ITGS

Overall grade boundaries

Higher level

Grade:	1	2	3	4	5	6	7
Mark range:	0 – 12	13 – 25	26 – 39	40 – 50	51 – 60	61 – 71	72 - 100

Standard level

Grade:	1	2	3	4	5	6	7
Mark range:	0 – 11	12 – 23	24 – 34	35 – 46	47 – 57	58 – 69	70 - 100

Internal assessment

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 – 4	5 – 8	9 – 11	12 – 15	16 – 18	19 – 22	23 – 30

The range and suitability of the work submitted

ITGS Projects were submitted following the requirements stated in the Handbook of Procedures for 2017 Section B3.5 with the Project folder using the Forms.zip template and being within the 750MB limit. This zip folder included the cover_page, Documentation folder and files, Product folder and screencast.

In most cases the zip file also contained a *Teacher's Marks Justification* form. This form is important as it helps the moderator to understand the rationale of how the teacher awarded marks and to provide appropriate feedback if the teacher's interpretation of the criteria is awry.

In some school samples there was an appropriate diversity in the range of products developed. These usually included problems for clients in a school or business environment. In other cases, it was clear that the starting point was not the client and problem as required, but was driven by creating a specific type of product and then identifying a client. These samples consisted of very similar products such as websites developed with the same features or databases with similar structures. This is an inappropriate approach for the ITGS Project.

There were some instances where the clients were under the age of 18 years old. In these cases, an adult co-client must be involved in all of the stages of developing the ITGS Project from Criterion A through Criterion F.

The choice of the IT products was, in almost all instances, appropriate for the client's needs and the requirements for the ITGS Project. Websites made with online web development tools or online services tended to be more successful than those developed by using code. There were also other IT solutions such as videos, desktop-published documents and databases.

The major shortcomings in the ITGS Projects were that a number of candidates:
- Did not understand the specific requirements of the various assessment criteria as they relate to their product.
- Did not conduct adequate research and investigation necessary for the design and development for the type of product being created.
- Did not work closely with their client throughout all of the stages of development that is set out in Criterion A through Criterion F.
- There was insufficient content included in the product to provide an insight into its functionality or appropriateness.

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Specific concerns included:

- Candidates must follow IB guidelines for submitting IA work. The candidate number must not appear on the cover page or be indicated in the screencast.
- Candidates in some schools did not have a clear understanding of the ITGS Project and the assessment criteria.
- Even though most projects used the forms.zip file, there were instances where candidates changed file names, folder names or the templates. This is not advisable because the cover page is setup to work with the original file and folder names. This lead to reduced marks for in Criterion G. Not using the templates can also lead to a loss of marks on other criteria.
- Documentation for some criteria was generic and lacked detail, especially Criterion B, Criterion C and Criterion D. Often references to specific client, problem, IT solution, tools, techniques and resources were not indicated.
- Most projects were submitted in .zip or .rar format. Please note .zip format is preferred because it is cross-platform and can be easily unzipped on both PC and Macintosh computers.
- Some screencasts were not submitted. This is a requirement in Criterion G. Screencasts should be submitted in a cross-platform format (i.e. mp4 or mov). File formats such as avi and wmv are not cross-platform.
- Candidates lost marks due to simple omissions and errors such as the links on the cover_page.htm did not work or a link on the cover page did not open the specific product. URLs for products and passwords must appear on the cover page.
- Some types of products (e.g. videos, DTP documents, products made with applications not commonly available to the moderator) must be submitted in the original file format and in a cross-platform format to ensure that the moderator can access the product. For example, a desktop publishing product made with Adobe InDesign needs to be saved in the Product folder in the original format and also in PDF format.
- Where products are websites and are only fully functional online or cannot be downloaded from online services, sufficient evidence from the making of the product must be provided in the Product folder. An empty Product folder may not be submitted.
- Some diagrams and screenshots in Criterion D and Criterion E were not accompanied by sufficient explanation, not appropriately labelled or were too small and illegible.
- Some screencasts had considerable background noise, were illegible or did not fully demonstrate that the product was fully functional.
- The techniques in Criterion E must be highlighted and it must be clear that the product contains sufficient content material.
- In instances where the word count exceeded 2000 words, only the documentation up to 2000 words can be awarded marks. No marks were awarded for the documentation that was beyond the 2000th word.

Candidate performance against each criterion

Criterion A: Initial investigation

The clients and their problems were largely appropriate for the Project and were identified in both the consultation and the investigation. However, in many cases the consultation between the candidate and the client was not well planned and did not provide sufficient evidence for Criterion A. Furthermore, the consultation did not always have a clear heading, name of interviewee, position of the interviewee, name of interviewer, date and method of interview.

Any ITGS Product which involves either the setup of a commercial product e.g. a school management system or involves a particular device e.g. RFID reader is not appropriate.

Major problems in Criterion A included:
- Candidates did not explain what approaches are currently being used / have been used in the past and why they are not successful.
- It was not clearly understood what a 'cited reference' means. The interviewee, their position, and date of the interview must be clearly stated in Criterion A in the Consultation and Investigation.
- The questions were not carefully considered in the consultation and, therefore, the investigation in Criterion A was superficial and lacked the depth required.
- In some cases, it was not clear what the proposed IT solution should achieve.

Criterion B: Analysis

The information in the Requirement Specification section often lacked detail and was incomplete.

IT terminology used in the subtitles; system interaction, input, output, processing and security does not appear to be understood and therefore the content either was incorrect or lacked the necessary detail. Often the names of the applications were not accurate or misspelled ie 'Microsoft Office' was listed instead of Microsoft Access which was the application used to create the product, 'imovie' was listed instead of 'iMovie'. Version numbers are helpful to moderators to access products.

There were inconsistencies between the resources listed in Criterion B and those indicated in Criterion D and Criterion E.

In some cases *Specific Performance Criteria* were stated as phrases, were not appropriate nor were well-considered. These *Specific Performance Criteria* must be stated with sufficient detail so that the criteria are unambiguous, realistic and measurable. The *Specific Performance Criteria* are the basis for the product testing in Criterion D and are specifically used in the feedback from the client and product evaluation for Criterion F.

The justification for the choice of the IT solution was often limited. Very few candidates considered how websites, desktop published products and videos would be publicized, distributed or accessed as part of their justification and how the product would address the

requirements of the client. The feasibility of the development of the solution and its implementation must be considered.

Criterion C: Product schedule

Project Schedules tended to be a generic list of tasks that could have been written for any product of the same type (e.g. website, publication, video or database). The entries were often not specific to the client, the problem being addressed, product or applications, tools and techniques used.

All stages of development must be included for Criterion A through Criterion F: planning, designing, developing, testing and implementing.

It was obvious, in some cases, that the Project Schedule was not planned, but maintained as each criterion was completed. Students need to plan the Project Schedule and then add rows and complete entries as needed throughout the development of the Project.

Criterion D: Product design

Candidates must not only research the tools that they will be using, but also research how to design products using those tools. Accepted ways of presenting both the overall structure and internal structure of the specific product were not always used. Databases, websites, DTP products and videos – all have accepted conventions for showing the overall structure and internal structure.

Additional research may be helpful to determine how problems of a similar nature have been addressed by a similar IT solution in the past.

Appropriate methods for showing the design of the particular product must be included including diagrams and sketches. They must have good quality and be legible. Some scanned images were too faint and some photographed images contained shadows. Screenshots from the product are not acceptable in Criterion D because the design process is completed before development takes place.

The list of resources must include the source of all of the resources required to create the product both the content and online services. This includes URLs wherever necessary. The list of techniques may include basic techniques and must include all of the non-basic appropriate techniques identified in Criterion E.

The depth of testing was quite variable. The tests carried out must directly relate to the *Specific Performance Criteria* in Criterion B and the overall functionality and content of the product. It should also include tests for the techniques identified in Criterion E.

Often the signature of the client was missing to indicate agreement with the design of the product.

Criterion E Product Development

Few projects achieved the higher marks, i.e. accessing the 6-7 markband. This was primarily due to the choice of inappropriate techniques and the overall structure of the actual product not being explained. Most projects described the techniques used in the development of the product **(how)**, but did not explain why they were appropriate or the choice of the technique over other possibilities **(why)**. This criterion is designed to **assess the choices the candidate makes**, and **why** they are appropriate for the product they are developing.

In many projects the sources were not cited in the explanation of the techniques.

Websites were the most common product. Where templates from online services are used as a starting point for the development of the website, they must be cited. Templated websites tend to include only basic techniques available through the provider. Candidates must give more consideration to the needs of the client and how to include appropriate techniques in their websites rather than opt for a quick and simplistic solution. (See *Guidance on the appropriateness of an information technology solution* on the OCC)

Text boxes on screenshots can point out how the tools were created and used. However, text boxes are not counted by word counting features in software. If the text within the text boxes provides descriptions or explanations, it will be considered as part of the overall word count. Please see additional guidance in the ITGS Teacher Support Material regarding word count. The same applies for the use of tables.

Where code has been used as a technique, two screenshots are needed:
- A screenshot of the code (with an accompanying explanation of what it does and why it is appropriate).
- A screenshot that shows the outcome of the code.

Criterion F: Product evaluation and future product development

The feedback from the client should focus on two types of questions; about the process of developing the product and to what extent the *Specific Performance Criteria* were met. Feedback that consisted of responses to yes/no questions provides little useful information in Criterion F. In some instances, the candidate provided only the feedback from the client and did not include any evaluation from the candidate which is required. Criterion F received no marks in these instances.

Additional criteria that have emerged during the development process or from consultation with the client may also be considered as part of the evaluation.

Questions relating to recommendations for the future development of the product may be included in the feedback from the client. More reflective thinking must be given to the future development of the product. Too often recommendations were made that should have been included in the current product or were superficial or unrealistic.

Similar to Criterion D, the signature from the client was missing in many instances.

Criterion G: Requirement elements

A few candidates did not submit screencasts. Although an audio commentary is not required, a silent screencast makes it difficult for the moderator to 'guess' what is actually being demonstrated. The size of the screencast must be limited to 5 minutes for maximum effectiveness. Moderators have been instructed not to view for more than 5 minutes.

The most common issue in this criterion was not having any evidence in the Product folder, except for a link to an online product. An empty product folder should not be submitted as this implies that no techniques were used in developing the product. It is unlikely that every image will be included with no adaptation of the original.

Forms.zip must be used for the Project. File names, folder names and the actual templates should not be changed, instead the files need to be saved to doc (or docx) while the Project is being developed and then to pdf format for submission. If this is done the links on cover pages will function properly. Only the product needs to be linked to the cover page.

The links on the cover page must be tested before the product is submitted and that the product and all of the documentation is accessible and functions properly. It is advised that this be tested on several different computers. There were instances where the pdf version of the documentation was not created properly. Fortunately, the doc (or docx) versions were included in the Documentation folder.

Recommendations for the teaching of future candidates

Only refer to the most recent ITGS Guide and use the new assessment criteria. Also read *Guidance on the appropriateness of an information technology solution*.

Review the Project section in previous ITGS subject reports which are available on the Online Curriculum Centre (OCC). Please note that there were changes from May 2015 onwards in Criterion E and Criterion G.

Guide candidates closely throughout the process of development which would include the following these steps for each criterion:
- The teacher explains the particular assessment criterion and the command terms used within the level descriptors.
- The teacher demonstrates the criterion by using exemplars from the Teacher Support Material (TSM).
- The candidate conducts research and investigations as needed for the particular IT solution.
- The candidate develops the criterion and submits it for feedback from the ITGS teacher. The teacher can comment on only one draft of a criterion.
- The candidate makes the necessary edits/adjustments before proceeding to the next criterion.
- If changes are made in one criterion, they may have an impact on others. The candidate ensures that all of the necessary changes are made before progressing to the next criterion.

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When the product is completed, the candidate proofreads all the documentation for content and layout and checks that the cover page, product and screencast function properly.

Further comments

Consult relevant information regarding the ITGS project on the OCC or the new *Programme Resource Centre*:

- *ITGS Subject Reports* from May 2016 and November 2016.
- *ITGS Guide* including updated Criterion E and Criterion G.
- *Teacher Support Material* which includes both information and exemplars.
- *Forms.zip* templates which must be used for the Project (link included in TSM).
- *Guidance on the appropriateness of an information technology solution* for the project.
- *IB Coordinator Notes* containing update notices for ITGS.

For professional development regarding the ITGS Project, please participate in:

- OCC ITGS Discussion Forum or join the new Programme Communities ITGS Discussions where questions and comments can be posted regarding the ITGS Project.
- ITGS online workshops (cat 1 & 2) or ITGS face-to-face workshops (cat 1 & 2, cat 3) where approaches to guiding the Project and specific Project samples are discussed.

Higher level paper one

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 – 7	8 – 14	15 – 22	23 – 28	29 – 35	36 – 41	42 - 60

General comments

Higher level (HL) Paper 1 and Standard level (SL) Paper 1 are separate components. However, many of the comments that apply to one component apply to the other. Given the overlap between the HL and SL papers (three out of the four SL questions also appeared on the HL paper), **comments offered for SL Paper 1 should be read in conjunction with those for HL Paper 1.**

In this session the three questions common to both papers were as follows:

Q1 - Airport luggage control

Q2 - Apurimac Health Centre

Q3 - Updating the Wisconsin High School (WHS) Database

The comments for these common questions are included within the HL Paper 1 comments on specific questions.

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

A number of candidates did not read the question carefully, particularly parts b and c. The most important skill in reading an exam question is understanding what is required to clearly address the command term used in the question.

Students should identify the key terms in the question in order to be able to focus on a clear answer. One way to teach students to do this is to create a system of quickly marking these elements in the question. Here is one example previously included in the November 16 Subject Report. It is not the only way to accomplish this goal.

Circle the command term. Please note that students need to be very familiar with the command terms and the kinds of responses they should elicit.

Draw a box around the number of responses required if applicable.

Use an arrow to indicate the stakeholder.

Underline key technical terms or key issues to address.
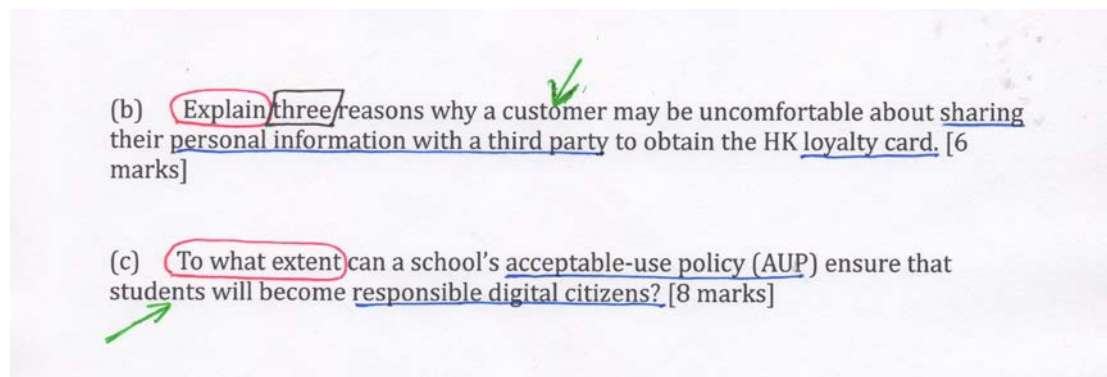
In part a questions, a few candidates are still writing fairly long answers for identify questions and therefore losing time that could be spent on extended response question.

In part b when the command term is "analyze" few candidates went beyond description to engage in analysis supported by reasoning and detail. Candidates had less trouble with explanations.

Part c of the questions posed the most significant problems. Some candidates are still writing lists, usually of advantages and disadvantages, sometimes with minimal description, and often in the form of bullet points. However, the command terms for question c should elicit developed arguments, not lists. To earn a 5 or above for these questions, candidates need to show evidence of critical thinking by providing arguments that are supported by reasoning, examples, and details. Some candidates did show evidence of the ability to apply what was learned in class to new situations.

These two examples from the November 16 Subject Report illustrate two approaches to question c.

In this first example note that the student is writing inductively. The main idea is the last sentence in the paragraph.

Student text	Comments
One of the issues that an AUP may educate students about is cyberbullying, and it may be included in a school's AUP that students should not use the internet to threaten or bully other students, for example by sending offensive messages or images over social networking websites.	*The student shows understanding of the nature of an AUP by describing a specific example.*

By including this in their AUP, schools can hold students accountable for their actions, as students will often have to sign the AUP at the start of the year. If a student then engages in cyberbullying behaviour, they will have breached the AUP and the school may punish them accordingly.	*Explains in detail how this use of the AUP might work.*
Hence, the use of an AUP may discourage students from cyberbullying by holding them accountable for their actions and making them aware of the consequences of such actions.	*Analyzes the impact of this use of an AUP.*
However, an AUP may not be enough to eliminate cyberbullying at schools.	*Introduces the idea that the impact previously explained may well be limited.*
An example, of this was a recent case of a secondary school in Victoria, Australia, in which images of students at the school were shared in a private Facebook group without the knowledge or permission of the people in the images	*Illustrates the point with a specific example which could have been discussed in class or could have come from the student's own reading.*
Even though an AUP was already in place, and students had been warned about the consequences of such behaviour, this ultimately did not deter them from behaving as irresponsible digital citizens.	*Draws the conclusion that impact of AUP can be limited.*

The second example, taken from a previous exam, illustrates a deductive approach to responding to a part c question. Note the use of words that clarify the logic of the argument such as hence and however, as well as the use of for example.

Note that the student has qualified the initial assertion by saying that the data must be protected and used properly. This sets up the disadvantages explained later in the essay.

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Underlying all of these issues is a lack of conceptual understanding of the technology and its impacts. Memorizing definitions and other information is not enough. What is needed is understanding and knowledge that a candidate can apply to new situations.

Answering "analyze" and "explain" questions can also be difficult for students. The command term asks students to explain **why** something occurs, **why** it is important to the point s/he is making, or **describe** the consequences of a policy/action/ uses of IT. Each of these requires specific support.

Most important, candidates did well when questions addressed technology they used in their own lives, but did poorly when understanding of concepts beyond their own experience was required. While that is quite reasonable, a major goal of education is to extend candidate's knowledge and understanding beyond their individual experience. This can be accomplished in a variety of ways both in and out of the classroom.

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

Being able to answer three questions instead of four gives the candidates the opportunity to think carefully and develop their ideas thoroughly. Candidates need to be taught how to take utilise their time when answering these type of question.

Additionally, candidates often seemed best prepared on what was most recently taught i.e. sections 3.10 and sometime 3.11 of the syllabus. This suggests that a systematic review of the entire course needs to be a significant part of exam preparation. Many candidates performed better in Section B than in Section A.

Candidates who did very well had clearly done more than memorize definitions, lists of attributes and so on. Instead, they had a deep enough understanding of what they had learned so they could apply it to a new scenario very effectively.

Overall, there were more candidates writing thoughtful answers to part c questions than in the past suggesting that teachers are helping students structure arguments and support them with analysis and examples.

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

Section A:

Question 1 (Airport luggage control):

(a)(i) Most candidates did well on this question.

(a)(ii) While some candidates could identify relevant steps, many did not realize that a database holds the needed information and that the 10-digit barcode number was needed to identify the relevant record.

(b) Many candidates were able to provide a partial analysis, often lacking some detail. Many candidates concentrated on RFID, forgetting about barcode printed tags.

(c) Most candidates were able to identify issues stated in the markscheme, but few were able to move beyond description and engage in analysis of these issues.

Question 2 (Apurimac Health Centre):

(a)(i), (a)(ii), and (a)(iii) Most candidates were able to gain marks on these questions.

(a)(iv) A number of students didn't focus on the key function of a spreadsheet i.e. to perform calculations.

(a)(v) A significant part of the candidates provided the role of ISP without proper identification of characteristics. Here the answers "provides an Internet connection" and "takes a monthly fee", that were provided in the stem, are not enough to achieve a mark.

(b) Candidates were usually able to identify positive/negative issues, but few were able to develop these specifically.

(c) Some candidates were not aware that the health centre had received 6 new computers with basic software. As a result, they were unable to use this information when evaluating the difference between the two options.

Question 3 (Updating the Wisconsin High School (WHS) Database):

(a)(i) Most candidates did well on this question demonstrating an understanding of validation and verification techniques.

(a)(ii) A number of candidates had a vague notion of the structure of a relational database but had difficulty describing that structure clearly and precisely.

(a)(iii) Most candidates could identify a parameter, but very few identified a logical condition.

(b) (i) Many candidates were able to explain two types of tests, usually alpha and beta. A number were able to explain a third type.

(c) Overall, candidates were able to identify strengths and weaknesses of both options and provide some descriptive. However, they had much more difficulty analyzing the impact of the choices on the functioning of the health centre.

Section B: all section B questions integrate Topics 3.10 and 3.11.

Question 4 (AI and cyber-bullying):

(a)(i) Many candidates were able to identify at least one characteristic. However, many did not have a conceptual understanding of machine learning beyond what is implied in the name itself.

(a) (ii) Many candidates were able to identify at least one use. But, as in (a) (i), a lack of conceptual understanding resulted in very vague answers in many cases.

(a)(iii) Most candidates were able to outline a limitation.

(b) (i) Candidates who understood phased changeover had no difficulty with this question.

(b)(ii) and (b)(iii) The majority of candidates did well on these questions.

(c) Candidates who focused on the impact on the employees and who had a good understanding of the strengths and limitations of AI produced answers that were very well developed. Some candidates focused on the managers and, thus, did not address the question that was asked.

Question 5 (Japan's robot hotel):

(i) Most candidates had little difficulty with this question; however, many did not quite understand how facial recognition software works.

(ii) The question asks about natural language not natural language software; this caused problems for some students.

(b) Many candidates did quite well on this question, especially those who referred to the specific robots and the problems that were cited in the question.

(c) Candidates who produced a very generic response citing common problems associated with robots without analytical development did poorly. Many however were able to discuss the specific scenario and many of those were able to develop a very well substantiated and analyzed argument.

Question 6 (Self-driving trucks):

(i) Candidates who had some knowledge of the uses of various types of sensors did well on this question.

(ii) Surprisingly, many candidates struggled with this question. One would expect that candidates could achieve one mark by saying something about step by step processes, but that was not the case.

(iii) Most candidates gained full marks on this question.

(b) (i) Many candidates had no clear conception of what is meant by pattern recognition.

(b) (ii) Many candidates had a very limited notion of the purposes of a feasibility study. Hence, they had difficulty explaining their answers in detail.

(c) Most candidates were able to able to describe benefits and disadvantages.

Question 7 (Saving elephants from poaching):

Very few candidates answered this question.

(a)(i) Most candidates were able to identify one or two characteristics of machine learning but the wording often lacked clarity suggesting an underlying lack of conceptual understanding.

(ii) candidates were able to identify ways to protect privacy, but some had difficulty adding description.

(i) For this question, candidates either knew the difference or they didn't. Again, those who had a conceptual understanding of both ideas did very well.

(b) (ii) candidates were often able to give a reason but had difficulty explaining it.

(c) A few candidates did not read the question carefully and did not deal with advertising campaigns. Some provided analysis but struggled with the extent to which the technology can be effective.

Recommendations and guidance for the teaching of future candidates

- Concepts should be taught in specific contexts so students can see how the concepts relate to real world conditions. Then, students should be presented with a new scenario (context) and asked to apply what they have learned to that new situation. This can be done by using current news articles from reliable sources and creating activities that require students to provide supported arguments and to evaluate the impacts of information technology on specific stakeholders.

- Students should keep a record of what is learned in class including copies/links to news articles discussed, notes on concepts which have been taught, copies of formative assessments and so. The format does not matter as long as the candidates have an organized body of material to review before the exam.

- Sample exams with comments will be provided in the Teacher Support Material. Teachers should check the OCC regularly to see when they will be available. In addition, a different set of examples will be provided for use in workshops.

- Teach students how to read questions carefully so that they do not miss key elements or misinterpret the question entirely.

- Students need to be thoroughly familiar with the markbands and the command terms. This can be done by using them for formative assessments, having students use them to evaluate their own work and/or the work of other students, and applying them to samples such as those available on the OCC.

- Often textbooks, news articles, and websites do not provide clear substantive explanations of topics related to artificial intelligence and robotics. For teachers, the best sources for understanding the basic concepts are often, take a deep breath, books. MIT and Oxford Press each have a series of books that are very short (100-200 pages), low cost, basic introductions to a number of technological topics. Occasionally they can become a bit obtuse but overall, they offer clear systematic explanations that are hard to extract from websites and article and develop concepts beyond the kind of comprehensive texts sometimes used in ITGS classes. They can be a good resource for teachers.

- An effective approach to teaching students how to develop an idea is to provide them with a sample answer to question c (or a similar writing prompt), project that on a screen so the entire group can see it, and then as a group revise the text so that it reaches a proficient level (detailed knowledge, ITGS terms, well supported and balanced analysis). Follow up activities could include having pairs of students do the same process, exchange their work with another pair of students so that each pair marks the other pair's work. Then can then discuss the result or present it to the entire group. These kinds of activities can begin with simple paragraphs that develop one idea and progress to more complex arguments. Writing exercises should be incorporated throughout the entire course.

Standard level paper one

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 – 4	5 – 8	9 – 13	14 – 17	18 – 22	23 – 26	27 - 40

General comments

Higher level (HL) Paper 1 and Standard level (SL) Paper 1 are separate components. However, many of the comments that apply to one component apply to the other. Given the overlap between the HL and SL papers (three out of the four SL questions also appeared on the HL paper), **comments offered for SL Paper 1 should be read in conjunction with those for HL Paper 1.**

In this session the three questions common to both papers were as follows:

Q1 - Airport luggage control

Q2 - Apurimac Health Centre

Q3 - Updating the Wisconsin High School (WHS) Database

The comments for these common questions are included within the HL Paper 1 comments on specific questions.

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

Given the overlap between the HL and SL papers these comments should be read in conjunction with those offered for the HL paper.

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

Teachers appear to be guiding candidates effectively about the need to make references to the scenario in their responses. However, some candidates are still writing responses that are inconsistent with the detailed context of the given scenarios.

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

In this session there were three questions that were common to both papers. They were as follows:

Q1 - Airport luggage control

Q2 - Apurimac Health Centre

Q3 - Updating the Wisconsin High School (WHS) database

The comments for these common questions are included within Section A of the HL Paper 1 comments on specific questions.

Question 4 (Wei Tan Enterprises):

(a)(i) Most candidates had a general idea that bandwidth had some connection to the transfer of data. A sufficiently precise understanding that included the element of time (e.g. the amount of data transferred in a given amount of time) or the units involved (bits per second) was less common.

(a)(ii) Most candidates managed to suggest that a LAN was limited to a defined geographical area (e.g. a company, building or campus). Fewer candidates were able to identify a second characteristic, although there are several to choose from.

(a)(iii) Although many candidates were able to identify benefits of a cloud-based email service, fewer expressed these in terms of benefits *for the IT department*, which was a requirement of the question.

(b) Although many candidates answered this question reasonably well, some lost marks by simply re-stating information from the stem. In addition, some candidates did not focus their responses on the specified stakeholders (colleagues in a company).

(c) Most candidates managed to include some relevant points in their responses. The better candidates managed to go beyond generalisations to suggest specific issues associated with the benefits and limitations of both strategies and offer suggestions of how the company might optimise the effectiveness of either strategy.

Recommendations and guidance for the teaching of future candidates

These recommendations should be read in conjunction with the HL recommendations as many are applicable to both levels.

- Although the inclusion in responses of examples studied in class or explored through independent research can provide useful information and insight, candidates should be taught that merely describing an example will add little to the response. Where examples are used that are not drawn directly from the given scenario, the reasons for including them must be made clear and explicit. Any conclusions drawn from an example should be fed-back into the scenario of the question and actively used to help answer the question that has been asked. There are similarities between the use of examples in ITGS and the use of examples in TOK. In both situations the purpose of an example is to facilitate the analysis of the claim (or counterclaim) being made and suggest implications for the developing arguments.

- As has been stated in previous reports, the links between the strands are as important as the content of each strand. Students must be taught that the inclusion of vocabulary and concepts from each strand must go beyond a simple "naming of parts" in order to access the upper markbands. For example, where a social/ethical issue and a related IT system are explained, candidates must also make it clear how and why that IT system causes, mitigates or has other implications for the issue. The ITGS triangle remains the key focus point and this should be highlighted throughout the ITGS course.

- Again, as stated in previous examiners' reports, teachers and candidates must be aware that while markschemes from past exams are a useful resource for teachers, they are not model answers and should not be treated as such, especially with respect to part (b) "analyse" questions and part (c) questions. Responses in the form of "advantage" and "disadvantage" tables are never appropriate for part (c) responses and strongly advised against for part (b) responses.

- Students must be made aware that for part (c) responses a descriptive list with no analysis or further development of the points presented is unlikely to gain more than 2 marks. A list is still a list even when it is presented as continuous prose.

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Paper two

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 – 3	4 – 6	7 – 9	10 – 12	13 – 15	16 – 18	19 – 26

General comments

This paper uses the same questions and assessment criteria for each session but a different article. This article's topic was based on the use of drones that raised a number of significant ITGS issues. Even though drones are not mentioned in the subject guide the networking (peer to peer) and other ICTs involved are; and the article presented information that enabled candidates to apply their ICT knowledge to this article. There were a broad range of ITGS themes connected to the use of drones and a number of these were highlighted in the article which enabled candidates to get started, and to not become locked into one theme, such as security or privacy, even though some did. Also, this article highlighted a number of positive impacts that could be used in Criterion C. This resulted in candidates in the lower grades being able to obtain credit for knowledge that was included in the article, or easy to extrapolate from the article.

The questions lend themselves to a structured approach and teachers seem to be emphasising this to their students. It is clear that teachers are preparing their candidates better with this in mind when responding to Criterion C (Question 3) and Criterion D (Question 4). However, even though it was clearly apparent that the candidates could easily access the article, the depth of analysis and evaluation which was needed for access to the higher markbands in questions 3 and 4 was lacking in the same way as in previous sessions. Teachers need to emphasize that it is not enough to identify and describe issues and problems, but to analyse and evaluate the overall impact of the IT and its use in Criterion C, and the effectiveness of the solution in Criterion D (Question 4). Teachers should also be aware that using an overly constrictive teaching framework for this paper can stifle the creativity and originality necessary for the highest grades.

Interlinked ICT systems, such as drones/smartphones are becoming more prevalent in the modern world and candidates are encouraged to study them in detail. Other similar {all pervasive} examples could include self-driving cars, and the Internet of Things. Therefore, in order to be well prepared for Paper 2 and the other Papers, teachers and candidates need to keep up with developments in ICT, especially those that appear in the news, and to be aware that ICT systems are becoming increasingly interlinked.

Overall, candidates did not have problems with the variety of ITGS issues or the ICT system itself. The mark boundaries remained the same as for the May session in 2016.

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

As usual the higher mark bands for Criterion C and Criterion D were rarely accessed as there were very few conclusions, and even fewer substantiated conclusions. The conclusions that were provided were often a summary or a superficial evaluative comment. Furthermore, a significant number of candidates did not provide sufficient impacts and issues in Criterion C and sufficient strengths or weaknesses in Criterion D to be able to develop a substantiated conclusion.

A second area of weakness was that too often candidates will identify a concern or impact and omit the details (i.e. a superficial response lacking in depth). Teachers need to direct the candidates to explain why there is a problem, or why there are positive or negative impacts. In the process of explaining why, candidates usually provide the relevant details (and depth).

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

Again, it was pleasing to see structured responses in Criterion C and Criterion D. However, the use of a standard structure did not lead to an increase in the display of higher order thinking skills needed for the higher marks in these criteria. Also, most candidates were well prepared for responding to Criterion A and Criterion B.

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

Criterion A

This question is meant to be an opportunity for the candidates to become engaged with the details of the article and the major themes of the articles. The material required in the responses usually comes directly from the article and candidates who did not use the article well lost marks.

Part A

Generally, this question was done well with most responses focusing on privacy. However, there was some confusion about privacy and security, and security and reliability. Candidates need to learn that there is an overlap but they are different concerns. Often by security candidates really meant privacy.

Part B

This question is about the use of the ICT by the stakeholders. Candidates who did not do well did not refer to the details in the article but provided general descriptions, or became side-tracked discussing impacts on various stakeholders. However, most candidates answered this question well.

Criterion B

Part A

Considering the limited space in the answer booklet it was not uncommon for candidates to use pages from an extra answer booklet, which is very useful for demonstrating their ICT knowledge. It is expected that the candidates begin with the steps required to use the drones that are in the article and then expand them to demonstrate they know how the ICT in each step works. The purpose of the question is to provide an opportunity for the candidates to demonstrate their ICT knowledge. The markscheme indicates the difference between the ICT that is included in the article, and the ICT that could be used to demonstrate their knowledge beyond the article.

Two particular problems were that a number of candidates had not studied the various types of networks possible and thought that the drone operated through the Internet rather than through a peer-to-peer WiFi network. Also, there were candidates who had not taken the advice from previous reports and had not learnt that GPS does not require a signal to be sent to the satellites, or direct communication with them.

Part B

The connection between the IT system and the concern needs to be analysed, and often candidates provided more information about the concern but did not analyse the connection to the IT system. The response needs to focus on the deficiencies of the polices, hardware, software, processes, etc. associated with the use of system, to analyse WHY these deficiencies enable the negative impact/effects to happen. The classic case is the 'signal from the drone can be hacked' but this does not explain a specific weakness in the security of the WiFi signal, e.g. that the signal was not encrypted. Many candidates only explained how the negatives could happen. The markscheme clearly shows the difference between the HOW and the WHY.

Criterion C

As was mentioned above a concern was the number of candidates who identified impacts but did not provide details describing the impact. Also lists of impacts were common ranging from identifications of issues and concerns to detailed descriptions. But these alone limited the marks to the lower end of the mark range as an analysis and evaluation of the impacts is required for entry to the higher mark bands.

Candidates are expected to show evidence of consistent critical thinking by making analytical connections between impacts to show how they are related to each other; and making evaluative comments about the impacts in terms of size, the future, links to other effects, impacts on other stakeholder, duration, extent, etc. For example, a candidate could make an explicit analytical link between the benefits for the owner of the drone from taking aerial videos, and at the same time, explain that the same feature of the system could lead to an invasion of privacy for another stakeholder. An evaluative comment would be that this could happen unintentionally as the focus of the video shot was on a nearby feature. This problem could then be addressed in Criterion D.

The more successful responses were structured on the various stakeholders as specified by the question, rather than an issue based structure. This enabled candidates to provide a balanced set of at least positive and negative impacts for each of two main stakeholders. Otherwise, the top mark level for this question cannot be entered. A conclusion about the overall impact (positive or negative) cannot be argued unless there is a balanced comparison of impacts that can be used to justify the conclusion. The main word here is 'argue' not 'state' the conclusion, and the details would need to justify the conclusion. Too many candidates mistook a summary for an argument.

Criterion D

Candidates were asked to identify the problem before providing a solution. All candidates filled in this section which provided a focus for the response. As usual a number of candidates included more than one solution and penalised themselves. Only the FIRST solution will be marked. Fortunately, very few candidates provided a problem that was NOT mentioned in Criterion C, which would have led to them self-penalising.

Candidates need to describe a solution to one of the problems found in Criterion C but far too often candidates did not provide a detailed description of the solution, especially technical details (who, where, when, what, how) or details of policies, laws or procedures that needed to be implemented.

Also, candidates need to explain how it solved the specific problem. And too often candidates provided a detailed description of the solution with very little reference to the main technology in the article, the drone. Such textbook type solutions receive low marks if not connected to the article, e.g. a description of encryption or security measure such as passwords and biometrics. How these could be implemented in the drone/smartphone system must be clearly described, and an explanation of how it solves the specific problem. Too often the problem was generic and lacked details connected to the article.

Then candidates need to provide a balanced set of further positive and negative evaluations of the effectiveness beyond the direct solving of the problem. These could include consequential impacts of the solution on other problems, stakeholders, long and short-term benefits, costs, etc. These must be used in the conclusion that argues that the solution overall was effective or limited in solving the problem considering the negative impacts, or vice versa.

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Recommendations and guidance for the teaching of future candidates

Considering the significant number of inadequate responses for Criterion A and Criterion B candidates need to return to them and ensure they align with the rest of the response. There was very little evidence of this happening. A response can always be improved. This suggests that candidates are not planning their response sufficiently. A possible teaching strategy is to make students plan out a full response in 15 minutes, but not write it. Time spent planning at the start will 'pay dividends' in the latter part of the exam.

For Criterion C and Criterion D teachers need to emphasize the critical thinking skills required. The previous examiners reports and the comments and examples above indicate what is required to achieve these marks; and the markscheme shows how the marks are awarded when a candidate demonstrates the appropriate critical thinking skills. To promote these analytical and evaluation skills candidates should be provided with a list of impacts for Criterion C from previous markschemes and asked to group them in a structured manner by stakeholder, provide analytical connections between impacts, provide additional evaluation comments, and finally an argued conclusion. For Criterion D candidates should be provided with a problem and solution from previous markschemes and asked to provide the details of the solution, apply it to the problem, provide at least four balanced evaluations and to write an evaluative conclusion analysing the usefulness of the solution. A mind-map approach to the planning of Criteria C and D in class could be carried over into the actual examination.

Higher level paper three

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 – 4	5 – 8	9 – 14	15 – 17	18 – 19	20 – 22	23 - 30

General comments

The topic of the case study was clearly accessible to many of the students and that they had engaged to varying degrees with Smart watches and their features. This access to the topic lent itself to enabling students to respond to each question. It was also pleasing to see that students were being better coached on how to approach each style of question although this was not consistent throughout. For the most part, candidates managed to stay on topic and also craft responses that focussed on what they should be answering.

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

Technical background. Most candidates lacked the technical background of the technologies highlighted in the case study with only a superficial understanding, which did not extend much beyond the definition. It is important that teachers carefully go through the Case Study and evaluate and look at areas that have specific terminology, specifically the list of words and topics at the end that will definitely be used to formulate questions.

Adequate explanations. Candidates must ensure that in Question 2 once the reason has been identified, adequate explanation follow (technical or otherwise) and relate back to the question. Structuring answers in paragraphs can also aid this process.

Use of the information in the case study. Many candidates utilized the Case study to identify the issues to discuss, but in many cases responses were not fully developed with detailed descriptions or explanations and supporting examples. Candidates have approximately a year to become familiar with the case study and identified technologies and issues.

Making supported judgements and conclusions. Many students wrote descriptive answers which were either one sided and lacked balance. Judgements were often made and not backed up. Also there was a tendency for students to write about advantages and disadvantages without adapting the approach to the question based on the wording of the question. Making judgements and drawing conclusions can help students answer the question asked, instead of writing about the topic of the question. Some candidates still continue to answer Question 3 and Question 4 with short responses that lacked examples.

Use of Independent Research. This year, there was a varied presence of explicit reference to independent research, however, given that the students have one year to prepare for this case study, there is still an inadequate amount of research appropriately used to support the arguments being made. Some candidates did not link any real or relevant independent research into the response for Question 4. This means that candidates were not able to access the top level of the grade boundary.

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

It was clear that the many students had studied fitness watches first hand possibly with them having one at home or someone at school, thus making this topic very accessible to students.

Students were knowledgeable in the items of data that a fitness watch could collect, their features and the range of popular brands available.

Students were more able to consider the benefits to consumers of KHT developing their watches and for Doctors accessing their data and were able to talk about health.

The wording of the questions helped students identify relevant lines of the case study to support their answers, with many students selecting other relevant points to include in their responses.

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

Question 1a
- Most candidates were able to identify items of data that would be collected by a fitness watch, showing that they knew the difference between data collected on a fitness watch compared to a regular watch.
- A few candidates did give general responses that were not actually items of data.
- Some candidates identified items of data that were mentioned in the case study but not currently being collected by the KHT watch e.g. glucose levels.

Question 1b
- Many candidates were able to give a basic reason for using xml, but lacked the technical explanations to support the reasons why this data format was chosen.
- Candidates who only wrote a definition of xml did not gain marks because the question was not to define xml but to explain the reason for using it.

Question 2
- A wide range of reasons were given for why KHT fitness watches have different results. In general students understood that this was possible and most likely experienced this in their research. Reasons such as physical differences between the friends, level of effort applied and calibration of the watch were popular responses.
- Some candidates identified a number of different physical differences but this was only considered one valid point. e.g. height affecting stride and physical fitness affecting

heart rate.

- Candidates who wrote about the synchronization between the watch and the website, did not earn marks, because the question specifically was asking about the differences read from the watch.
- Less able students did not develop each point in order to explain the difference.
- Candidates who wrote three distinct paragraphs were more able to explain clearly as their thoughts and response were well structured.

Question 3

- This question was on the whole approached well, with many candidates being able to present a balanced argument. Candidates were able to consider the positive arguments for customers or KHT using the points identified in the Case Study.
- More able candidates were able to make the links between the impacts on the customers and how this affected KHT and supported their assertions with examples.
- Many students made reference to the KHT Case Study throughout their responses and some included examples from their research.
- Candidates who did not perform well in this question used just the information from the case study without further development. Simply identifying the advantages and disadvantages is not sufficient to access the higher marks.
- Some candidates discussed how the watch could be developed and how it managed health which did not directly answer the question on whether KHT should develop the watch.
- Still many candidates did not write a conclusion or simply repeated what was previously stated in the response and therefore were not able to earn full marks.

Question 4

- It was pleasing to see some candidates attempt to use their research to support their answers in Question 4, although there were still many who did not.
- It was evident that some teachers had coached their students into prepared responses using the main social and ethical issues of the case study, which were then adapted slightly to appear to answer the questions.
- Many candidates considered the advantages of allowing doctors to have access to their data as a way of improving patient health and many referred to reliability of this data and consequences of misdiagnosis. Candidates were able to discuss what the Doctor could do with data from the watch and the limitations of the data.
- Many candidates took advantage of the reference to line numbers in the question to identify relevant points, with the more able candidates developing these points with detailed descriptions supported with examples.
- Limited evidence of good quality research, with some candidates referring to particular brands of fitness watches with tenuous links to the question, while others made general remarks about surveys and visits to health organisations.
- Not all candidates took advantage of the three pages to develop their answers, with many lacking in depth of detail with supporting examples.
- Candidates who gave evaluative comments throughout tended to score higher in this question

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Recommendations and guidance for the teaching of future candidates

- **Link with available resources.** For the Case Study, both students and teachers, should access sites that will assist their preparations for the paper. There is the IB OCC, the ITGSopedia site which uses a number of techniques to collect appropriate ITGS resources, as well as the new and annual Facebook Case Study group.
- **Decoding of questions.** Students would benefit from more strategies and practice in decoding questions, so that in an examination, they can identify the focus of the question and which key stakeholders would be relevant. With the lead up to the exams, students should practice writing responses <u>and</u> get feedback from teachers, particularly on the level of analysis and evaluation on the extended response questions. Please see the section on Paper 1 for more information.
- **Explicit reference to Case Study**. For the higher mark bands explicit references to the case study are required. This should enable candidates to answer the question related to the case study and not for them to give generic answers about fitness watches.
- **Independent Research.** Although there was evidence of research which was used throughout questions 3 and 4, students need to do more thorough research covering a wider range of issues. Being able to name the source of the article or interview with a summary of the relevant points holds greater validity compared to one which refers to a friend or ''something I read". References to primary research such as interviews or questionnaires with a named person or to secondary research mentioning the source is required. Teachers should be exposing students to real life situations that link in with the core issues of the Case Study. Also teachers should take opportunities throughout the year to have students writing practice responses that particularly look at how to incorporate independent research. There has been an improvement on this from past years, however there is more work to be done.
- **Planning of essay style questions and providing a structured answer.** Candidates who planned their answers, were more able to structure their responses in a logical way. This enables them to link their analyses, judgements and conclusions coherently.
- **Case Study Terminology.** Candidates should develop a case study list of appropriate terminology. These terminologies listed in the Case Study provide the launch pads for class discussion and independent research and need to be integrated into their extended responses.

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