May 2016 subject reports

Design Technology

Overall grade boundaries

Higher level

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 14	15 - 28	29 - 40	41 - 51	52 - 62	63 - 74	75 - 100

Standard level

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 16	17 - 30	31 - 44	45 - 54	55 - 64	65 - 74	75 - 100

Introduction

Prior to the first examination session based on the new course many teachers had expressed concerns that, compared to the previous Subject Guide, they found many aspects of the current Subject Guide unclear in terms of expectations which made construction of a suitable Scheme of Work and preparing candidates for examinations difficult. Examination paper authors, moderators and script markers were sympathetic to the views expressed by experienced teachers and members of the Grade Award committee looked very closely at teacher feedback via the G2 forms and gave consideration to the context in which the first assessment took place when setting grade boundaries.

To provide as much support to teachers as possible this Subject Report will be both summative (reporting on the performance of candidates in the different components) as well as formative (providing guidance on the depth of coverage required, particularly at Higher Level (HL)). It will also outline how teachers can effectively manage the transition from the traditional paper based system of moderation of the Design Project to its online assessment from May 2017 onwards.

Higher level internal assessment

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 7	8 - 15	16 - 22	23 - 28	29 - 34	35 - 40	41 - 54

The range and suitability of the work submitted

Teachers should note that many of these comments are also applicable to the SL Design Project.

Teachers should note that moderators do not need to see evidence of the full Practical Programme other than the Design Project and the summative report of the Group Four Project. Moderators are not in a position, therefore, to provide feedback on the Practical Programme and how it supports the execution of the Design Project.

Unfortunately, some candidates failed to adhere to the overall page limit (see Guide page 97) – moderators were instructed not to credit work contained on pages beyond the maximum allowed – which led to candidates effectively self-penalising. The Subject Guide states that the page limit refers to A4 size (or its equivalent) so candidates who worked on A3 size paper needed to appreciate that each A3 page was equivalent to two A4 pages. Candidates were not penalised for exceeding recommended page limits related to individual assessment criteria, as specified in the Teacher Support Material, provided the overall page limit was not exceeded.

Some candidates made reference to important information contained in appendices. Appendices should not be used, see post on the OCC of 31st August 2016. In this examination session, due to teachers not receiving this information, candidates were not penalised if the content within the appendices was within the page limit specified in the Guide. In May 2017 and for future examination sessions appendices will not be permitted.

It was also clear that for some projects pages had been reduced in size to meet the A4 page limit. Unfortunately, in many cases, this ‘shrink to fit’ resulted in a font size which was very small and unreadable, especially on some annotations. Guidance will be provided in the eCoursework documentation to inform schools that should candidates submit work in a font size smaller than 11, the work will not be credited.

The implications of the font size requirements for teachers and candidates are that more time will be required to synthesise the research findings and analyses prior to the final writing of the extended text. Candidates who simply ‘dump’ everything will find out their research is unlikely to achieve high marks.

Teachers should also think about the sketches they use and ensure that any sketches do not become too feint to be legible once scanned. Teachers are advised to devote a reasonable percentage of the 60 hours allotted to the Design Project to planning an appropriate schedule and the organisation of the work within it.

Teachers were asked to provide notes to moderators justifying the marks awarded. Many teachers did this by highlighting assessment criteria they deemed appropriate within the level descriptors and by making references to key evidence in the Design Project. This practice was very helpful to moderators especially if they disagreed with the teacher assessment and appropriate feedback could then be provided. Not all teachers provided notes to assist moderators which was a pity and moderators commented accordingly on the Feedback Form.

It is likely that further instructions will be provided concerning the submission of the internally assessed work from May 2017 onwards. This will be posted on the OCC and on IBIS.

P13 of the Subject Guide shows the iterative nature of the DP design cycle clearly illustrated including links between the four 'core' aspects and the two HL only aspects. P96 of the Guide states 'award the marks for the upper level if the work demonstrates the qualities to a great extent OR the lower level if it demonstrates qualities to a less extent.' It is quite common for evidence relating to one criterion to straddle two (or even three) level descriptors. Judgment needed to be made to decide how much of the evidence fitted the criteria for the different level descriptors and what summative [best fit] mark to apply for that particular aspect.

On P97 of the Guide teachers are advised that 'the task produced should be complex and commensurate with the level of the course.' Teachers need to ensure that candidates embark on a Design Project appropriate to the level of study and which has scope for a fresh approach to the problem.

Candidate performance against each criterion

Criterion A

Prior to stating the design brief candidates should provide evidence of exploration into the design problem or opportunity in a chosen or given context. Teachers who set a common theme to explore need to ensure that each candidate carries out individual research and is able to identify a unique problem, leading to a design brief which normally takes the form of a set of instructions or 'needs' from a client. In practice, projects constrained to themes or set problems often limited access to the full mark range. The best work was from candidates who had fully analysed a problem, found data to back up its feasibility and considered the market opportunity appropriately.

The specifications should not be just a list of requirements but an explanation of the relative importance of the requirements in order to satisfy the design brief. Sometimes teachers provide candidates with a generic list of specifications e.g. safety; aesthetics etc. but many candidates did not use this starting point to relate the categories to their particular design context in order to compile a detailed set of specifications containing 'all of the requirements,

constraints and considerations' which were 'specific, feasible and measurable.' For the "design specification" nine 'requirements, constraints and considerations' are listed in the Subject Guide and the level of 'specificity, feasibility and measurability' will depend on the nature of the proposal. In many instances it was clear that further guidance was needed to ensure candidates were able to compile suitable specifications.

The "marketing specification" requires candidates to summarize information obtained about potential users and markets, competing or comparable products along with the general characteristics of an appropriate target market requiring a new or improved design. 'An appraisal of economic viability of the proposed design from a market perspective is important taking into account fixed and variable costs and pricing.' Fixed and variable costs and pricing relate to a proposed scale of production (commercial production) so even though the intended outcome may be a prototype manufactured in a school workshop by craft production it will be used to evaluate marketability via commercial production and the "brief" needs to reflect that. More detail of cost breakdown and marketing the final design will be shown for Criterion E and Criterion F. Evidence should be clear to justify the chosen market sector or segment.

Criterion B

Marks for Criterion B are differentiated by the extent to which candidates have explored, evaluated and refined ideas. For high marks genuinely alternative ideas need to be generated i.e. something novel about each one, not just a rehash of existing solutions. Annotations should show how the ideas impact on users, manufacturing and other important criteria stated in the brief and specifications e.g. the environment. The chosen design context should provide enough information about shape/form, size etc. but more precise information will be provided at the "detailed design" stage as a result of further development.

There was quite a large amount of evidence in sample project work of conceptual modelling both graphical and physical but not that much evidence of the use of tests/experiments e.g. tests to explore construction aspects, types of finishes etc. and experiments relating to properties of materials etc. Not enough candidates revisited the validity of the specifications now that they were trying to put them into action and in many instances it was obvious that further research was required but candidates were too engaged in a linear approach to oscillate between research and development. The best work displayed a wide range of original ideas, presented using appropriate techniques with detailed annotations.

Criterion C

Most candidates manufactured their own prototype and by doing so were able to identify potential weaknesses and have the chance to rectify them via more development. If the prototype is outsourced for manufacture it is important that documentation clearly shows that the candidate has retained "ownership" of the design and the prototype has been manufactured to their instructions/drawings. There is a danger that the design may have been taken over by a third party who has modified it based on their expertise and experience in order to make it more feasible. Teachers need to ensure that the Design Project remains the work of the candidate and that collaboration with others falls within the normal parameters of research/guidance. There was plenty of evidence of effective use of CAD and CAM but some

candidates clearly needed more guidance and exposure to such software to gain benefit during development and detailing of the chosen solution. The very best work made clear justifications for different choices of materials, fixings, construction and manufacture. Candidates had weighed up the alternatives and made judgements when considering cost, availability, stock availability and manufacturing limitations for the prototype. Unfortunately, many candidates listed their choices only and detailing for manufacture in the form of orthographic drawings or suitable alternatives was lacking. Far too many candidates did not plan effectively for manufacture taking into account sequencing, quality control and risk assessment but merely provided a retrospective "diary" of prototype manufacture which was inappropriate.

Criterion D

Candidates have been instructed to 'evaluate the success of the solution against the marketing specifications' which includes market analysis, competition and target market. To access the highest level descriptor the evidence needs to be objective e.g. from user trials, expert appraisal etc. Higher level candidate should consider the extent to which the outcome has potential for success in the marketplace and therefore what further development is required for commercial production at an appropriate scale forming the basis for modifications (Criterion E). When evaluating the success of the solution against the design specification technical feasibility is the key issue and able candidates are likely to suggest areas of uncertainty with the design and what else should be done though probably beyond the scope of their project in terms of time and resources. Some candidates did this well except that in the process they lost sight of the requirements of the marketing specifications. Physical prototypes that could be tested for functionality generally performed better in this section. The very best work showed evidence of a strategy for testing which included client feedback, expert appraisal and user research/observations with detailed drawings to address weaknesses identified through the testing.

Criterion E

This section proved quite problematic for many candidates. Much of the evidence seen during the moderation process was hypothetical in nature and unrealistic in practice. Although some candidates identified a scale of production they considered suitable for commercial production they did not relate this to the type of product and how to launch it to market. For example, "batch production" was often identified but no specific batch size such as 25,000 for the first production run followed by larger batch sizes if the product sold well. Evidence for Criterion E is linked to evidence for Criterion F therefore, as the analysis of costs will be based on production volume and promotion strategies will ensure feedback and control of costs.

Many candidates suggested modifications for commercial production which were theoretically possible but would not make commercial sense given market conditions. If candidates did not consider the holistic nature of the design cycle when compiling the "brief" and "specifications" then evidence for Criterion E and Criterion F tended to be 'tagged on' and poorly researched.

Criterion F

Many candidates seemed to focus on a sales price without much justification except for competitor pricing. Unfortunately, in many cases the nature of the final product and associated commercial production resulted in an unrealistic price. Evidence is required of a logical process using realistic data relating to aspects of economic viability such as likely unit costs, sales volume, selling price and financial returns. Moderators are looking to credit candidates who have made a genuine attempt to quantify the costs that contribute to the final cost of the product. It was common for figures to be almost 'plucked from the ether' which made a meaningful discussion of the appropriateness of the sales price impossible.

The example below shows how a particular framework can be used to determine and appropriate sale price. It should be noted that there are many alternatives to this approach and candidates must be aware of how the theory relating to price setting can be applied to their individual circumstances. It should also be noted that a number of assumptions need to be made about the nature of production and costs etc.

"The production of the compost tea collector is outsourced to a factory. The compost tea collector is initially produced in a one-off batch of 1200 units *(assumption based on evidence of potential initial market size)*.

For simplicity energy costs are subsumed into the cost of using the machinery *(assumption made to simplify calculations).*

As the labour cost is a one-off payment it is included as a fixed cost. The batch takes one week to produce and requires 5 employees *(assumptions made to enable calculations of break-even)*.

All figures are in $

Fixed costs (FC)

Machinery	30 000
Labour	3 250
TOTAL	32 500

Variable costs (VC)

Cost of materials for each compost tea collector - $265.70

In this scenario these variable costs will be considered as a one-off fixed cost as the materials are purchased prior to the manufacture of the compost tea collector.

Total costs (TC) of producing batch of 1200 units.

TC = 32 500 + (1200 * 265.70)

TC = 351340

If the sale price is $350 (as proposed by the candidate)

Total revenue (TR) if all units sold

TR = 350 * 1200

TR = 420 000

Profit if all 1200 units sold = 68660 (420 000 – 351 400)

Break-even (BE) can be achieved by using the following calculation:

BE = TC / 350

BE = 351 340 / 350

BE = 1003.8, so 1004 units (approximately 80% of the batch needs to be sold to break even).

This gives a margin of safety of 196 units."

Note: If the break-even point of the compost tea collector is calculated using continuous flow and a variable cost of each unit of $268.41 ($265.70 + $2.71), the break-even point will be at 364 units.

BE = FC/Contribution

BE = 30000/82.59

BE = 363.24

BE = 364 units.

In this example minor costs such as storage and distribution are not considered as they would not impact significantly on the calculation for break-even but for other design contexts they may not be so minor and would need to be taken into account. Candidates should show that they are aware of all relevant costs even though they may not include minor ones in their calculation of bringing the product to market.

In the discussion about strategies for marketing the product candidates need to avoid making assumptions based on existing products or just stating "theory" from topics five and nine in the Subject Guide. These topics may be a useful reference point as long as candidates apply the strategies specifically to their type of product and the identified market. The discussion should take into account the original market research and subsequent research to justify the market, pricing and competition e.g. even though the research indicates a potentially large market the initial production run may be quite limited and promotion targeted at a small sector (local/national) in order to test the market and gain feedback. Candidates need to provide evidence to back up their strategies. Many candidates merely provided a list of promotion strategies with comments relating to potential effectiveness but with no consideration of the impact on costs. Not many candidates linked promotion strategies to volume production so they discussed tapping into a very large, often international, market but without considering how demand would be satisfied in terms of the rate of production, storage, distribution etc.

Recommendations for the teaching of future candidates

May 2016 is the last session for submitting sample work in hard copy by post as moderation will be done online in the future. This has implications for teachers in ensuring that all the requirements for electronic submission for the Design Project are understood and met. These requirements are shown below:

Presentation of eCoursework

The following formatting is required for written eCoursework. This ensures the work can be easily read on-screen by examiners as well as ensuring there is consistency between the diploma subjects:

- Use of fonts such as Arial, minimum font size 11 (where the language / script supports it),
- Single (or greater) line spacing
- Numbered pages
- Portrait orientation (rather than landscape) – except where it is necessary or appropriate.

For components with page limits

- It is not acceptable to 'shrink to fit' an eCoursework assignment to remain within page limits by reducing white space on the page, reducing A3 to A4 so the font size becomes less than 11 or choosing a non-standard font. Examiners are instructed not to credit work that has been 'shrunk to fit' in this way.

The change to online submission and moderating will mean there will be a number of changes to how teachers need to prepare their students.

- Candidates need to appreciate that work will be viewed online so drawings should be clear, especially sketches and / or annotations.

- All text must be at least font size 11. See the eCourseowrk guidance on formatting.

- Teachers should note the acceptable formats for the Design Project. This information will be available on the OCC, and from the DP Coordinator.

- Candidates should include only analysis of research material is relevant. There is a temptation for candidates to include all the research undertaken for the Design Project and let the moderator sort out what is relevant. It is usual that some research will not be directly relevant to solving the problem though possibly useful to the candidate in considering how to solve it. The Design Project should be an objectively structured document relating to how the design cycle has been used to identify and

solve the problem to the stage of launching the product on the market. In many May 2016 design projects many candidates included tables of data for anthropometrics, material properties, manufacturing techniques etc. with little analysis of their relevance or usefulness. Sometimes, it was obvious which type of materials would be used because of what was stated in the brief/specifications but then pages of textbook research material were also included relating to a wide range of materials, none of which were applicable to the context. Some candidates stated that they were constrained by the availability of materials at school which was understandable as long as they realised that the materials may not be ideally suited to the solution and at the evaluation stage put this into perspective and identified the most appropriate material(s). As with all IB DP academic work, research sources should be cited (footnotes).

- Teachers may want to set a final project deadline well in advance of the IB submission deadline for moderation so they can see that all aspects of the sample work adhere to the eCoursework requirements and can clearly be viewed in portrait mode (as this is how the moderator will view the work). The Interim deadlines could be used to review work for each stage of the design cycle.

Probably the most important guidance provided by teachers is for the selection of an appropriate Design Project. By the time the Design Project is undertaken teachers will know their candidates well and be aware of their capabilities and style of working. To access the highest level descriptors, candidates need to focus on a design context which suits their interest, has a potential outcome which is manageable given the skills and resources available and is suitable for commercial production if a Higher Level Design Project. Many candidates decided to focus on an already crowded market so the design brief needed to clearly identify the USP. Often candidate stated that they would achieve a competitive edge by designing a solution which undercut the competition but this was rarely an astute strategy as the completion was already well established, selling in high volume and so very competitively priced.

Teachers may want to consider using case studies in their teaching to show candidates how different types of products have emerged from the design cycle to be successful in the marketplace. Such case studies would reinforce understanding of theory topics, help candidates prepare for tackling Section B of Paper Three (HL only) and see how different aspects of the design cycle has been prioritised.

In general, teachers and their candidates are to be commended on their approach to addressing the new assessment criteria through arrange of innovative projects. The presentation of work overall was of a higher standard to the previous year.

Standard level internal assessment

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 5	6 - 10	11 - 15	16 - 19	20 - 23	24 - 27	28 - 36

The range and suitability of the work submitted

Please read the information in the HL Design Project section in conjunction with this text.

Further clarification is needed to ensure candidates stay within page limits and use of font size and style complies with the requirements for future electronic submissions. Most work complied with these guidelines, but where work wasn't focused or concise candidates generally lost marks for evaluation as work in excess of 38 pages was not assessed or by 'shrinking the work to fit' making it too small to be legible.

Many teachers provided a justification of the rationale they had used in determining the marks for each of the criteria, but unfortunately many teachers submitted work without this guiding information making moderation more problematic.

Most candidates were able to explore open ended projects which met a real need for a specified client. Projects that were constrained to themes or set problems often limited access to the full mark range.

The best work was from candidates who had fully analysed a problem, found data to back up its feasibility and considered the market opportunity. A wide range of suitable tasks were evident across the sample, from packaging solutions, furniture, fashion garments and electronic products. Physical prototypes that could be tested for functionality generally performed better in evaluation. Teachers need to guide candidates towards projects that can access all of the level descriptors of the assessment criteria.

Evidence and use of CAD and CAM was good, but some candidates need further guidance and exposure to such software if they are utilise its benefits during development and detailing of ideas.

Candidate performance against each criterion

Criterion A

Where pupils had identified and analysed a suitable problem that could address a market need, performance was usually able to access the highest level descriptor. Further guidance is needed to ensure candidates are able to write focused, measureable and justified specifications.

Criterion B

There was a significant difference in the quality of work presented for this criterion. The best work displayed a wide range of original ideas, which presented using appropriate techniques with detailed annotation. Reference to specifications was considered throughout and concept modelling refined ideas to develop ergonomics, function, aesthetics, etc. However, this was often not the case and far too many candidates either copied existing solutions, presented few ideas or did not offer any supporting annotation. Some candidates did little idea and modelling work, to the point where it was impossible to make a solution to the problem.

Criterion C

The very best work made clear justifications for different choices of materials, fixings, construction and manufacture. The candidates had weighed up the alternatives and made judgements when considering cost, availability, stock form, and manufacturing limitations in school. This of course was not always the case and far too many candidates listed their choices. Detailing for making in the form of orthographic drawings or suitable alternatives is still considered a weakness in most schools and further focus should be given to addressing this through the use of TDA time. Far too many candidates did not plan manufacture, or consider the need to suggest timings, quality control measures and risk assessment. The use of diary of making is not required and is seen as retrospective to planning.

Criterion D

This was generally not given sufficient time to be addressed fully. Testing was often superficial and did not consider a strategy for testing which included client feedback, expert appraisal of user observations. The very best work did include all of this and detailed drawings to address weaknesses identified through testing. Suggesting making outcomes, lighter, smaller, bigger, etc. was deemed to have lacked detail when making recommendations. More specific details are required.

Recommendations for the teaching of future candidates

Candidates need to be taught how to identify real life problems that address other user groups. Further teaching of presentation techniques for ideas, development and use of modelling strategies need to be explored. CAD should be utilised to aid detailing before manufacture. Interim deadlines need to be built in to planning of the course so as to leave sufficient time to address each criterion.

See the “Recommendations for the teaching of future candidates” in the HL Design Project section for guidance about meeting the eCoursework requirements.

In general, teachers and candidates are to be commended on their approach to addressing the new assessment criteria through a range of innovative projects.

Higher level paper one

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 10	11 - 16	17 - 22	23 - 26	27 - 29	30 - 33	34 - 39

General comments

Many thanks for the significant/record number of G2s we received for this session's papers - 21 G2s were received for the higher level paper 1. As we have commented in previous sessions the G2s are particularly useful to the examining team at the Grade Award. 1067 candidates sat the higher level paper 1.

95.24% (20) of the G2s said the difficulty of the paper was appropriate; 4.76% (1) said it was too difficult. 19.05% (4) said the paper was a little easier than the previous year's paper; 38.1% (8) said it was of a similar standard; 14.29% (3) said it was a little more difficult. 28.57% (6) respondents did not comment presumably because they were in new schools. With a mean mark of 27.33 compared to a mean mark of 25.51 for May 2015 the statistics would suggest that the paper was slightly easier.

In terms of clarity of wording 9.52% (2) thought was poor; 23.81% (5) thought it was fair; 28.57% (6) thought it was good; 38.1% (8) thought it was very good. In terms of presentation of the paper 14.29% (3) thought it was fair; 33.33% (7) thought it was good; 33.33% (7) thought it was very good and 19.05% (4) thought it was excellent.

It would have been useful to have more information on where teachers perceived there to be problems with the questions so the examining team/question setters can attempt to avoid such problems in future sessions. One message came through very strongly and that was that teachers do not favour questions featuring double negatives or "what is NOT". Message received and understood - the examining team will try to make sure these are minimised/eliminated in future sessions from May 2017 onwards (the November 2016 papers have already been signed off).

The difficulty (actually the easiness index, it is the percentage of candidates who got the correct answer) and discrimination indices for individual questions are shown in the table below:

Question	A	B	C	D	Difficulty	Discrimination
1	994	42	15	16	93.16	0.11
2	41	116	829	81	77.69	0.29
3	50	10	40	967	90.63	0.19
4	9	84	962	12	90.16	0.14
5	812	92	95	68	76.10	0.35
6	85	160	209	612	57.36	0.22
7	944	69	43	11	88.47	0.19
8	34	731	286	16	68.51	0.32
9	268	286	367	145	86.32	0.06
10	732	209	51	75	68.60	0.32
11	363	191	69	444	76.63	0.06
12*	511	51	327	178	.00	0.00
13	356	30	64	616	57.73	0.24
14	52	881	43	92	82.57	0.25
15	13	97	247	710	66.54	0.33
16	138	786	86	57	73.66	0.40
17	86	99	845	37	79.19	0.26
18	42	83	692	250	64.85	0.13
19	94	800	154	18	74.98	0.31
20	26	45	63	732	68.60	0.34
21	52	308	679	27	63.64	0.30
22	16	33	947	71	88.75	0.12
23	659	146	33	228	61.76	0.37
24	34	972	41	20	91.10	0.15
25	456	120	95	394	36.93	0.21
26	290	492	57	226	46.11	0.27
27	558	74	118	316	81.91	0.21
28	228	644	173	22	60.36	0.34
29	25	832	164	36	77.98	0.20
30	233	240	504	90	21.84	0.22
31	153	8	832	72	77.98	0.35
32	13	708	70	276	66.35	0.42
33	132	85	724	124	67.85	0.29
34	118	30	892	28	83.51	0.17
35	120	168	734	4	68.79	0.17
36	969	7	81	10	90.82	0.11
37	55	6	8	998	93.53	0.06
38	163	112	289	502	47.05	0.22
39	232	761	47	27	71.32	0.37
40	8	54	235	769	72.07	0.43

As can be seen, there were no negatively discriminating questions, i.e. questions where the higher scoring students got the question wrong. Negatively discriminating questions always get considerable attention from the examining team.

General comments on the paper included:

- Overall good paper with a few tricky questions as always – why are we even doing multiple choice questions still?

  An excellent comment but one that will have to be discussed at the next curriculum review. For this version of the Guide the decision was been taken to have a paper 1 comprising 40 multiple choice questions at higher level and 30 at standard level.

- Some of the questions and answers in Paper 1 were too vague for mule choice format.

  The examining team agrees that unless the precise design context is specified the questions could be considered ambiguous. This is an ongoing concern.

- The paper covered the syllabus content well and the questions seem to be well worded. From the paper it is evident that the content in topic 4 is extremely large.

- A fair paper

- It covered most of the topics with respect to syllabus content.

- A good paper. Students thought it was fair, no big surprises or concerns.

- Images and stem context should support the actual questions. For examples, a picture of a single bicycle associate with a bicycle produced in a range of sizes with adjustability is not appropriate. Instead the picture should show a range of sizes (or there shouldn't be a picture).

- Students thought the paper was suitable and checked a wide range of their understanding.

- A very well laid out paper and I think easier to access than in previous years.

- We think it is essential that the IB provides a glossary of technical terms that students need to know as there were far too many specific technical terms required in the paper. As teaching is entirely up to individual teacher, it is unfair to expect that every teacher is going to use the same specific terminology and definitions. Specifically 1) environmental impact matric, 2) subtractive manufacturing.

  The examining team wholeheartedly agrees with this comment and welcomes the initiative taken by a group of teachers to address this shortcoming.

Question 2

- The image of the bicycle should have been supportive of the question to be specific to the answer, so a range of the same model but different frame size so as to offer range and adjustability … paper writing/authoring error.

  It might have been better to use a different image but this was the image that was available. The stem makes the different frame sizes explicit and mentions about the maximum and minimum height of the seat. The table above shows that the students found the question fairly easy (78.14) although it was reasonably discriminating (0.24). No action was taken.

Question 6

- This question suggests that material costs would also reduce but this would not necessarily be the case if efficiency was increased and output and demand was higher.

  The examining team discussed this and agreed that while it was not perfect it was not a problem for most candidates. The questions would have been better is a specific design context had been made explicit.

Question 8

- Q2, 8 and 24 are pretty dull examples of products. Would be good to be exposing our students to more exciting products. I think as designers we have a responsibility to expose our students to highest examples of design whenever we can.

  Whilst philosophically the examining team agrees with this sentiment. In one sense the examining team cannot win – it is important that the design context is accessible to all candidates, which is a challenge in a global context. When more exciting products are selected as exemplars G2s have commented that they cannot see how candidates can be expected to understand the design context and therefore questions based on such contexts are unfair to candidates. Unfortunately mobile phones and bicycles are seen as being globally accessible and relevant to the candidate's age, interests and experience, and therefore are often selected as contexts for questions.

Question 9

- Could be legislation or cost. Legislation (B) could be correct as it requires companies to meet standards, but standards may be too low. Cost (C) could be correct, as it is a barrier in starting the technology, but may realize cost saving ultimately which is a driver.

  Agreed – the question would have benefitted by being placed in a specific design context. Action: A, B and C accepted as correct.

Question 11:

- Metal has been deposited by using FDM

  The examining team discussed this and agreed that A and D were possible responses. This aligned with the candidate's responses.

Question 19

- These techniques are not mentioned explicitly in guide or TSM, more clarification is needed. Just an assumption schools would have covered these.

  The guide should make explicit the techniques to be covered so that no assumptions need to be made by teachers/candidates.

- Why split a similar question into SL and HL? E.g. q19, 21 coca cola theme in HL paper (q27 in SL) – this doesn't matter to the student in an exam but could prove a challenge to explain to a class if both papers are used simultaneously either as a past paper or an aid to teaching – might the change in emphasis be a possible disadvantage to either group? Would asking for answers on common core topics and then an additional HL set of questions at the end of the paper be better? Perhaps like the sections A and B in other papers.

  The examining team takes on board these comments. The question did not seem to disadvantage the candidates. However, it must be noted that the primary purpose of the paper is an exam paper.

- Image not fully support the question should be a preform and the Coke PET bottle … or no images at all.

  The two images would probably have been the best solution to this problem.

Question 23

- Do users offer new solutions?

  Again, depending on examples given to students, this may not be the case.

Question 24

- Q2, 8 and 24 are pretty dull examples of products. Would be good to be exposing our students to more exciting products. I think as designers we have a responsibility to expose our students to highest examples of design whenever we can.

  Whilst philosophically the examining team agrees with this sentiment. In one sense the examining team cannot win – it is important that the design context is accessible to all candidates, which is a challenge in a global context. When more exciting products are selected as exemplars G2s have commented that they cannot see how candidates can be expected to understand the design context and therefore questions based on such contexts are unfair to candidates. Unfortunately mobile

phones and bicycles are seen as being globally accessible and relevant to the candidate's age, interests and experience, and therefore are often selected as contexts for questions.

Question 26

- Could be B or D.

  The examining team felt the correct response was D.

Question 29

- 'Most appropriate', poor wording, how can this be determined? Demographic suggests 'family size' but psychographic has 'lifestyle and social class'. Money will usually be a major factor but so are several others, both B and C could be accepted.

  Comments noted. The candidates overwhelmingly went for B.

Following consideration of the G2 comments A, B and C were accepted as correct for question 9. A and D were accepted as correct for question 11 and A and D as correct for question 27.

Standard level paper one

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 7	8 - 12	13 - 18	19 - 20	21 - 22	23 - 24	25 - 29

General comments

Again many thanks for the significant number of G2s we received for this session's papers - 14 G2s were received for the SL Paper 1 – a record in IB DP Design Technology terms. As we have commented in previous sessions the G2s are particularly useful to the examining team at the Grade Award. A total of 901 candidates sat the standard level paper 1.

85.71% (12) said the difficulty of the paper was appropriate; 14.29% (2) said it was too difficult. 14.29% (2) said the paper was a little easier than the previous year's paper; 64.29% (9) said it was of a similar standard; 14.29% (2) said it was a little more difficult. 7.14% (1) respondents did not comment presumably because they were in new schools.

In terms of clarity of wording 7.14% (1) said it was very poor; 14.29%% (2) thought was poor; 28.27% (4) thought it was fair; 50% (7) thought it was very good. In terms of presentation of the paper 7.14% (1) said it was very poor; 7.14% (1) thought it was fair; 14.29% (2) thought it was good; 42.86% (6) thought it was and 28.57% (4) thought it was excellent.

It would have been useful to have more information on where teachers perceived there to be problems with the questions so we can attempt to avoid such problems in future sessions.

The general comments on this paper were:

- Some of the questions were too vague for the multiple choice format.

  This is a fair comment - the design context needs to be specified.

- Considering the physics content (forces and levers) was supposed to be taken out of Design Technology, I was astonished to see a calculation question about torque. Here as it was covered in 1.1c Physiological factors on the Syllabus. The new text book only implies torque in Physiological factors on page 13 – using terms like leverage and grip force, not going into calculations at all. Seeing a question in the standard paper – equations were given – was disappointing as the topic cold have been covered more extensively if it was known.

  This comment relates to Paper 2 not Paper 1 and will be addressed in the report on the Paper 2.

- A good paper. Students thought it was fair, no big surprises or concerns.

  Thanks. Positive comments are as useful as negative comments!

- We think it is essential it is essential that the IB provide a glossary for of technical terms that students need to know as there were far too many specific technical terms required in the paper. As teaching is entirely up to the individual teacher, it is unfair to expect that every teacher is going to use the same specific term and definitions.

  The examining team wholeheartedly agrees with this comment and welcomes the initiative taken by a group of teachers to address this shortcoming.

The difficulty (actually the easiness index, it is the percentage of candidates who got the correct answer) and discrimination indices for individual questions are shown in the table below:

Question	A	B	C	D	Difficulty	Discrimination
1	810	49	19	23	89.90	0.18
2	43	116	704	38	78.14	0.24
3	779	104	15	3	86.46	0.25
4	54	21	52	774	85.90	0.26
5	5	54	819	22	90.90	0.14
6	634	113	86	68	70.37	0.33
7	57	147	174	523	58.05	0.28
8	39	592	253	17	65.70	0.37
9	30	56	704	111	78.14	0.38
10	20	52	245	584	64.82	0.42
11	201	275	312	113	87.46	0.20
12*	512	180	71	138	72.14	0.39
13	120	26	718	36	79.69	0.32
14	374	54	330	142	0.00	0.00
15	400	288	168	45	44.40	0.36
16	398	34	59	510	56.60	0.30
17	47	714	63	77	79.25	0.21
18	23	85	245	546	60.60	0.39
19	125	227	257	291	25.19	0.38
20	154	527	79	141	58.49	0.33
21	33	85	566	216	62.82	0.12
22	200	10	23	668	74.14	0.34
23	650	121	73	57	72.14	0.33
24	51	163	46	640	89.12	0.15
25	45	164	667	24	74.03	0.13
26	264	60	56	519	57.60	0.43
27	92	255	426	125	47.28	0.29
28	231	256	283	129	28.41	0.27
29	83	628	172	24	68.59	0.28
30	96	299	484	18	33.19	0.45

As can be seen, there were no negatively discriminating questions, i.e. questions where the higher scoring students got the question wrong. As mentioned above negatively discriminating questions always get considerable attention from the examining team.

In terms of G2 comments relating to specific questions:

Question 2

- The image of the bicycle should have been supportive of the question to be specific to the answer, so a range of the same model but different frame size so as to offer range and adjustability … paper writing/authoring error.

  It might have been better to use a different image but this was the image that was available. The stem makes the different frame sizes explicit and mentions about the maximum and minimum height of the seat. The table above shows that the students found the question fairly easy (78.14) although it was reasonably discriminating (0.24). No action was taken.

Question 2 and question 8

- Q2 and Q8 are pretty dull examples of products. Would be good to be exposing our students to more exciting products.

  In one sense the examining team cannot win – it is important that the design context is accessible to all candidates, which is a challenge in a global context. When more exciting products are selected as exemplars G2s have commented that they cannot see how candidates can be expected to understand the design context and therefore questions based on such contexts are unfair to candidates. Unfortunately mobile phones and bicycles are seen as being globally accessible and relevant to the candidate's age, interests and experience, and therefore are often selected as contexts for questions.

Question 10

- Though biomass emits CO2, the whole point of it is a net value of zero, so this confused the students a bit – maybe reword the question.

  The G2 comment emphasises the whole point of the question.

Question 11

- Could be legislation or cost. Legislation (B) could be correct as it requires companies to meet standards, but standards may be too low. Cost (C) could be correct, as it is a barrier in starting the technology, but may realize cost saving ultimately which is a driver.

  Agreed – the question would have benefitted by being placed in a specific design context. Action: A, B and C accepted as correct.

Question 13

- Graphic model: "visualization of an idea, often created on paper or software can be 2D or 3D …" Answer is?

  The authors felt the answer was C. Most candidates and the examining team agreed.

Question 17 and 19

- Both use 'what is NOT', which is explicitly mentioned as something not to do in the paper authoring guide.

  Apologies – comment noted and accepted.

Question 19

- What is not a characteristic of glass. The obvious answer is B – it has a crystalline structure. However answer D it is 100% recyclable. I have not found any products that are made from 100% glass. The obvious answer – it has a crystalline structure - was felt to be the right answer by the examining team. The candidates answered A 125, B 227, C 257, D 291. This may be an example of there the 'What is not structure' has caused a problem.

  Point about 'what is not' duly noted.

Question 29

- There is no clarification in the guide as to which shaping or manufacturing techniques students need to know (blow moulding and injection moulding should be explicitly mentioned in the guide or TSM if they are going to be assessed.

  The examining team agrees that the needs to be more detail in the guide or the TSM.

Question 27-30

- Poor resolution images

  The examining team felt the images were adequate for the purpose of the questions and should not have disadvantaged the candidates.

Following consideration of the G2 comments A, B and C were accepted as correct for question 11. A and D were accepted as correct for question 12 and B and D as correct for question 24.

Higher/Standard level paper two

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 5	6 - 11	12 - 15	16 - 21	22 - 26	27 - 32	33 - 50

General comments

The areas of the programme and examination which appeared difficult for the candidates

Candidates did not demonstrate a good understanding of some of the new concepts in the DT guide, including:

- Dematerialization
- Biodegradability
- Rogers' characteristics
- Biomechanics

The two calculation questions were not difficult, however, the conversion of units to get the correct answer and working proved confusing for some candidates.

The answer for the calculation question (1di) was either rounded up or down to varying degrees, or given with a range of different numerical values by the candidates.

The areas of the programme and examination in which candidates appeared well prepared

Overall, many questions particularly from Section A were accessible enough to allow the candidates to access a range of marks. There were some good responses to extended answer questions particularly the extended response question for (5d) Woven Easy chair and (7d) Babaolat Play Drive tennis racquet.

More candidates this year were concise with their answers, making good use of sub-headings and short statements rather than long sentences.

The strengths and weaknesses of the candidates in the treatment of individual questions

STRENGTHS
Section A

Q1 (a) (i) The majority of candidates answered this question well.

Q1 (b) (i) Provision of a good diagram/illustration helped candidates with this question

Q1 (c) (ii) Many candidates answered from the 'glass is brittle' cluster well

Q1 (d) (ii) A number of candidates linked their answer to the clear data provided in Figure 2b

Q1 (e) (ii) A number of candidates used the term 'deforestation' and achieved 2 marks

Q2 (b) Almost all candidates achieved 1 mark at least for grip, effort, and/or ease of use

Q3 Almost all candidates mentioned, 'high cost/time consuming' in their answers, a number of candidates also mentioned, 'low rate of production and less negative impact on the environment'.

Section B

Q5 (a) Almost all candidates achieved 1 mark at least for 'durability/resist fraying' or 'moisture resistant'

Q6 (a) (i) and (ii) The majority of candidates answered these questions well.

WEAKNESSES

Section A

Many candidates lost marks because they:

Q1 (b) (ii) Confused trademark with IP, patent, registered design and copyrights.

Q1 (d) (i) Incorrectly rounded the number of Tetra Pak cartons.

Q1 (e) (i) Discussed the effect of dematerialization on the environment rather than on the design of the carton. Many candidates did not understand the concept of 'dematerialization'.

Q2 (a) Candidates did not notice/know how to convert the units from mm to m.

Q4 Candidates did not understand the word ‘implications’ in the question. It was also clear many candidates did not understand the concept of ‘biodegradability’. Some candidates discussed the problems of non-biodegradable plastics in the environment. Very few candidates achieved 2-3 marks for this question.

Section B

Q5 (b) Very few candidates managed to obtain a full 3 marks for this question.

Q5 (c) Very few candidates managed to obtain 4 or more marks for this question. Candidates wrote in general terms and subjectively about the form and function of the chair

Q5 (d) Many candidates misunderstood the ‘durability’ aspect and achieved lower marks for that cluster but performed better on ‘production costs’ and ‘ease of maintenance’ clusters

Q6 (c) Very few candidates managed to obtain 4 or more marks for this question. There seemed to be confusion about the types of testing for feedback using each method and not enough focus on the advantages of each method of modeling.

Q6 (d) The concepts of ‘relative advantage’, ’complexity’ and/or ‘observability’ were not generally well understood. Many candidates answered this question poorly.

Q7 (a) Many candidates did not link ‘technology push’ to existing smart devices

Q7 (b) Only a few candidates used the term ‘obsolescence’ at all. Most discussed functional or technological aspects for 1-2 marks only. Very few candidates achieved 3 marks

Q7 (c) many candidates discussed ‘biomechanics’ from the perspective of ‘static’ and ‘dynamic’ data.
There was some overlap seen with this question and question 7d. Many candidates only achieved 1 mark from the second cluster relating to improving the racquet’s design

Q7 (d) The most accessible marks were for defining/clarifying the meaning of static and anthropometric data and/or discussing hand sizes in relation to percentile ranges.

Recommendations and guidance for the teaching of future candidates

- Remind candidates to make use of all the diagrams, graphs and photographs in the examination paper.
- Answer in clear concise sentences, (not bullet points except for state, list and identify questions).
- Do not repeat the question in the answer.
- Underline key words in the question to ensure the answer is clearly focused.

Higher level paper three

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 4	5 - 9	10 - 12	13 - 18	19 - 24	25 - 30	31 - 40

General comments

The areas of the programme and examination which appeared difficult for the candidates

This was the first examination for the new guide and was received well by the majority of centres that responded. This was borne out by the greatly reduced number of 'No Response' marks recorded.

One comment by some centres was that it concentrated too heavily on Topic 9. The Grade Award team agreed with this comment and it will be addressed in future papers.

A small number argued that the case study for Question 3 was too long. This was not felt to be the case by the majority of teachers or the Grade Award team. Indeed some teachers felt that was a good study, and this was supported by many candidates' responses. The change in the structure of HL Paper 3, with it having 15 minutes longer to obtain the same number of marks compared the previous version of the paper, is deliberately intended to provide a context for the candidates to develop more in-depth responses than may have been previously required. This additional 15 minutes can therefore be seen as an opportunity for candidates to read (more than once if necessary, especially important if the candidate is not a native speaker of English or Spanish) and assimilate the information as a starting point for the extended response questions towards the end of the paper.

The areas of the programme and examination in which candidates appeared well prepared

Much of the business elements of the new guide did not appear to have been taught and candidates were answering from a basis of general knowledge only. This applies specifically to Qu's 1c and 3e.

Whilst candidates could usually attempt a basic answer to the stem of a question, the extended responses often lacked structure, detailed knowledge and lost the focus for the response – often resulting in repetition.

The strengths and weaknesses of the candidates in the treatment of individual questions

Q.1a Well answered by the majority of candidates.

Q.1b. Candidate's generally understood Datschefski's principles, but did not restrict themselves to the 'social' aspect.

Q.1c. This question was not understood by the vast majority of candidates

Q.1d. Repetition of one or two points limited many candidates to 2 marks. Explanations were often not coherent.

Q.2a. Well answered by the majority of candidates

Q.2b. A disappointing number of candidates could not specify one of the aspects, considering at least three could be argued. Many more mixed up the definitions.

Q.2c. Most candidates were able to achieve one mark, but the majority did not explain that one designer is unlikely to understand all the user needs.

Q.2d. Once again, the lack of a coherent response lost candidates marks, with the majority concentrating on 'design improvement'. A significant minority thought that 'focus groups' were designers who 'focussed' on one aspect of the design.

Q.3a. Well answered by the majority of candidates.

Q.3b. Well answered by the majority of candidates, except for those who postulated that it was to make restaurant goers travel more miles and therefore wear out their tyres more quickly

Q.3c. Well answered by the majority of candidates.

Q.3d. Well answered by a significant proportion of candidates. Once again, a lack of a coherent response to a higher mark question limited the marks awarded to some candidate's responses.

Q.3e. This question tested the 'core' of the extra content of the new guide. Whilst knowledge of the 'basic' aspects of growth strategies was in evidence in many cases, it appeared to have been gained from simple internet searches. The deeper understanding of aspects, such as 'risk vs reward', had clearly not been taught or understood.
Many candidates completely mixed up the definitions.
Some of those who didn't were unable to give a relevant example – or used an incorrect one.
The vast majority failed to proffer any of the 'evaluative' comments which are required for a 'discuss' type question.

Recommendations and guidance for the teaching of future candidates

The new topics in the guide need to be considered in more depth.

With respect to candidates' approach to the actual examination:

- Repetition remains a weakness of candidates, as does repeating the stem of the question, assuming that this will receive a mark!
- Writing outside the space allowed, rather than using additional pages, can result in missed work by the examiner.
- Handwriting continues to deteriorate, making many scripts extremely difficult to read.
- The use of pens that 'bleed through' the paper results in scanning that is also difficult to read.