements rather than replicates the information that the animation contains. This is a good example of using the opportunities delivered by an on-screen environment for contextualising information about the items in a way that is meaningful and necessary for learners. Question 6 is shown in **Figure 16**.
## Figure 16: MYP Mathematics, May 2018, Question 6



Question 8 as shown in **Figure 17** is a great example of the additional functionality that an on-screen system can deliver not only in providing a stimulus for learners but also in enabling them to respond to items in a particular way. In this case learners can use the slider in order to respond to the items. This is a great use of interactive elements in an onscreen environment and significantly adds value to the tasks that learners are expected to undertake. This illustrates the future of on-screen tools for teaching, learning and assessment in which a range of advanced functionalities can be incorporated into a digital platform that enable learners to undertake activities, deepen their thinking and apply tasks in a real world environment in ways that are difficult to do on paper.

#### Figure 17: MYP Mathematics, May 2018, Question 8



Overall, the mathematics assessment experts who reviewed the assessment material felt that in some places the possibilities offered by a digital platform had been used to really add value to items and to engage learners in stimulating and meaningful activities, while in other places they had been used less well, or were not required at all.

In addition to the comments about exemplar items, the reviewers further recommended that there should be continuity between formative and summative assessment formats so that the functions on the platform were familiar to learners prior to an examination situation.

#### **Science**

#### Figure 18: DP Chemistry Higher Level, Paper 1, Item 16



The review of science specimen assessments looked at paper-based DP assessments and an MYP e-assessment:

- Diploma Programme Chemistry, Higher and Standard Level, Specimen papers 1, 2 and 3, for first examinations in 2016;
- Diploma Programme Biology, Higher and Standard level, Specimen papers 1, 2 and 3, for first examinations in 2016;

- Middle Years Programme Specimen Assessment – Biology, May 2018; and
- Middle Years Programme Specimen Assessment – Chemistry, May 2018.

#### Diploma Programme

Paper I in both the Biology and Chemistry assessment consist of multiple-choice items, all of which could easily be transformed into an on-screen mode. Doing so would both enable marking to be automated and would also enable the stimuli to be static, video or animated images of real-world situations where possible, enhancing authenticity. For example item 16 (paper SPEC/4/CHEMI/HPM/ENG/TZ0/XX) is illustrated in **Figure 18**.

In this example it would be possible to

replicate the image on-screen in exactly the same format, or to illustrate the process in a video or animation. At present, there is a separate stimulus for each item. If investment is to be made into, for example, an animation, optimal value would be achieved if a more complex image was linked to multiple items.

Moving beyond simple MCQs, a further possibility would be to have learners use a drag and drop option to label diagrams, to order stages in a process or to construct equations by dragging and dropping different elements, with a number of other options also likely to be possible. All of these could be set up to enable automated marking, achieving the same efficiencies as

the use of MCQs at present. For example, **Figure 19** illustrates item 20.



Figure 19: DP Biology Higher Level, Paper 1, item 20

This is an excellent example of an item which could be transformed by the use of onscreen delivery, for example by having actual photographs of the creatures and the opportunity to require learners both to order them as well as responding to a number of items about them.

In both Biology and Chemistry, almost all items in papers 2 and 3 require learners to create complex text with few singlework answers. This means that careful consideration about appropriate item types would be required if there was a shift to an on-screen assessment in order to optimise the benefits that an onscreen environment would have to offer. In some cases the approach to leveraging opportunities within an on-screen mode in order to change the item without altering the knowledge or skill assessment is quite obvious. For example, **Figure 20** shows a biology item in which learners are presented with an image of an onion cell and asked to (a) Identify the phase of mitosis represented by cell X and (b) Outline two distinctive features of cells undergoing mitosis in the micrograph.

In this case the first part could be changed to ask learners to 'click on / select a cell in the image that is undergoing X phase of mitosis'. Similarly, the second part could involve learners identifying and labelling cells going through different phases, or dragging and dropping labels to do the same. Again, these responses could be marked automatically. In an on-screen environment a further affordance would be the ability to use a coloured photograph image to add authenticity to the task.

Similarly, **Figure 21** illustrates a chemistry item in which on-screen affordances would be useful. This is a labelling item and in an on-screen environment this could be presented in the same way – with learners entering text into a box – or through having learners choose from a set of labels (e.g. a drop down box of options for each one) and then placing them accurately.

#### Figure 20: DP Biology Higher Level, Paper 3, item 1



The latter option would allow for automatic scoring. These options leave the item in a similar format but additional ways of designing the item could also be used that would make even better use of on-screen features.

Overall, most elements of the DP Chemistry and Biology papers have the potential for shifting to an on-screen environment with a concurrent increase in the types of skills and knowledge that learners could be called on to

### Figure 21: DP Chemistry Higher Level, Paper 2, item 7

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Middle Years Programme

In relation to the MYP Chemistry assessment from May 2018, a number of items were selected for review here in order to demonstrate the extent to which the digital environment and its associated functionality has been optimised, and also items in which it could have been further leveraged.

Question 6 is illustrated in **Figure 22** and relates to an oil spill and provides learners with an engaging animation that is partly interactive

and adds value for their comprehension. This is a good example of how digital function can be used effectively to present learners with stimulus which is impossible in paper based testing.

Figure 22: Oil Spill interactive stimulus

use and the authenticity of stimuli material. Where items are more mathematical in nature, and require the use of equations, similar approaches to those outlined in the section on mathematics above could be utilised to overcome perceived challenges.



Interestingly, however, the items do not necessarily require reference to the stimulus and could easily be replicated on paper. For item 6a, illustrated in **Figure 23** for example, learners need to recall the structure of methane and then link that to the production of gas at the top of the column. They could also respond to 6b without the need to refer to the diagram if they had previously learnt the process of distillation.

If they had not previously learnt about distillation, they could refer to the diagram but the reviewer felt that it is doubtful that many learners who have not been taught the process would be able to construct it from the stimulus. Another consideration here is the value of asking learners to 'describe' a process that is shown in a diagram. This is a lower order skill and rethinking the item would enable deeper thinking to be assessed by using the same diagram.



#### Figure 23: MYP Chemistry, items 6a and 6b

**Figure 24** shows item 6c which does tap into higher order skills in that it asks learners to both 'discuss' and 'evaluate'. In this case the stimulus is used quite effectively. The stimulus is animated on a loop and shows, for example, the plane dispersing an oil spill. This is a real world issue and learners would almost certainly be aware of the issue, even if they have no knowledge of the specific methods of removal. The item requires learners to engage with the information in the stimulus.

#### Figure 24: MYP Chemistry, item 6c



One consideration here would be another way of asking learners to consider this issue. For example the inclusion of data tools such a 'pro' and 'con' tables would allow learners to organise information in a way that is not just linear text.



An example of an item that could be exactly replicated on paper and does not make use of online functionality is question 4, illustrated in **Figure 25.** 

#### Figure 25: MYP Chemistry, item 4a



learners require in order to respond to an item. Learners are asked to both calculate and identify and since the answer is not immediately clear from the raw data this requires some careful consideration, meaning that the items is appropriately challenging and

could not be answered from prior knowledge. The presence of the data on 'teeth', however, is somewhat distracting and the inclusion of otherwise unnecessary data could be re-considered.

In terms of biology, a number of items were also selected for review in order to demonstrate the extent to which the digital environment and its associated functionality has been optimised, and also items in which it could have been further leveraged.

The items refer to the static charts and tables that are provided but there is no interactivity. The inclusion of experimental errors in

the item is good – although they do look a little strange given the accuracy of the other points.

While the graph does show the discrepancy, the stimulus provides little background on the experimental design used to gather the data – so the 'suggest' in item 4a would seem to relate to general principals of experimental design, rather than something specific in the stimulus. An alternative or additional item could have asked learners to estimate the 'true' values of the errors.

Item 4b includes the presentation of a table of data and learners have to interact with both the graph in 4a and the table in 4b (shown in **Figure 26**) in order to respond. This is a good example of meaningful stimulus that

#### Figure 26: MYP Chemistry, item 4b

	Percentage by mass of	f calcium carbonate / %
Animal	Teeth	Bone
Elephant	20.93	22.58
Horse	28.80	24.70
Human	29.82	23.10
Monkey	29.93	23.12
Dolphin	22.12	15.16

One bone sample of mass 9.71 g was placed in hydrochloric acid and produced 540  $\rm cm^3$  of carbon dioxide.

Using data from the graph and the table, calculate the percentage by mass of calcium carbonate in the bone sample and identify which animal the sample comes from.

 $\left[ \begin{array}{c|c} \mathsf{B} & I & \leftarrow & \rightarrow \end{array} \right] \underbrace{\mathsf{U}}_{} \mathbf{x}_{*} \mathbf{x}^{*} \left[ \begin{array}{c|c} \vdots & \vdots \\ \vdots & \vdots \\ \end{array} \right] \Omega \left[ \begin{array}{c|c} \Sigma \end{array} \right] \text{ Styles } \mathbf{x}^{*}$ 

**Figure 27** illustrates two items in question 2. The stimulus for question 2 is a fantastic diagram that is engaging, stimulating and provides a great deal of information. One question raised by the reviewer, however, was about why it is shown after item 2a. Item 2a asks learners to 'outline how plants and animals are connected in the carbon cycle. The order means that if learners have moved ahead to 2b they can respond with reference to the diagram, while learners who have not moved ahead would be disadvantaged. To overcome this, it may have been better to have had the diagram before 2a as well.

The other issue to consider when using such a detailed diagram (which is accompanied by a chart showing longitudinal data) is the cost vs

Question 2 (6 marks) × Question 2a (3 marks) Outline how plants and animals are connected in the carbon cycle. B I + + U × × Π = = Ω Σ mm + Question 2b (3 marks) The diagram and graph below show some information about the carbon cycle. Factory Carbon dioxide he atmosphere Deer

benefit ratio. When detailed stimuli are used it is advisable to link them to a number of items so that the greatest benefit is drawn out for the resources required in creating the stimulus (a tension that test developers commonly have to deal with). One way to do this would be to transform the stimulus into one with draggable shapes and text boxes so that learners could introduce components into the

carbon cycle.

#### Figure 27: MYP Biology, items 2a and 2b

The repeated use of a stimulus from question 4 to question 5 is a good example of how the optimal use of stimuli can be achieved. In this case the stimulus is a video which helps position the context in the real world of scientific investigations, which is an excellent use of digital functionality. **Figure 28** illustrates item 5a.



#### Figure 28: MYP Biology Item 5a

The items within question five do raise some issues around item type used. For example item 5a simply asks learners to 'state the name of the enzyme that breaks down lactose'. This

could easily be replaced with a multiple-choice option and would save time and resources on marking.

Question 5 also includes the use of a table of data and a plot area on which learners can drag and drop to plot the data from the table, as shown in Figure **29** This is a great example of using digital technology to place a learner assessment in a real world scientific activity and the items are all relevant to the stimulus provided. The use of digital technology here should also lead to more consistency in marking if the locations of the learner placed points are automatically marked.

The only drawback of a task such as this is that learners have to undertake the same function multiple times in order to complete the chart, which could take up a great deal of time. An alternative would be to mark some of the points in advance and then have learners complete others.

Moreover, the flow of stimulus – from experiment to table to data to plotting it on a chart –

replicates the flow of a genuine scientific method to some degree. In addition, a number of items are related to this stimulus and this provides another good example of how the tension between the cost of stimulus per item can be resolved.



Question 5b (5 marks) The table below shows the data collected by the students Concentration of lactose / gdm-3 Time for colour change / s 78 2 4 63 54 6 46 8 10 43 12 42 14 41 Plot the data from this table on the axes below, add values to both axes and label the y axis. The effect of changing lactose concentration on the time for colour change Draggable: ٠ abod Concentration of lactose /

> In design terms, several of the items require learners to refer to the stimulus, which also makes the connection between the two logical and relevant. In general, learners often find graphing tasks challenging and hence scaffolding of such items may be required if they are to provide an optimally realistic assessment of their skills.

# **APPENDIX 4: QUESTIONNAIRE**

It is important to note that this survey was delivered online and was fully dynamic, meaning that certain sections were only shown to respondents if they had responded in a certain way to prior sections. No respondent was presented with all items.

In addition, while this gives the text from the survey provided to respondents in the Diploma Programme, many items were worded slightly different (e.g. DP was replaced with PYP) in other versions.

#### **Survey Introduction**

**IB DP Survey - The Relationship between Teaching, Learning and Digital Assessment** Welcome to the survey! We would be grateful if you could spend the next 20 minutes answering our questions. This survey will inform the policy and practices of the International Baccalaureate Organisation as it considers the relationship between teaching, learning and digital assessment. Please note that - unless otherwise specified - all reference to assessment in this survey refers to BOTH formative AND summative assessment.

#### **Research Ethics**

This survey has been approved by the Research Ethics Committee of the Australian Council for Educational Research. We take the protection of your identity very seriously. It will be impossible for anyone to identify you individually from this survey and we will not attribute any of the responses that you make on this survey to you or to the school that you work in.

Your participation in this survey is entirely voluntary and you are free to stop participating at any time (although we hope that you will respond to all questions).

Please respond to the statement below to indicate your willingness to participate in the survey.

#### I confirm that I am willing to participate in this survey

Please choose only one of the following: O Yes O No

#### About Me

I teach the following subject or subjects:

Please write your answer here:

#### **Prior Experience of Digital Assessment**

Digital assessment is the presentation of evidence, for judging student achievement, managed through the medium of computer technology (including hardware, software and networks)

### I have previously taught in a programme other than the IB where digital assessment was used

Please choose only one of the following:

◯ Yes

🔿 No

#### The name of the programme was

Please write your answer here:

#### Digital assessment was used in that programme for

Please choose only one of the following:

- O Formative Assessment Only
- O Summative Assessment Only
- O Both Formative and Summative Assessment

#### Digital assessment in that programme led to changes in the way I taught

Please choose only one of the following:

🔘 Not at all

- 🔾 A little
- O Quite a lot
- A great deal

#### Please describe these changes

Please write your answer here:

### The use of digital assessment in that programme impacted student learning in a way that was

Please choose only one of the following:

- O Mainly Positive
- O Both Positive and Negative
- O Mainly Negative

#### Please give a reason for your response

Please write your answer here:

#### **Opinion - Philosophy**

#### My personal opinion is that

Please choose the appropriate response for each item:

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Digital assessment aligns well with the IB philosophy	0	0	0	0	0
Digital assessment should be used in the DP programme	0	0	0	0	0

# I think that digital assessment should or should not be used in the DP programme because

#### **Opinion - Students**

#### My personal opinion is

Please choose the appropriate response for each item:

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
The use of digital assessment can make a positive contribution to the quality of student learning in the DP programme	0	0	0	0	0
Most DP students in my school would require training on how to use digital assessment tools	0	0	0	0	0
If digital assessment was used in the DP programme this would support students to better achieve the attributes in the IB student profile	0	0	0	0	0

#### I think that the use of digital assessment in the DP would have the following impact on students

Please write your answer here:

#### **Opinion - Teachers**

#### My personal opinion is that

Please choose the appropriate response for each item:

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
The possible use of digital assessment would increase the ability of DP teachers to monitor student progress effectively	0	0	0	0	0
The possible use of digital assessment would change the way in which DP teachers select and conduct learning activities	0	0	0	0	0
The possible use of digital assessment would expand the scope of what can be	0	0	0	0	0

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
assessed in the DP programme					
Most DP teachers in my school would require training and support in order to effectively use digital assessment	0	0	0	0	0
Digital assessment tools would be more suited for formative assessment than summative assessment in the DP programme	0	0	0	0	0

#### Please give a reason for your response

Please write your answer here:

#### **Opinion - School**

#### My personal opinion is that

Please choose the appropriate response for each item:

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Schools should be able to use an IB digital assessment platform to build their own formative assessments	0	0	0	0	0
My school would require support from the IB to use digital assessment in DP learning and teaching activities	0	0	0	0	0

### I have the following comments on the possible use of digital assessment in the DP Please write your answer here:

#### **Opinion - External Influences**

#### My personal opinion is that

Please choose the appropriate response for each item:

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
The possible use of digital assessment in the DP would influence parents in their choice about whether or not to enrol their children in the DP	0	0	0	0	0
The IB should reflect the increasing ubiquity of digital tools in daily life by using digital assessment in the DP	0	0	0	0	0
The IB should be seen to be innovative in its use of digital assessment in the DP in comparison with other exam boards	0	0	0	0	0

#### Please give a reason for your response

Please write your answer here:

#### Backwash (The effects of assessment on teaching and learning) - Formative

#### I currently use digital FORMATIVE assessment in teaching my subject(s)

Please choose only one of the following:

O Yes

🔿 No

#### I use the following digital tools for FORMATIVE Assessment

Please write your answer here:

## I think that the use of digital FORMATIVE assessment in my subject(s) influences changes in my teaching as follows

Please choose the appropriate response for each item:

	Not at all	A little	Quite a lot	A great deal
My ability to use data insights to inform my teaching	0	0	0	0
The way in which I plan my teaching	0	0	0	0
The way in which I select activities and tools for use in teaching	0	0	0	0
My approach to content	0	0	0	0
The teaching strategies I use	0	0	0	0

	Not at all	A little	Quite a lot	A great deal
The way in which I manage my classrooms	0	0	0	0
The homework that I set	0	0	0	0
The way in which I monitor student learning	0	0	0	0

# Examples of ways in which the use of digital FORMATIVE assessment in my subject(s) influences <u>my teaching</u> include

Please write your answer here:

# I think that the use of digital FORMATIVE assessment influences changes in my subject(s) as follows

Please choose the appropriate response for each item:

	Not at all	A little	Quite a lot	A great deal
The nature of the subject(s) I teach	0	0	0	0
The nature of learning objectives in the subject(s) I teach	0	0	0	0
The prioritisation of conceptual understanding in my subject(s)	0	0	0	0
The topic list in my subject(s)	0	0	0	0

Examples of ways in which the use of digital FORMATIVE assessment influences my subject(s) include ...

# I think that the use of digital FORMATIVE assessment in my subject(s) influences changes in student learning as follows

Please choose the appropriate response for each item:

	Not at all	A little	Quite a lot	A great deal
The skills that students use	0	0	0	0
The ability of students to monitor their own progress	0	0	0	0
The priority that students place on certain topics or skills	0	0	0	0
The strategies that students use in planning, monitoring and evaluating their learning	0	0	0	0
The likelihood that students will become more independent students	0	0	0	0
The motivation and engagement of students	0	0	0	0
The strategies that students use to prepare for assessment	0	0	0	0

#### Examples of ways in which the use of digital FORMATIVE assessment in my subject(s) influences changes to student learning include

Please write your answer here:

#### I think that the use of digital FORMATIVE assessment in my subject(s) influences changes in assessment as follows

Please choose the appropriate response for each item:

	Not at all	A little	Quite a lot	A great deal
The ways in which the skills, knowledge and conceptual understanding of students can be assessed	0	0	0	0
The insights that I can gain into my students' learning strengths and needs	0	0	0	0
My ability to use data to inform adjustments to my teaching	0	0	0	0
The reliability and validity of assessments	0	0	0	0
The security of assessments	0	0	0	0

#### Examples of ways in which the use of digital FORMATIVE assessment in my subject(s) influences changes to assessment include

Please write your answer here:

#### I think that the use of digital FORMATIVE assessment in my subject(s) influences my broader professional role as follows

Please choose the appropriate response for each item:

	Not at all	A little	Quite a lot	A great deal
The opportunity I have to contribute to the development of e-assessment materials	0	0	0	0
My understanding of the role of digital technology in education	0	0	0	0
My understanding of formative assessment	0	0	0	0
My professional development needs	0	0	0	0
The professional development opportunities that I am being offered	0	0	0	0
My participation in the IB Educator Network	0	0	0	0
My collaboration with other teachers in my school	0	0	0	0

#### Examples of ways in which the use of digital FORMATIVE assessment in my subject(s) influences changes to my broader professional role include

#### Backwash (The effects of assessment on teaching and learning) - Summative I think that the possible use of digital SUMMATIVE assessment in my subject(s) would influence changes to my teaching as follows

	Not at all	A little	Quite a lot	A great deal
My ability to use data insights to inform my teaching	0	0	0	0
The way in which I plan my teaching	0	0	0	0
The way in which I select activities and tools for use in teaching	0	0	0	0
My approach to content	0	0	0	0
The teaching strategies I use	0	0	0	0
The way in which I manage my classrooms	0	0	0	0
The homework that I set	0	0	0	0
The way in which I monitor student learning	0	0	0	0

Please choose the appropriate response for each item:

# Examples of ways in which the possible use of digital SUMMATIVE assessment in my subject(s) would influence my teaching include

Please write your answer here:

# I think that the possible use of digital SUMMATIVE assessment would influence changes to my subject(s) as follows

Please choose the appropriate response for each item:

	Not at all	A little	Quite a lot	A great deal
The nature of the subject(s) I teach	0	0	0	0
The nature of learning objectives in the subject(s) I teach	0	0	0	0
The prioritisation of conceptual understanding in my subject(s)	0	0	0	0
The topic list in my subject(s)	0	0	0	0

# Examples of ways in which the possible use of digital SUMMATIVE assessment would influence my subject(s) include

# I think that the possible use of digital **SUMMATIVE** assessment in my subject(s) would influence changes in <u>student learning</u> as follows

Please choose the appropriate response for each item:

	Not at all	A little	Quite a lot	A great deal
The skills in my subject(s) that students use	0	0	0	0
The ability of students to monitor their own progress in my subject(s)	0	0	0	0
The priority that students place on certain topics or skills	0	0	0	0
The strategies that students use in planning, monitoring and evaluating their learning	0	0	0	0
The likelihood that students will become more independent students	0	0	0	0
The motivation and engagement of students in my subject(s)	0	0	0	0

# Examples of ways in which the possible use of digital SUMMATIVE assessment in my subject(s) would influence changes in <u>student learning</u> include

Please write your answer here:

# I think that the possible use of digital SUMMATIVE assessment in my subject(s) would influence changes to assessment as follows

Please choose the appropriate response for each item:

	Not at all	A little	Quite a lot	A great deal
The ways in which the skills, knowledge and conceptual understanding of students can be assessed	0	0	0	0
The insights that I can gain into my students' learning strengths and needs	0	0	0	0
My ability to use data to inform adjustments to my teaching	0	0	0	0
The reliability and validity of assessments	0	0	0	0
The security of assessments	0	0	0	0

# Examples of ways in which the possible use of digital SUMMATIVE assessment in my subject(s) would influence changes to assessment include

# I think that the possible use of digital SUMMATIVE assessment in my subject(s) would influence changes to my broader professional role as follows

Please choose the appropriate response for each item:

	Not at all	A little	Quite a lot	A great deal
The opportunity I have to contribute to the development of e-assessment materials	0	0	0	0
My understanding of the role of digital technology in education	0	0	0	0
My understanding of summative assessment	0	0	0	0
My professional development needs	0	0	0	0
The professional development opportunities that I am being offered	0	0	0	0
My participation in the IB Educator Network	0	0	0	0
My collaboration with other teachers in my school	0	0	0	0

# Examples of ways in which the possible use of digital SUMMATIVE assessment in my subject(s) would influence changes to my broader professional role include Please write your answer here:

#### Nature of digital assessment

### I think that - if used - SUMMATIVE digital assessment in the DP programme should be (select all that apply)

 $\Box$  A substitute for a paper based examination with no change to the type of tasks students are asked to complete

 $\Box$  Very similar to a paper based examination but with the inclusion of some new functions for students to use eg an embedded video or a digital calculator

Quite distinct from a paper based examination with tasks for students that are different to those on a paper based test such as the creation of multimedia elements to convey ideas

Very different from a paper based examination, including innovative tasks for students that would not be possible on a paper based test, such as the use of a variety of multimedia to collect, communicate and distribute findings and conclusions

#### Please give a reason for your response

Please write your answer here:

### I think that - if used - FORMATIVE digital assessment in the DP programme should be (select all that apply)

 $\Box$  A substitute for a paper based examination with no change to the type of tasks students are asked to complete

 $\Box$  Very similar to a paper based examination but with the inclusion of some new functions for students to use eg an embedded video or a digital calculator

Quite distinct from a paper based examination with tasks for students that are different to those on a paper based test such as the creation of multimedia elements to convey ideas and collaborative tasks

Very different from a paper based examination, including innovative tasks for students that would not be possible on a paper based test, such as the use of a variety of multimedia to collect, communicate, and distribute findings and conclusions.

#### Please give a reason for your response

Please write your answer here:

#### **Digital Pedagogy**

Digital pedagogy can be considered as the thoughtful use of technologies in teaching and learning, including an awareness of their impact on learning. Technologies can be used in online, blended and face-to-face environments and include a range of elements from using slide creation programs (like Microsoft Power Point®) to flipped classrooms, blogging assignments, the use of social media in the classroom and getting students to use digital tools to test ideas.

#### I integrate digital pedagogy into my teaching

Please choose only one of the following:

- 🔿 Never
- In some lessons
- O In most lessons
- O In all lessons

#### I use the following digital tools in my teaching and assessment activities

Please write your answer here:

#### I choose to integrate digital pedagogy into <u>my teaching</u> mainly in

Comment only when you choose an answer.

Please choose all that apply and provide a comment:

- Certain year levels (If yes, which ones?)
- Certain subjects (If yes, which ones?)
- Certain topics (If yes, which ones?)
- Certain skills (If yes, which ones?)
- Certain competencies (If yes, which ones?)

**Examples of the ways in which I integrate digital pedagogy into** <u>my teaching</u> include Please write your answer here:

#### When I integrate digital pedagogy into my teaching it changes

Please choose the appropriate response for each item:

	Not at all	A little	Quite a lot	A great deal
The way I plan lessons.	0	0	0	0
The way I select teaching resources.	0	0	0	0
The way I manage my classrooms.	0	0	0	0
The way I select activities classroom activities.	0	0	0	0
The way I define learning outcomes for my students.	0	0	0	0
The way I collect evidence of student learning	0	0	0	0
The way I use data on student learning to inform my teaching.	0	0	0	0

	Not at all	A little	Quite a lot	A great deal
The way I provide feedback to students.	0	0	0	0
The way I set homework.	0	0	0	0

# The most significant ways that the integration of digital pedagogy changes $\underline{my}$ teaching are

Please write your answer here:

I believe that the integration of digital pedagogy into teaching can help students Please choose the appropriate response for each item:

	Not at all	A little	Quite a lot	A great deal
To become more inquiring.	0	0	0	0
To become more knowledgeable.	0	0	0	0
To become deeper thinkers.	0	0	0	0
To become better communicators.	0	0	0	0
To become more principled.	0	0	0	0
To become more open-minded.	0	0	0	0
To become more caring.	0	0	0	0
To take more risks.	0	0	0	0
To be more balanced.	0	0	0	0
To be more reflective.	0	0	0	0

# The most significant way that the integration of digital pedagogy can impact students is

Please write your answer here:

I believe that the integration of digital pedagogy into teaching can help teachers Please choose the appropriate response for each item:

	Not at all	A little	Quite a lot	A great deal
To improve their direct instruction	0	0	0	0
To enhance the quality of student interaction(s)	0	0	0	0
To stimulate enquiry based learning	0	0	0	0
To facilitate effective small group work	0	0	0	0
To encourage effective peer tutoring	0	0	0	0
To support students in their metacognition	0	0	0	0
To support students to become independent students	0	0	0	0
To motivate and engage students	0	0	0	0

	Not at all	A little	Quite a lot	A great deal
To cater to a range of learning styles	0	0	0	0
To identify students' learning strengths and needs	0	0	0	0
To increase their amount of collaboration with other teachers	0	0	0	0

# The most significant ways that the integration of digital pedagogy can support teachers are

Please write your answer here:

The challenges for teachers in integrating digital pedagogy into their teaching are Please write your answer here:

#### The following factors prevent me from integrating digital pedagogy into <u>my teaching</u> Please choose all that apply:

I am not interested in integrating digital pedagogy in my teaching.

Digital pedagogy is not relevant for the DP programme.

It would take too much time to plan lessons that use digital pedagogy.

I do not feel confident in my skills in integrating digital pedagogy in my teaching.

I cannot access the resources I need to integrate digital pedagogy in my teaching.

I do not receive any support in integrating digital pedagogy in my teaching.

# The other factors that prevent me from integrating digital pedagogy into <u>my teaching</u> include

Please write your answer here:

# The following factors would encourage me to integrate digital pedagogy into <u>my</u> <u>teaching</u> more than I do at the moment

Please choose the appropriate response for each item:

	Not at all	A little	Quite a lot	A great deal
The inclusion of digital assessment in the DP programme.	0	0	0	0
Access to relevant professional development (inside or outside my school).	0	0	0	0
Online modules to teach me how to use different digital applications in teaching.	0	0	0	0
More confidence in my technological skills.	0	0	0	0
Being able to learn from other teachers in my school.	0	0	0	0

# Other factors that would encourage me to integrate digital pedagogy into <u>my teaching</u> more than I do at the moment include

#### Students' ICT skills

I estimate that ..... of my students can use digital technologies to do the following Please choose the appropriate response for each item:

	None	A few	Some	Most	All
Participate in digital networks for learning	0	0	0	0	0
Manage digital reputation and online identity	0	0	0	0	0
Adopt, adapt and use digital devices, applications and services	0	0	0	0	0
Study and learn effectively in technology rich environments	0	0	0	0	0
Find, interpret, evaluate, manage and share information	0	0	0	0	0
Critically read and creatively produce communications in a range of media	0	0	0	0	0
Participate in emerging educational practices that depend on digital systems	0	0	0	0	0

#### I have the following comments to make about my students' digital literacy

Please write your answer here:

#### **Personal Characteristics**

#### l am

Please choose only one of the following: O Female O Male

O Other

#### l am

Please choose only one of the following:

- 30 or under
- 031-45
- 0 46-60
- O 60 or over

#### I have been a teacher for

Less than 5 years
5 to 10 years
11 to 20 years
More than 20 years

#### I live in the following country

Please write your answer here:

#### The language(s) of instruction at my school is/are

Please choose all that apply:

- Arabic
- Chinese

\_\_\_ English

French

German

Indonesian

🗌 Japanese

🗌 Spanish

Turkish

Other

If 'other', please specify

Please write your answer here:

#### My first language(s) is/are

Please write your answer here:

#### My school is

Please choose only one of the following: Private International Private National Public (Rest of the world) Public (USA) Other

**If 'other', please specify** Please write your answer here:

Thank you very much for your time - your responses will be extremely valuable in informing IB policies and practices.

# **APPENDIX 5: SUMMARY OF QUESTIONNAIRE DATA**

#### Schools Sampled by Region, School Type and Programme (n= 4995)

Programme		PYP			MYP			DP			СР	
Region / Type	Total	No.	%	Total	No.	%	Total	No.	%	Total	No.	%
IBA												
Charter	41	8	20%	21	4	19%	48	10	21%	4	4	100%
Private	122	27	22%	106	31	2 <b>9</b> %	482	106	22%	16	6	38%
State	450	90	20%	333	89	27%	1041	211	20%	77	15	19%
State Subsidized	2	2	100%	4	4	100%	17	17	100%	2	2	100%
Totals		127			625			344			27	
					•							
IBAEM												
Charter	2	2	100%	0	0	0%	4	4	100%	0	0	0%
Private	148	39	26%	76	33	43%	575	145	25%	23	8	35%
State	18	5	28%	23	6	26%	214	46	21%	37	7	19%
State Subsidized	5	5	100%	3	3	100%	33	33	100%	I	I	100%
Totals		51			42			228			16	
BAP												
Charter	0	0	0%	0	0	0	0	0	0	0	0	0%
Private	268	56	21%	62	21	34%	431	113	26%	11	3	27%
State	52		21%	23	7	30%	48	10	21%	I	I	100%
State Subsidized	0	0	0%	0	0	0%	10	10	100%	0	0	0%
Totals		67			28			133			4	

Initial sampling of schools based on data provided by IB from 3/2019. Due to a low participation of CP in the initial survey distribution, a secondary distribution was delivered to all CP coordinators.

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#### **Personal Characteristics of Respondents**

SURVEY ITEM	RESPONSE	PYP	ΜΥΡ	DP	СР
l am	Female	83.5%	65.7%	59.3%	66.3%
	30 or under	1 <b>9</b> .1%	<b>9.9</b> %	9.7%	18.8%
Lam	31-45	51.5%	38.0%	48.9%	34.4%
	46-59	26.4%	43.7%	36.2%	36.5%
	60 or over	3.0%	8.5%	5.1%	10.4%
	Less than 5 years	15.1%	9.7%	8.5%	12. <b>9</b> %
I have been a teacher for	5 to 10 years	27.8%	16.7%	24.2%	22.6%
Thave been a teacher for	II to 20 years	32.6%	36.1%	36.1%	30.1%
	60 or over	24.5%	37.5%	31.2%	34.4%
	Private International	59.7%	63.9%	38.2%	29.5%
	Private National	1 <b>9</b> .1%	I 3.9%	20.0%	24.2%
	Public (Rest of the world)	6.7%	I 3.9%	26.7%	9.5%
	Public (USA)	11.2%	4.2%	10.2%	33.7%
	Other	3.3%	4.2%	4.9%	3.2%
	Americas (IBA)	37.4%	28.6%	50.4%	65.1%
My school is in	Africa, Europe the Middle East (IBAEM)	22.4%	61.4%	28.5%	25.6%
	Asia Pacific (IBAP)	40.3%	10.0%	21.0%	9.3%

#### **Prior Experience of Digital Assessment**

SURVEY ITEM	RESPONSE	РҮР	МҮР	DP	СР
I have previously taught in a programme other than the IB where digital assessment was used	Yes	13.5%	7.4%	۱6.5%	23.2%
Of those respondents who answered 'Yes' to the previous item					
Digital assessment was used in that programme for	Both Formative and Summative Assessment	65.0%	57.1%	64.3%	84.4%
Digital assessment in that programme led to changes in the way l taught	Quite a Lot or a Great Deal	54.1%	28.6%	48.8%	37.5%
The use of digital assessment in that programme impacted student learning in a way that was	Mainly Positive	57.6%	28.6%	49.8%	61.3%

#### **Personal Opinion**

SURVEY ITEM	RESPONSE	ΡΥΡ	MYP	DP	СР
Digital assessment aligns well with the IB philosophy	Strongly agree/agree	70.6%	57.3%	62.2%	70.2%
The amount of digital assessment used in the MYP programme is appropriate	Strongly agree/agree	-	47.9%	-	-
Digital assessment should be used in IB programmes	Strongly agree/agree	73.1%	-	63.0%	72.5%
More digital assessment should be used in the MYP programme	Strongly agree/agree	-	35.4%	-	-
Students	•				
The use of digital assessment can make a positive contribution to the quality of student learning	Strongly agree/agree	79.2%	58.2%	63.9%	80.3%
Most students in my school would require training on how to use digital assessment tools	Strongly agree/agree	69.4%	75.0%	64.7%	59.0%
If digital assessment was used, this would support students to better achieve the attributes in the IB student profile	Strongly agree/agree	54.0%	-	49.0%	67.5%
If more digital assessment was used in the MYP, this would support students to better achieve the attributes in the IB learner profile	Strongly agree/agree	-	35. <del>9</del> %	-	-
Teachers					
The possible use of digital assessment would increase the ability of teachers to monitor student progress effectively	Strongly agree/agree	77.8%	53.4%	67.8%	84.3%
The use of digital assessment would change the way in which teachers select and conduct learning activities	Strongly agree/agree	71.9%	<b>76.</b> 1%	70.4%	77.4%
The use of digital assessment would expand the scope of what can be assessed	Strongly agree/agree	63.7%	48.8%	55.5%	64.3%
Most teachers in my school would require training and support in order to effectively use digital assessment	Strongly agree/agree	76.5%	77.3%	<b>79</b> .1%	70.2%
Digital assessment tools would be more suited for formative assessment than summative assessment in the CP programme	Strongly agree/agree	49.7%	22.7%	45.3%	34.8%

SURVEY ITEM	RESPONSE	PYP	MYP	DP	СР
Schools					
Schools should be able to use an IB digital assessment platform to build their own formative assessments	Strongly agree/agree	76.0%		75.0%	<b>79.</b> 1%
Schools should have advance access to the digital assessment platform used for MYP summative assessment to enable students to become familiar with it	Strongly agree/agree	-	85.1%	-	-
My school would require support from the IB to use digital assessment in learning and teaching activities	Strongly agree/agree	74.8%	64.0%	77.5%	66.7%
External Influences					
The possible use of digital assessment would influence parents in their choice about whether or not to enrol their children in IB programmes	Strongly agree/agree	40.3%	32.9%	26.0%	21.7%
The IB should reflect the increasing ubiquity of digital tools in daily life by supporting the use of digital assessment	Strongly agree/agree	68.3%	43.5%	64.5%	66.1%
The IB should be seen to be innovative in its support of digital assessment in comparison with other international education programmes	Strongly agree/agree	<b>72.9</b> %	56.5%	62.9%	71.3%

#### Formative Digital Assessment

SURVEY ITEM	RESPONSE	ΡΥΡ	MYP	DP	СР	
I currently use digital FORMATIVE assessment	Yes	31.1%	51.1%	38.2%	47.3%	
Of those respondents who use digital formative assessment						
I think that the use of digital FORMATIVE assessment influences changes in						
My teaching						
My ability to use data insights to inform my teaching	Quite a lot/A great deal	67.2%	48.8%	63.4%	84.3%	
The way in which I plan my teaching	Quite a lot/A great deal	63.8%	58.5%	64.2%	76.0%	
The way in which I select activities and tools for use in teaching	Quite a lot/A great deal	73.0%	63.4%	71.9%	72.5%	
My approach to content	Quite a lot/A great deal	62.9%	51.2%	56.3%	72.5%	
The teaching strategies I use	Quite a lot/A great deal	62. <b>9</b> %	61.0%	63.2%	70.6%	
The way in which I manage my classrooms	Quite a lot/A great deal	53.9%	53.7%	58.4%	72.5%	
The homework that I set	Quite a lot/A great deal	51.7%	53.7%	66.5%	72.5%	
The way in which I monitor student learning	Quite a lot/A great deal	76.7%	58.5%	70.1%	82.4%	
Students	·					
~ The skills that students use	Quite a lot/A great deal	72.8%	50.0%	65.5%	76.5%	
~ The priority that students place on certain topics or skills	Quite a lot/A great deal	58.3%	38.9%	53.3%	60.8%	
~ The ability of students to monitor their own progress	Quite a lot/A great deal	<b>69.6</b> %	47.4%	74.2%	78.0%	
~ Strategies that students use in planning, monitoring and evaluating learning	Quite a lot/A great deal	56.6%	44.7%	61.4%	74.5%	
~ The likelihood that students will become more independent students	Quite a lot/A great deal	65.8%	52.6%	61.9%	74.5%	
~ The motivation and engagement of students	Quite a lot/A great deal	<b>76.</b> 1%	57.9%	61.1%	66.7%	
~ The strategies that students use to prepare for assessment	Quite a lot/A great deal	61.4%	47.4%	61.3%	74.5%	



SURVEY ITEM	RESPONSE	ΡΥΡ	MYP	DP	СР
My subject(s)					
~ The nature of the subject(s)	Quite a lot/A great deal	-	35.0%	34.6%	38.0%
~ The nature of learning objectives in the subject(s) I teach	Quite a lot/A great deal	-	35.0%	37.8%	48.0%
~ The prioritisation of conceptual understanding in my subject(s)	Quite a lot/A great deal	-	40.0%	43.7%	50.0%
~ The topic list in my subject(s)	Quite a lot/A great deal	-	25.0%	31.9%	36.0%
Assessment					
~ The ways in which the skills, knowledge and conceptual understanding of students can be assessed	Quite a lot/A great deal	62.2%	45.9%	61.1%	72.0%
~ The insights that I can gain into my students' learning strengths and needs	Quite a lot/A great deal	67.6%	48.6%	62.8%	80.0%
~ My ability to use data to inform adjustments to My teaching	Quite a lot/A great deal	72.1%	43.2%	66.5%	83.7%
~ The reliability and validity of assessments	Quite a lot/A great deal	65.8%	37.8%	53.3%	66.0%
~ The security of assessments	Quite a lot/A great deal	59.5%	37.8%	50.1%	65.3%
My professional role					
~ My opportunity to contribute to the development of e-assessment materials	Quite a lot/A great deal	61.6%	44.7%	54.5%	68.6%
~ My understanding of the role of digital technology in education	Quite a lot/A great deal	<b>68.8</b> %	70.3%	67.4%	78.4%
~ My understanding of formative assessment	Quite a lot/A great deal	59.8%	47.4%	50.9%	62.7%
~ My professional development needs	Quite a lot/A great deal	57.1%	50.0%	53.8%	66.7%
~ The professional development opportunities that I am being offered	Quite a lot/A great deal	60.4%	48.6%	50.5%	60.8%
~ My participation in the IB Educator Network	Quite a lot/A great deal	50.0%	42.1%	43.7%	56.9%
My collaboration with other teachers in my school	Quite a lot/A great deal	63.1%	44.7%	57.6%	58.8%

#### Summative Digital Assessment in the MYP

These survey items were only provided to respondents from the MYP.

SURVEY ITEM	RESPONSE	MYP
The school I teach in has opted to use e-assessment in the MYP	Yes	67.6%
For those respondents who responded 'Yes' to the previous item		
The amount of digital assessment that is used in the MYP is appropriate	Strongly agree/agree	47.9%
I am happy with how my school approaches the use of digital assessment in the MYP	Strongly agree/agree	39.5%
Schools should have advance access to the digital assessment platform used for MYP summative assessment to enable students to become familiar with it	Strongly agree/agree	85.1%
Schools should be able to use the same digital assessment platform as used in MYP summative assessments to build their own formative assessments	Strongly agree/agree	83.9%

#### **Summative Digital Assessment**

These items were written in two ways depending on respondents prior answers but the data has been collated here:

- For those who are using digital summative assessment what has been the impact?
- For those who have not used digital summative assessment what would be the impact?

SURVEY ITEM	RESPONSE	ΡΥΡ	MYP	DP	СР		
I think that the use of digital summative assessment influences / would influence changes in							
My teaching							
My ability to use data insights to inform my teaching	Quite a lot/A great deal	71.3%	58.8%	56.9%	71.6%		
The way in which I plan my teaching	Quite a lot/A great deal	79.4%	62.9%	56.5%	59.2%		
The way in which I select activities and tools for use in teaching	Quite a lot/A great deal	78.7%	62.9%	62.7%	61.4%		
My approach to content	Quite a lot/A great deal	73.3%	48.6%	49.5%	52.0%		
The teaching strategies I use	Quite a lot/A great deal	72.0%	54.3%	55.6%	55.6%		
The way in which I manage my classrooms	Quite a lot/A great deal	68.3%	48.6%	48.9%	47.0%		
The homework that I set	Quite a lot/A great deal	60.1%	48.6%	60.2%	57.4%		
The way in which I monitor student learning	Quite a lot/A great deal	72.0%	57.1%	63.7%	69.0%		
Students	·						
The skills that students use	Quite a lot/A great deal	84.7%	54.3%	55.3%	55.0%		
The ability of students to monitor their own progress	Quite a lot/A great deal	75.9%	57.1%	61.7%	71.7%		
The priority that students place on certain topics or skills	Quite a lot/A great deal	76.7%	48.6%	53.1%	56.0%		
The strategies that students use in planning, monitoring and evaluating their I learning	Quite a lot/A great deal	69.5%	57.1%	59.1%	67.0%		
The likelihood that students will become more independent students	Quite a lot/A great deal	81.5%	57.1%	52.3%	62.0%		

SURVEY ITEM	RESPONSE	ΡΥΡ	MYP	DP	СР
The motivation and engagement of students	Quite a lot/A great deal	88.4%	48.6%	49.0%	58.2%
The strategies that students use to prepare for assessment	Quite a lot/A great deal	80.4%	57.1%		
My subject(s)					
The nature of the subject(s)	Quite a lot/A great deal	-	25.7%	33.5%	34.3%
The nature of learning objectives in the subject(s) I teach	Quite a lot/A great deal	-	31.4%	36.4%	38.4%
The prioritisation of conceptual understanding in my subject(s)	Quite a lot/A great deal	-	42.9%	38.6%	42.9%
The topic list in my subject(s)	Quite a lot/A great deal	-	37.1%	30.6%	33.3%
Assessment					
The ways in which the skills, knowledge and conceptual understanding of students can be assessed	Quite a lot/A great deal	62.7%	57.1%	59.0%	69.1%
The insights that I can gain into my students' learning strengths and needs	Quite a lot/A great deal	74.7%	54.3%	54.2%	<b>69.</b> 1%
My ability to use data to inform adjustments to My teaching	Quite a lot/A great deal	67.7%	54.3%	57.6%	71.1%
The reliability and validity of assessments	Quite a lot/A great deal	64.6%	54.3%	51.4%	63.9%
The security of assessments	Quite a lot/A great deal	60.0%	60.0%	52.5%	64.9%
My professional role	·				
My opportunity to contribute to the development of e-assessment materials	Quite a lot/A great deal	65.4%	45.7%	54.9%	62.2%
My understanding of the role of digital technology in education	Quite a lot/A great deal	78.5%	60.0%	60.5%	63.9%
My understanding of formative assessment	Quite a lot/A great deal	61.9%	54.3%	45.1%	49.5%
My professional development needs	Quite a lot/A great deal	67.5%	48.6%	53.9%	48.5%
The professional development opportunities that I am being offered	Quite a lot/A great deal	64.2%	45.7%	52.9%	55.1%
My participation in the IB Educator Network	Quite a lot/A great deal	61.3%	40.0%	50.0%	55.7%
My collaboration with other teachers in my school	Quite a lot/A great deal	75.5%	34.3%	52.6%	56.1%
# Type of Digital Assessment

SURVEY ITEM	RESPONSE	PYP	MYP	DP	СР
I think that - if used – FORMATIVE digital assessment should be					
A substitute for a paper based examination with no change to the type of tasks students	Voc	13.0%	0.0%	13.0%	13.0%
are asked to complete	Tes	13.0%	0.7/0	13.0%	13.0%
Very similar to a paper based examination but with the inclusion of some new functions	Yos	195%	26.8%	25.8%	26.0%
for students to use eg an embedded video or a digital calculator	165	17.5%	20.076	23.0%	20.076
Quite distinct from a paper based examination with tasks for students that are different					
to those on a paper based test such as the creation of multimedia elements to convey	Yes	29.5%	23.6%	22.0%	24.9%
ideas and collaborative task					
Very different from a paper based examination, including innovative tasks for students					
that would not be possible on a paper based test, such as the use of a variety of	Yes	37.1%	22.0%	27.4%	26.0%
multimedia to collect, communicate and distribute findings and conclusions					

SURVEY ITEM	RESPONSE	MYP	DP	СР
I think that - if used – SUMMATIVE digital assessment should be	•			
A substitute for a paper based examination with no change to the type of tasks students are asked	Yes	10.6%	15.9%	13.0%
to complete	165	10.076	13.7/0	13.0%
Very similar to a paper based examination but with the inclusion of some new functions for	Yes	27.6%	30.9%	23.7%
students to use eg an embedded video or a digital calculator	163	27.070	50.770	23.770
Quite distinct from a paper based examination with tasks for students that are different to those on				
a paper based test such as the creation of multimedia elements to convey ideas and collaborative	Yes	19.5%	19.6%	22.6%
task				
Very different from a paper based examination, including innovative tasks for students that would				
not be possible on a paper based test, such as the use of a variety of multimedia to collect,	Yes	24.4%	23.7%	22.0%
communicate and distribute findings and conclusions				

## Use of Digital Pedagogy

Any cases where 2/3 or more of respondents agreed are highlighted

SURVEY ITEM	RESPONSE	ΡΥΡ	MYP	DP	СР
I integrate digital pedagogy into my teaching	In most lessons	26.6%	32.0%	35.1%	50.0%
I choose to integrate digital pedagogy into my teaching mainly in					
Certain year levels	Yes	14.9%	15.7%	13.3%	12.6%
Certain subjects	Yes	21.0%	14.9%	11.0%	14.3%
Certain topics	Yes	12.4%	25.6%	15.2%	9.7%
Certain skills	Yes	13.8%	14.0%	13.4%	7.4%
Certain competencies	Yes	4.8%	8.3%	6.4%	5.1%
When I integrate digital pedagogy into my teaching it changes					
The way I plan lessons	Quite a lot/A great deal	65.2%	68.1%	58.4%	55.8%
The way I select teaching resources	Quite a lot/A great deal	<b>77.9</b> %	75.0%	71.1%	67.4%
The way I manage my classrooms	Quite a lot/A great deal	61.3%	53.7%	50.7%	58.8%
The way I select activities classroom activities	Quite a lot/A great deal	71.5%	67.6%	65.1%	72.4%
The way I define learning outcomes for my students	Quite a lot/A great deal	54.8%	44.1%	43.6%	52.3%
The way I collect evidence of student learning	Quite a lot/A great deal	69.4%	66.7%	58.5%	<b>75.9%</b>
The way I use data on student learning to inform my teaching	Quite a lot/A great deal	62.6%	55.1%	53.5%	74.4%
The way I provide feedback to students	Quite a lot/A great deal	60.6%	50.0%	57.9%	73.6%
The way I set homework	Quite a lot/A great deal	44.8%	52.2%	56.6%	61.6%

SURVEY ITEM	RESPONSE	PYP	MYP	DP	СР
I believe that the integration of digital pedagogy into teaching can help students					
To become more inquiring	Quite a lot/A great deal	81.6%	64.3%	63.3%	75.8%
To become more knowledgeable	Quite a lot/A great deal	84.7%	64.7%	61.7%	73.6%
To become deeper thinkers	Quite a lot/A great deal	69.7%	49.3%	51.9%	57.8%
To become better communicators	Quite a lot/A great deal	69.7%	54.3%	56.8%	65.9%
To become more principled	Quite a lot/A great deal	56.1%	32.9%	38.7%	50.5%
To become more open-minded	Quite a lot/A great deal	74.5%	61.4%	54.9%	72.5%
To become more caring	Quite a lot/A great deal	44.5%	27.1%	34.1%	41.8%
To take more risks	Quite a lot/A great deal	66.7%	49.3%	49.8%	63.7%
To be more balanced	Quite a lot/A great deal	52. <b>9</b> %	36.8%	43.0%	52.7%
To be more reflective	Quite a lot/A great deal	70.1%	46.4%	51.9%	69.2%
I believe that the integration of digital pedagogy into teaching can help teachers					
To improve their direct instruction	Quite a lot/A great deal	67.4%	64.3%	60.0%	61.8%
To enhance the quality of student interaction	Quite a lot/A great deal	65.3%	45.7%	52.7%	67.0%
To stimulate enquiry based learning	Quite a lot/A great deal	76.9%	64.8%	65.7%	76.4%
To facilitate effective small group work	Quite a lot/A great deal	68.3%	55.7%	60.2%	70.5%
To encourage effective peer tutoring	Quite a lot/A great deal	61.4%	43.7%	53.9%	64.0%
To support students to become independent students	Quite a lot/A great deal	77.8%	59.2%	66.1%	76.4%
To motivate and engage students	Quite a lot/A great deal	79.6%	65.2%	65.2%	71.9%
To cater to a range of learning styles	Quite a lot/A great deal	79.2%	70.6%	69.6%	82.0%
To identify students' learning strengths and needs	Quite a lot/A great deal	69.7%	50.7%	58.1%	73.0%
To increase their amount of collaboration with other teachers	Quite a lot/A great deal	69.4%	50.0%	57.9%	67.0%

# Barriers to Use of Digital Pedagogy

Any cases where 2/3 or more of respondents agreed are highlighted

SURVEY ITEM	RESPONSE	ΡΥΡ	MYP	DP	СР	
I integrate digital pedagogy into my teaching	Never	6.7%	2.7%	3.4%	2.0%	
For those respondents who responded that they never integrated digital pedagogy into their teaching						
The following factors prevent me from integrating digital pedagogy into my teaching	ıg ~					
~ I am not interested in integrating digital pedagogy in my teaching	Yes	0.8%	2.0%	0.9%		
~ Digital pedagogy is not relevant for the PYP programme	Yes			0.8%		
~ It would take too much time to plan lessons that use digital pedagogy	Yes	I. <b>9</b> %		1.6%		
~ I do not feel confident in my skills in integrating digital pedagogy in my teaching	Yes	3.1%		1.8%		
~ I cannot access the resources I need to integrate digital pedagogy in my teaching	Yes	3.1%	2.0%	1.6%	1.1%	
~ I do not receive any support in integrating digital pedagogy in my teaching	Yes	2.3%		1.7%	1.1%	

## Support to use More Digital Pedagogy

Any cases where 2/3 or more of respondents agreed are highlighted

SURVEY ITEM	RESPONSE	ΡΥΡ	MYP	DP	СР
The following factors would encourage me to integrate digital pedagogy into my teaching more than I do at the moment					
Access to relevant professional development (inside or outside my school)	Quite a lot/A great deal	<b>79.6</b> %	62.0%	67.8%	<b>76.</b> 1%
Online modules to teach me how to use different digital applications in teaching	Quite a lot/A great deal	73.5%	55.7%	64.6%	70.8%
More confidence in my technological skills	Quite a lot/A great deal	68.5%	58.6%	56.7%	61.8%
Being able to learn from other teachers in my school	Quite a lot/A great deal	75.2%	61.4%	59.1%	67.4%

#### Students' Ability to Use Digital Technologies

Any cases where 2/3 or more of respondents agreed are highlighted

SURVEY ITEM	RESPONSE	PYP	MYP	DP	СР	
I estimate that of my students can use digital technologies to do the following						
Participate in digital networks for learning	Most/All	45.4%	50.0%	64.2%	<b>80.9</b> %	
Manage digital reputation and online identity	Most/All	34.1%	29.2%	53.1%	64.9%	
Adopt, adapt and use digital devices, applications and services	Most/All	50.5%	48.6%	68.8%	79.6%	
Study and learn effectively in technology rich environments	Most/All	55.6%	38.9%	58.3%	74.5%	
Find, interpret, evaluate, manage and share information	Most/All	45.4%	62.5%	60.8%	<b>69.9</b> %	
Critically read and creatively produce communications in a range of media	Most/All	36.3%	33.3%	48.3%	58.5%	
Participate in emerging educational practices that depend on digital systems	Most/All	44.7%	45.1%	52.4%	60.2%	