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February 2018 Volume 4 Number 3

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- Guide to a successful written assignment for HL languages
- How Mao Zedong won the Chinese Civil War
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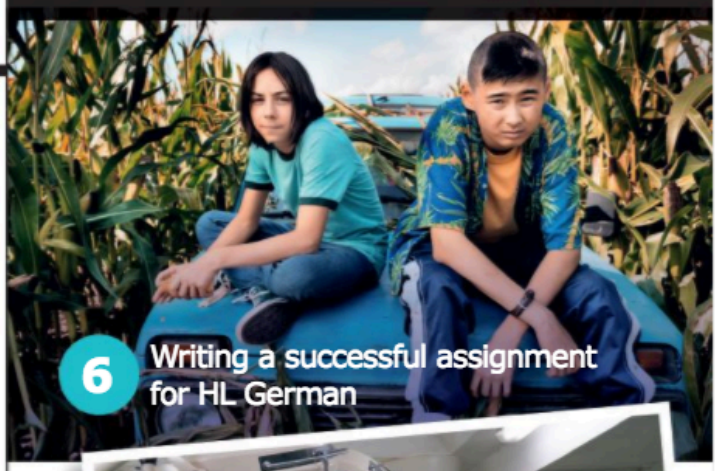

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It's important to read the extract carefully, highlighting and annotating as you go along

Preparing for the oral commentary

Hermione Paddle provides advice for improving your outcomes in the individual oral commentary for language A: literature

Exam context

The skills you need for the IOC are similar to those you need to use in paper 1 of your final exam. The close reading; identifying details about language, structure and style; and your analysis of these aspects are all integral to your writing in paper 1. The exam is based on your written commentary (rather than oral) of an unseen text. You are expected to write a fluid, continuous essay that analyses the language and style of the extract. Just like with your IOC, you need to constantly refer to the passages, identifying key moments, quoting them and commenting on the purpose and effect of these, within the context of the piece.

Your individual oral commentary (IOC) is an internally assessed and externally moderated task that is worth 15% of your final grade in literature. The task requires you to verbally comment on and analyse an extract from one of the texts that you have studied in part 2 (detailed study) of your course.

Table 1 What you will be doing

Standard level	Higher level
Preparation time: 20 minutes	Preparation time: 20 minutes
Total delivery time: 10 minutes	Total delivery time: 20 minutes
Oral commentary: 8 minutes	Oral commentary on poetry: 8 minutes
Teacher questions: 2 minutes	Teacher questions on poetry: 2 minutes
	Discussion on second text: 10 minutes

At both standard level (SL) and higher level (HL) you'll need to speak for 8 minutes, with a subsequent 2 minutes of questions from your teacher. For SL you'll explore one of two possible texts, and for HL you'll focus on poetry. At HL you will also undertake a 10-minute discussion with your teacher on a second text you've studied (Table 1).

The IOC gives you a chance to be yourself and it has several advantages to it, including:

- it's only you and your teacher — you don't have to 'perform' in front of your classmates
- the recording is only an audio recording — it's not filmed
- you have a chance to respond verbally to a text studied in class, which is great if writing isn't your best way of expressing yourself

Planning your IOC

Students often worry about exactly how to give their commentary, and while there is no 'right' way to go about it, you can follow the basic structure below to ensure that you are meeting all of the criteria to the best of your ability.

Preparation time

You have 20 minutes to plan your commentary, and you'll be given a clean copy of the extract as well as additional blank pages for you to use. Read the extract. Then read the extract at least two more times so that you don't miss anything. It's really important to read slowly and carefully, highlighting and annotating as you go along. Initially, number all of the lines, so you can make careful and accurate references to them in your commentary. Then, identify the different literary features that you find, thinking about the impact they have on the meaning of the text.

The extract will be a passage of text from one of the works studied in part 2 from the IB prescribed list of texts. You won't know which text

Zoom

you'll be speaking on until your preparation time (usually chosen at random from a collection of options). Text for the commentary should be 20–30 lines. There will be a range of different extracts chosen for your class, but it is possible that you will be given the same extract as one of your classmates.

The extract must give the title of the text, so you won't need to guess which poem you've been given or which novel you're speaking on. The extract must have two 'guiding questions' to help prompt your discussion (but it is not mandatory that you respond to these). The lines in the extract should be numbered.

Your introduction

The IB encourages schools to keep coursework submissions anonymous. This means that you only need to introduce yourself with your 'personal code' (which your school will have). Avoid mentioning your name or your school.

In your introduction, state:

- the title and the author
- what the passage is about
- your thesis statement
- a clear list of what your commentary will be about

Thesis statement

A thesis statement is a declarative sentence that states the purpose of your essay. Because you are not responding to a particular question, you need to develop your own arguments and provide a sentence or two that precisely summarises your interpretation of the extract.

When creating your thesis statement, consider the following:

- Think of one or two sentences that convey your overall ideas in a sharply focused but succinct way.
- Make sure these sentences are not simply a description of what goes on in the passage.
- Focus on the ideas that arise in the extract, rather than listing literary devices.
- Try to include two or three ideas, so that your thesis statement is broad and overarching.

Table 2 shows some examples of thesis statements. The purpose of developing such a precise thesis statement is so that you can draw back all of your ideas to this central concern. It's all well and good finding a simile in the extract, and better to find one and suggest *how* it reveals something about a particular character, but your commentary will be far better organised if you can relate that simile to that character's emotional state that you mentioned in your opening.

Table 2 Example thesis statements

Weak thesis statement	Improved thesis statement
In 'Backdrop Addresses Cowboy' the poet talks about a cowboy who kills people and leaves a trail of destruction behind him	In the poem 'Backdrop Addresses Cowboy' Margaret Atwood effectively satirises the mythical figure of the American cowboy, depicting him as a character who is both comically entertaining yet also dangerous
'A Dill Pickle' is about two ex-lovers who meet in a coffee shop and then talk about their old relationship	The short story 'A Dill Pickle' is about the unlikely reunion of two past lovers who both reminisce and regret aspects of their relationship
In the passage Beatrice shows herself to be a funny character and one who does not approve of marriage	This extract from *Much Ado About Nothing* illuminates Beatrice's wit and cynicism, as she expresses her acrimonious view of matrimony

Questions and activities

1 Whether you're studying novels, short stories or poetry, develop content and theme statements for the opening paragraphs of each text. For novels, use the first two paragraphs of each chapter; for short stories use the opening of each; for poetry, try to develop them about the poem as a whole. Work on crafting your statements so they are fluid, cohesive phrases.

2 Practise 2-minute commentaries. Select any poem or extract and choose one particular device, such as figurative language or imagery. Then time yourself commenting on this feature, and only this feature, for 2 minutes.

3 Listen to yourself. One of the best ways to learn about how you sound is to listen to a recording of yourself. Take 10 minutes to undertake a practice and then play back your recording. What did you notice? Do you speak quickly? Repeat yourself? Seem disorganised? Lack focus? Hesitate? Do you resort to certain verbal ticks, such as saying 'like' frequently? Do you 'go up' at the end of a sentence, even when not asking a question, which suggests that you are unsure of what you're talking about? Think of ways to avoid doing this, so that your IOC has real fluency.

Your body section

Make sure your commentary is an analysis of the author's style and language. You might look at tone, imagery, diction, personification, symbolism, what is left 'unsaid', and so on. The list of literary devices is practically endless and these change depending on your text type, but do not neglect sound and rhythmic devices for poetry, narrative techniques for prose, or rhetorical devices for non-fiction texts.

The conclusion

Signal to your listeners that you are ending by **signposting**. This means to signal your next idea or to clearly state the point you are going to make, e.g. 'In conclusion…' or 'Overall…', and restate your thesis statement.

Give a short summary of the key literary techniques you commented on and their intended effect. End with an overall statement that ties up your main ideas.

Higher-level discussion

The purpose of the discussion is for you to demonstrate your knowledge of a second text by responding to questions from your teacher. Questions could be about any aspect of the text, including character, structure, language, technique, style and key moments, ideas or themes. Students at HL have two additional criteria to meet.

The assessment criteria:

The assessment criteria for the IOC are:

Standard level

- Criterion A: knowledge and understanding of the extract (10 marks).
- Criterion B: appreciation of the writer's choices (10 marks).
- Criterion C: organisation and presentation (5 marks).
- Criterion D: language (5 marks).

Higher level

- Criterion A: knowledge and understanding of the poem (5 marks).
- Criterion B: appreciation of the writer's choices (5 marks).
- Criterion C: organisation and presentation of the commentary (5 marks).

Develop content and theme statements for the opening paragraph of each text

- Criterion D: knowledge and understanding of the work used in the discussion (5 marks).
- Criterion E: response to the discussion questions (5 marks).
- Criterion F: language (5 marks).

Here are some tips for meeting each of the assessment criteria:

Criterion A (SL and HL)

- Consistently quote from the passage.
- Explore the interrelationships of different sections in terms of the overall meaning of the extract.
- Comment on the significance of the extract within the work as a whole.
- Provide brief mentions of biographical details and contextual information, if relevant.

Criterion B (SL and HL)

- Comment on literary features that help give a sense of the significance of the extract.
- Understand that the literary devices often don't work in isolation, so figurative language might work together with narrative voice to create a particular mood, or that schemes of language can contribute to how characters and settings are shaped.
- Avoid giving definitions of literary devices.

Criterion C (SL and HL)

- Develop a thesis statement based on the overall significance of the extract and draw all of your ideas back to this.

Listening to a recording of yourself is a good way of improving your performances

- Use deliberate signposting to indicate to your audience what is coming next.
- Don't deliver your commentary as a series of unconnected points or a list of devices you noticed.

Criterion D (HL)

- Have key sections you know well rather than trying to know everything.
- Memorise key quotations from these sections and be able to use them.
- Work out something to say about more difficult areas, such as considering the climax and being able to comment on the author's use of language.

Criterion E (HL)

- Genuinely answer what you've been asked.
- Clarify if you don't understand the question — it's fine to ask for more explanation if you're not sure.
- Try your best to give your own personal response.

Language criteria (SL and HL)

- Speak in formal English, in your natural speaking voice.
- Speak in present tense (even if the author is dead).
- Use a rich, wide range of vocabulary. In your planning time, think carefully about words to describe the tone, mood and feelings created so that you don't revert back to the same adjectives.
- Avoid informal language and repeating yourself.

Theory of knowledge

1 Consider how shared and personal knowledge function within the area of literary criticism. How much of what you discuss in your IOC will be personal knowledge? What shared knowledge do you need to equip yourself with to approach an oral commentary on an author's work?

2 The TOK knowledge framework is a tool used for analysis that explores aspects such as the key concepts, language and methodology in a given discipline. Consider the methodology, or structure and organisation, of your oral commentary. How does it use a framework that is particular to literary analysis or critical analysis in the arts?

Key points

- Your IOC is a chance to provide your personal interpretation on one of the texts studied in part 2.
- Developing a thesis statement is integral to the cohesion of your commentary.
- Explore the language, structure and style in the extract to 'show' the writer is doing something, rather than telling us what is happening.
- Signpost your ideas so that your commentary is clearly organised.
- Know and understand the criteria.

Hermione Paddle teachs IB literature, language and literature and TOK.

Next

GROUP 2: GERMAN

Writing a successful HL written assignment

Sheela Mahadevan explains how to write a successful written assignment for German B higher level based on the recent German bestseller *Tschick* by Wolfgang Herrndorf

Exam context

After reading this article, you will be able to write a successful HL German B written assignment based on Wolfgang Herrndorf's *Tschick*. Even if you don't study German, you could use this guidance to help you successfully write a HL written assignment in your chosen language.

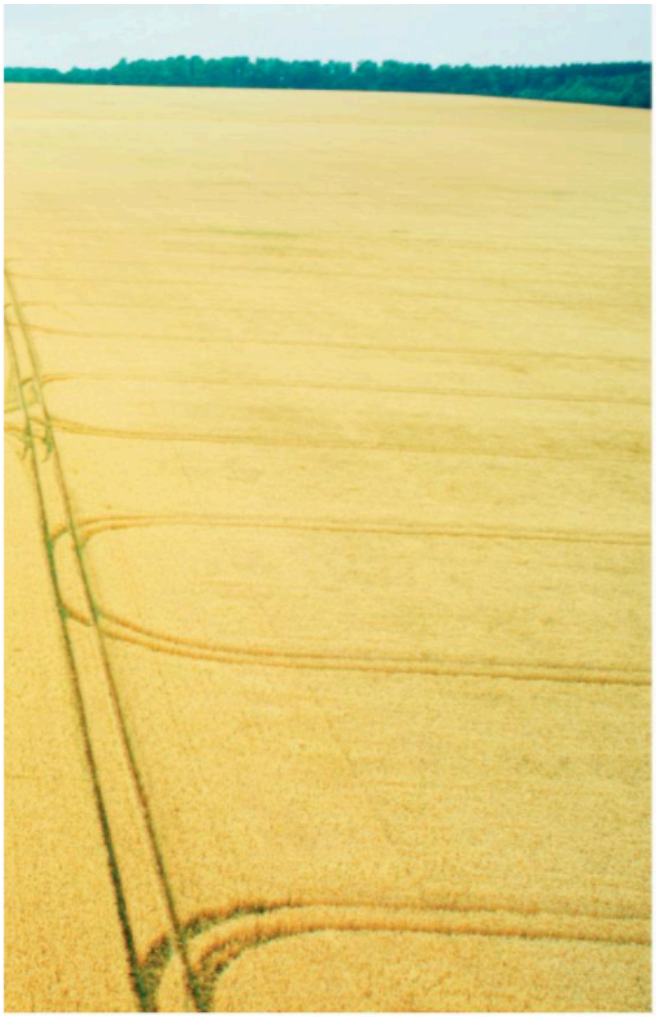
The written assignment for higher level (HL) is worth 20% of your grade for the language you are studying, and it is externally assessed. It is to be completed in the final year of your course, though you will do much preparation and reading for it in the first year of your course.

The written assignment requires you to read one or more literary works and write a creative piece of 500–600 words based on the chosen work(s). This might be, for example, a continuation of a story, an interview with one of the characters, an imagined diary entry or a blog written by a character in the novel, or a newspaper article reporting an event in the novel. You will also write a rationale of 150–250 words, in which you will give some background knowledge on the work(s), explain how your task is related to the literary work(s), and explain your aims and how you will achieve these.

Tschick

Wolfgang Herrndorf's *Tschick* would be an excellent — and highly successful — work to base your written assignment on. Published in 2010, the novel continues to be a bestseller in Germany. It has been translated into 16 languages and has been awarded numerous prizes. It is studied widely in German schools and is appealing to both adults and teenagers.

This humorous and enjoyable novel offers a refreshing change from other contemporary German works, which often deal with National Socialist Germany, the Holocaust or the fall of the Berlin Wall. Instead, *Tschick* tells the story of two teenagers, Maik and Tschick, who are both unpopular at school but develop a friendship. With a long summer holiday stretching out ahead of them, and with both teenagers left to their own devices, they embark in a stolen car upon a spontaneous,



Wolfgang Herrndorf, author of *Tschick*. Photo copyright Mathias Mainholz

adventurous road trip without map or compass, which takes them through various parts of Germany. The scene is set for various hilarious, touching and frightening encounters and experiences, as we follow their journey, numerous crimes and relationship.

If you are a standard level student, or if you do not have the chance to study this work in class, reading this novel independently is a valuable learning opportunity, as it also relates to the core topic 'social relationships' and to the option topics 'health' and 'leisure' on the language B syllabus. Reading this novel will therefore strengthen your knowledge of vocabulary relating to these areas, which will be useful for your performance in papers 1 and 2, and in the oral examinations. The novel also gives you a taste of slang German, and the language of the youth, *Jugendsprache*. This is often absent in German textbooks, but it is the kind of authentic language you may well hear among young native German speakers. If you are an ab initio student, you might like to read an abridged and simplified version of the novel, such as *Tschick: In Einfacher Sprache* (2017, Spaß am Lesen).

Reading the novel

As you read the novel, keep a record of what happens in each chapter. You are likely to need to look back at this when you begin to write your written assignment, in order to remember the sequence of events. For example, if you are writing a newspaper report on what happened in a particular event, you may well need to refer to your notes to remind yourself about what led up to the incident that you are reporting about.

Also make a note of aspects of the novel such as changing relationships between the characters, typical traits and the personalities of each character, and, crucially, what kind of language they use to speak to each other:

- Is it formal or informal?
- What register and tone are used?
- Why and how does it differ depending on whom the character is talking to?

It is also a good idea to make a list of the recurring expressions that certain characters use. All of these aspects are important, because if you are planning to write a diary entry from the point of view of a character, you might like to replicate the expressions, tone, register and style of language of this character as displayed in the novel.

It is also a good idea to note the use of perspective, dialogue and narrative voice in the work. For example, in *Tschick*, the story is told from Maik's perspective, and we never find out about Tschick's internal thoughts. We only find out about him from Maik's perspective, his internal thoughts and the dialogue of both characters. This is important, since if you are planning to write an additional or missing chapter for the novel, you will need to be aware of this use of perspective, narrative voice and dialogue, as you will need to replicate it in your chapter so there is an element of continuity.

Theory of knowledge

1 How is our knowledge and understanding of the characters shaped by their use of language?
2 Intuitively, Maik does not initially like Tschick. To what extent should one trust one's intuition, or can this be a barrier to knowledge and understanding?
3 Make a list of the various ways in which Maik comes to know about Tschick, including sense perception, emotion, reason, imagination and intuition.

Next

Tristan Göbel as Maik and Anand Batbileg as *Tschick* in the 2016 film

A useful resource to help you while you are reading the novel is a workbook called *Tschick: Schülerarbeitsheft von Elinor Matt* (2012, Krapp & Gutknecht). This has varied exercises on each chapter to help you shape your thoughts and strengthen your understanding of the novel as you read it. It also has numerous exercises relating to themes, characterisation, plot, language, narrative structure and interpretations to help you develop your analysis of the novel. After reading the novel, you might also like to watch Fatih Akin's 2016 film based on the novel, comparing Akin's and the actors' interpretations of the novel with the novel itself. Does the film correspond to your interpretation of the novel?

Planning and rationale

Once you have finished reading the work, it is time to start planning your aims for the written assignment, and how you are going to achieve them. Be creative and brainstorm various possible aims and how they might be achieved. Once you have chosen one specific idea, it is a good idea to formulate the rationale. After giving some background information to introduce the work in the rationale, it is crucial to have clear aims, and you must be clear about how you will achieve them:

- Which text type will you select to fulfil your aim? Why?
- Which perspective, register and style of language will you use, and why, and for whom is the text intended?
- How will your choice of all of these aspects help you to achieve your aim?

In your rationale, you will also need to explain how the task will relate to the literary text, and so you should display an awareness of the context of your piece, and ensure that you situate it in relation to the literary work. When in the story does it take place? Which specific part of the story does it relate to? You should also explain how the language of your piece relates to the language of the literary text.

The aims and how they will be fulfilled might be expressed as follows:

> In my written assignment I will write from the point of view of Maik's mother, as we never see her perspective; we only see her through Maik's perspective in the novel. This piece of writing

Zoom

Questions and activities

1 Write a newspaper article reporting on one of the crimes committed by the boys, which was witnessed or discovered afterwards.
2 Write a series of diary entries written from the point of view of Tatjana, spanning the period of the entire novel and her evolving relationship with Maik.
3 Wolfgang Herrndorf was diagnosed with a brain tumour in 2010, the year when *Tschick* was published, and he committed suicide in 2013. He wrote a blog during his illness, from March 2010 until his death. It is a moving and inspiring read, which you can access at **www.wolfgang-herrndorf.de**
4 Herrndorf began to write a sequel to *Tschick*, which was published posthumously in 2014 as an unfinished novel: *Bilder deiner großen Liebe* (2014, Rowohlt). Compare this with *Tschick*.

takes place after chapter 13, in which Maik's mother leaves for the alcohol rehabilitation clinic for four weeks. In chapter 6, we are informed that in the clinic, all patients are asked to write down their thoughts and desires for therapy on pieces of paper, and so it is likely that Maik's mother may have also written a diary as a means of therapy, and my written assignment therefore constitutes a diary entry. In the diary entry, my aim, writing as Maik's mother, is to personally reflect on my situation, on my family, and express my emotions and hopes. My chosen text type is ideally suited to my aim, as a diary entry is a medium of personal expression and reflection; there is no other audience than the writer and diary itself. Writing as Maik's mother, I will use exclamations, rhetorical questions and emphatic and emotional language to express my emotions. I will also use slang language and a humorous tone, as these are features of Maik's mother's language in the novel.

Planning the content

Once you have decided on your aims and how you are going to achieve them, you should write a plan outlining what you are going to include in the text. Remember, you only have 500–600 words for the task itself, so careful planning of the content is important. You will be marked for organisation and effective development of ideas, so think about what you will include and in what order, and how you will develop each idea. If you are writing from the point of view of a character, it is a good idea to plan from this point of view. For example, the content of the task outlined above might be planned in note form as follows:

- Explanation of my current situation and why I'm writing. How did I come to be here? (See chapters 6 and 13).
- How I feel, and what I am asked to do in the clinic (see chapter 6).
- Reflection on relationship with my husband, including details, thoughts and emotions. Examples of problems which have occurred (see chapter 6).
- Reflection on Maik: a reflection on my relationship with him, what he has learnt from me (see chapter 6), how the family situation might have affected him, and what he might be doing now.
- Hopes for the future?

You may then begin to write the task, and as you begin to write a piece such as a diary entry, ensure you are 'in character' as the person who you are writing as. This will help you to imagine from the character's point of view. You must remain 'in character' throughout the written assignment, just as an actor plays and remains 'in character' throughout a performance. In this respect, the written assignment is a performance, and you are playing a role. Ensure that you consistently use the same register and tone of language as the character uses in the novel.

Checking your work

Once you are done, checking your work is vital. First, mark your own work according to the mark scheme and see if you would give it full marks. If not, rework it again. You might use the following checklists:

Criterion A

- Are my aims clear, and have I said how I will achieve them in the rationale?
- Is my chosen text type appropriate to the audience and purpose stated in the rationale, and is it applied consistently throughout the task? Is my writing consistently connected to the literary work(s)?

Criterion B

- Have I developed my ideas effectively?
- Are my ideas organised?

Criterion C

- Have I effectively used a wide range of vocabulary and rhetorical features appropriate to my work?
- Is language used appropriately to the task, and consistently?
- Are complex structures clear and effective in the task?

Second, ensure that spelling and grammar are accurate. There is no excuse for poor spelling or grammar in this component, as you are not writing under timed conditions, and you have access to a dictionary, unlike in paper 2.

Finally, you may submit your draft to your teacher, who is permitted to give you one round of verbal feedback, commenting generally on how your draft may be improved. After this, you are on your own to make changes and submit the work. As you are only allowed one round of feedback, ensure that your first draft is as good as it possibly can be. Viel Glück!

Key points

Four top tips for a successful written assignment:
- Read the literary work(s) carefully, making notes on plot, characterisation, narrative perspective, register and tone of language used by the characters.
- Formulate clear aims and decide how you are going to achieve them, and carry these out consistently throughout the written assignment.
- Plan the written assignment carefully in advance of writing it.
- Check it through carefully for accuracy and mentally mark it against the mark scheme to check you have fulfilled all criteria.

Sheela Mahadevan teaches German B at St Clare's College, Oxford and is an IB examiner for German B. She taught German literary translation at the University of Oxford and is the author of two language textbooks.

The Chinese Civil

Paul Letters investigates how Mao Zedong ended up as leader of China when at the start of the civil war the odds were so stacked against him

Poster depicting the entry of Communist forces into Beijing

Exam context

The Chinese Civil War is relevant for both paper 2 (under topic 11 on twentieth-century wars) and paper 3 (under topic 12: China and Korea, 1910–50).

Come the defeat and withdrawal of the Japanese at the end of the Second World War, the Chinese Nationalists (Guomindang, GMD) and Communists (Chinese Communist Party, CCP) turned on each other once again, resuming a clash that had begun in the 1920s. As the Cold War arose from the embers of world war, the GMD were (initially, at least) backed by the USA, and they were expected to defeat their Communist opponents.

During the battle against the Japanese (1937–45), which weakened the GMD, Chiang Kai-shek was recognised by most foreign governments as China's official head of state. Chiang had become the military and political leader of the Guomindang after the death of Dr Sun Yat-sen. He was also known as the 'Generalissimo'

In 1946 the Communists held some countryside areas but not any big cities. The Communists had no air force, few railways, no navy and — at this point — no significant foreign backing.

The Chinese Civil War began in earnest in June 1946 when the GMD began a huge offensive in northeast China, in Manchuria — a region the Japanese had ruled since the early 1930s. The GMD had problems maintaining supply lines to their troops in Manchuria, far from the Guomindang heartlands of central and southern China.

The CCP's armed wing, the People's Liberation Army (PLA), led by the shrewd General Lin Biao, had to resist the GMD's mighty firepower before the Communists could fight back using guerilla tactics.

USSR in, USA out

Early on in the Chinese Civil War, the GMD — supported by US training, equipment and money — gained ground at the PLA's expense. Mao seized on US interference for propaganda purposes, with the aim of persuading more

War, 1946–49

Nationalist troops guard Communist prisoners

non-committed Chinese to join the Communist side. He said the US was, 'attempting to take over Japan's position in this country [from the Second World War] and to transform China into a colony of American imperialism.' Such propaganda would hurt Chiang Kai-shek's reputation throughout the civil war.

Historians Ian Halliday and Jung Chang blame US intervention for inadvertently helping the communists. In 1946, the USA's General George Marshall (known in Europe for the Marshall Plan) ordered a ceasefire for the GMD in Manchuria. This gave Mao a break — the war had been going badly for the Communists. The PLA were able to strengthen their positions in the Manchurian countryside.

They also used the time to quietly gain military supplies from the Soviet Union, which shared an 800 km border with Manchuria. The Soviets helped link a railway network in Communist territory with Russia, and they handed over ex-Japanese weaponry. Chang and Halliday estimate that the Soviets gave the PLA over 3700 pieces of artillery, 900 aircraft, 700 tanks, 12 000 machine-guns, armoured cars, anti-aircraft guns and hundreds of thousands of rifles.

General Marshall returned to America in January 1947 — a moment historians point to as a turning point in the civil war. Seeing the GMD as corrupt and incapable, President Truman withdrew US support from the Guomindang.

GMD advance, PLA regroup

In March 1947, Chiang Kai-shek allowed GMD General Hu Zongnan to launch the biggest offensive so far, aimed at the CCP capital, Yan'an. The 150 000 troops Hu was given — although he wanted more — succeeded in taking Yan'an, together with 10 000 Communist prisoners. This could have been the beginning of the end of the war, were it not for the fact that General Hu's aide was a Communist spy, as was Chiang's assistant chief of staff. So Mao had been informed of GMD plans and had 2 weeks' notice in which to evacuate the

Next

Shanghai, 1948

Communist leadership, military equipment, medicines and even printing presses. His propaganda presented the Communist retreat as a tactical victory. Mao reportedly said:

> We give Chiang Yan'an. He will give us China.

The PLA soon became adept at gaining weapons at GMD expense. Historian Odd Arne Westad asserts that, 'The Communists became masters at stealing and buying weapons from local GMD units.' Often, the PLA would set up an ambush solely for the purpose of acquiring such equipment. During the second half of 1947, using nighttime raids and ambushes, the PLA made gains in Manchuria and elsewhere in northern and central China.

Hearts and minds

> The battle for China is a battle for the hearts and minds of the peasants.
>
> Mao Zedong

Questions and activities

1 Which foreign power played the greater role in the Chinese Civil War: the USA or the USSR?
2 What was the greater cause of the CCP victory: Communist strengths or Nationalist weaknesses?
3 Who were the key individuals and to what extent did they contribute to the outcome?

Theory of knowledge

1 How can we know for certain whether, during the civil war, the GMD or the CCP treated ordinary Chinese people better than the other side?
2 Look at the questions in the 'Questions and Activities' box. Can historians quantify who plays the 'greater role' in events, or what was the 'greater cause'? How can historians know?

The Chinese population suffered not only warfare but also hunger and poor living conditions. When the fighting erupted in the summer of 1946, the Guomindang had control of over three-quarters of Chinese territory. With a lack of discipline and considerable corruption, Nationalist rule often seemed to make matters worse for ordinary people. Murders and intimidation committed by the GMD in the cities they controlled lost them support. Not only did Chiang suppress people suspected of being Communist sympathisers, he clamped down on those who called for democracy. This encouraged members of the Democratic League to join the Communists.

By late 1947, when the Communists were gaining ground, they sent CCP officials into villages that came under PLA control. These officials presented the advantages of Communist rule compared to GMD rule, such as low taxation and the rights of villagers to run their own affairs rather than be dictated to. The CCP also took farmland from landowners and distributed it among the peasants, pleasing the majority of people.

The numbers of Communist supporters and fighters swelled, and Communist units often gave their soldiers better clothes and food than either the GMD or free society could offer them. Furthermore, the fatality rate was lower for PLA soldiers that GMD ones. If such incentives failed to recruit peasants, the PLA was known to conscript people into the army, as was the GMD.

Worsening economic and social conditions in GMD-controlled areas lost the Nationalists much support. From mid 1947, the prices of basic goods — including rice — spiralled out of control. **Hyperinflation** meant that prices increased more rapidly than wages: people could not afford to buy food. The value of a single grain of rice in April 1949 was around 2500 Chinese dollars. Strikes and riots broke out in protest against GMD misrule.

The three great campaigns

In 1948 the Communists changed military strategy to a policy of all-out assault. During the last months of 1948, the three great campaigns began, and together they would determine the outcome of the civil war.

The Liaoshen campaign, September–November 1948

This campaign centered around the city of Shenyang in the province of Liaoning, in the south of the Manchuria region. The PLA's brilliant general, Lin Biao, came up against Chiang Kai-shek's pick as his supreme commander in the area, General Wei Lihuang. But when Chiang ordered Wei to move some of his forces forward from Shenyang to engage the PLA, Wei refused. Odd Arne Westad claims that Wei believed the city of Shenyang was Lin Biao's main objective and to remove GMD troops from the city would be to fall into a Communist trap.

However, Chang and Halliday emphasise that many GMD leaders were secretly working for the communists, and they assert that General Wei was one of them. Chiang Kai-shek apparently had suspicions of Wei's loyalty, yet Chiang still put Wei in command of 550000 GMD troops in Manchuria. Wei was liked by the Americans because he had fought well against the Japanese during the Second World War. During the US presidential campaign of 1948, Chiang hoped to see the victory of the Republicans, who promised aid to the GMD. Yet the USA would not send military aid to generals they did not trust, so Wei was appointed in part as a futile attempt to gain US equipment and funding. Truman went on to win the election for the Democrats.

When Chiang Kai-shek arrived in person at the northeast headquarters, General Wei had no choice but to send his troops out of Shenyang. Chiang had missed the chance to retreat his forces south,

Next

Figure 1 Map of China at the time of the civil war

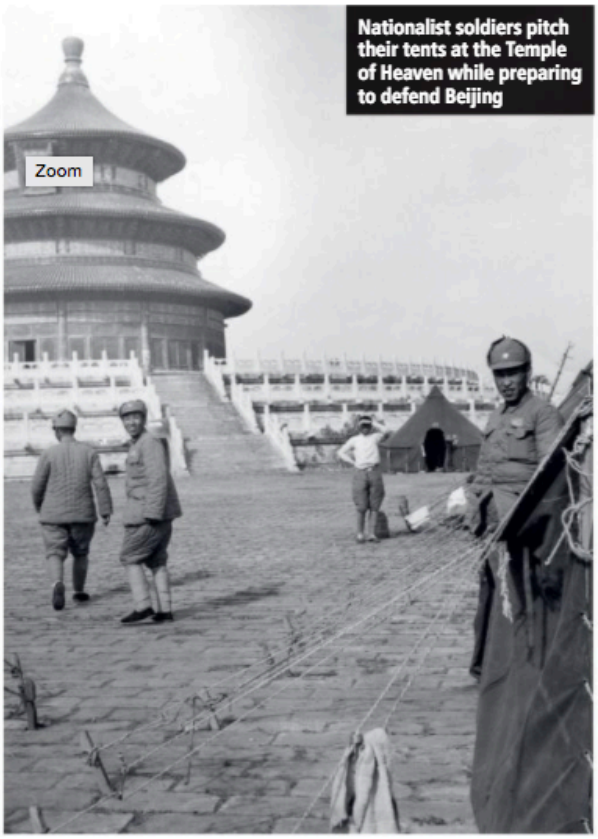
and in the fighting that followed he lost 400 000 of his best troops. Shenyang fell on 2 November 1948. The PLA isolated Wei's forces in the remaining Nationalist-held cities, and attacked them one by one. Manchuria was lost to the Communists. Through a combination of military victory and propaganda, Mao rose to god-like status. Tens of thousands of GMD soldiers and many leading officers swapped sides.

The Beijing–Tianjin campaign, December 1948–January 1949

In December 1948 the cities of Beijing and Tianjin were ruled by GMD **martial law**. Communist spies had infiltrated the headquarters of the Nationalist commander in this campaign, General Fu Zuoyi. At least one of Fu's key advisers was a communist agent. In addition, Fu's own daughter — recruited by her Communist fiancé — was assigned by the CCP to stay with her father in this period and report his every move.

In the know about the GMD's tactics and intentions, the PLA under Lin Biao took city after city. Tianjin, the third largest city in China, fell on 15 January 1949. The fiercely anti-Communist GMD mayor of Tianjin was captured with his mistress in a supposedly secret apartment — it transpired that the mayor's wife was a Communist agent.

Around Beijing there was no sign of GMD resistance to the advancing Communists. Fu was informed that Chiang Kai-shek was about to resign, so he met with PLA leaders and renounced his allegiance to the GMD.



Nationalist soldiers pitch their tents at the Temple of Heaven while preparing to defend Beijing

The Huaihai campaign, November 1948–January 1949

At the same time as PLA troops marched on Tianjin and Beijing, other Communist forces advanced southwards towards the Yangtze River.

By now the Communists had grown greatly in number as millions of peasants joined them. In addition to growing in terms of personnel, the Communists had captured so much GMD equipment that Mao had become increasingly confident of moving from guerilla tactics to fighting head-on battles. That is what he did in the largest military engagement fought since the Second World War, the Battle of Huaihai — which took place between the Huai River and the Lung Hai railway line. This was in the heartland of China, just north of Chiang's capital, Nanjing. At its peak, the battle involved 1.8 million men.

The PLA used heavy artillery, concentrated on the centre of GMD formations, while advancing mobile PLA units on the flanks to pin down the Nationalists. Chiang became exasperated by his commanders in neighbouring areas who refused to send their own troops to help. Fear and panic spread through the GMD forces as their dead mounted up: bodies stacked up faster than graves could be dug.

Rather than retreat, the bulk of the remaining GMD forces hunkered down in the city of Xuzhou, the location of a key railway junction. Eventually the GMD army was lured out of the city into an area where the terrain aided the Communist plan to encircle the enemy. In early December 1948, 230000 GMD troops marched away from Xuzhou. Deng Xiaoping (who would lead the People's Republic of China in the 1980s) mobilised a peasant army 2 million strong and led the shelling of the rear of this column. In January 1949, as winter temperatures dropped and the snow began to fall, the remaining 200000 GMD troops surrendered.

By mid January 1949 the Communists had concluded all three major campaigns triumphantly. But they were still concentrated north of the Yangtze River.

Aftermath

In April 1949 a Communist army of 1.2 million soldiers crossed the Yangtze River. By May 1949 they had taken the capital, Nanjing, and the financial centre, Shanghai. By now, more Nationalist commanders wanted to swap sides, but Mao told them to stay with Chiang until the right moment. Chang and Halliday observe that as early as 10 January 1949, Mao told Soviet leader Joseph Stalin that his government 'can be created in summer [or] earlier'.

That same spring, Mao entered Beijing, which had been the capital of the Chinese empire for many dynasties from the twelfth century to the twentieth. Mao would make it his capital.

The war was not yet over. During October 1949, Lin Biao pursued the Nationalists south through the southern province of Canton (known today as Guangdong). Chiang Kai-shek would not retreat to the island of Taiwan until December, yet even as the fighting continued, Mao publicly announced the foundation of the People's Republic of China. On 1 October 1949 at Tiananmen Square, the crowd of over 100000 chanted 'Long live Chairman Mao!' Mao waved and shouted back into the microphone: 'Long live the people!' He had, against the odds, defeated the Nationalists and made himself mainland China's all-powerful leader.

Key points

- Chiang took a gamble in sending his main force to Manchuria at the beginning of the civil war. He threw away his initial superiority in troop numbers and equipment in a failed campaign far from his main base of support in central and southern China.
- The USA withdrew support for Chiang Kai-shek and the GMD.
- Mao's double agents placed inside the GMD's leadership informed the Communists of GMD plans.
- The Communists defeated the Nationalists both through their military strategy and by prioritising winning the hearts and minds of Chinese peasants.

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A tale of two fisheries

Drying cod along the shore. Community life in Newfoundland revolved around fishing

Veryan Blake contrasts two fisheries, looking at their development and management and relating this to the concept of sustainability

Exam context

This article relates to sub-topic 4.3: aquatic food production systems.

The consumption of fish as a source of food increased from 18 million tonnes in 1950 to over 150 million tonnes in 2016. **Aquaculture** overtook beef production for the first time in 2012, with 66 million tonnes of fish being produced by aquaculture techniques in comparison to 63 million tonnes of beef. In the same year, farmed fish consumption overtook wild fish consumption by 10 million tonnes, with the average person consuming 19 kg of fish per year, an increase from 10 kg in the 1960s. How can this growth be managed sustainably?

Iceland and Newfoundland

Both Iceland and Newfoundland have a cultural heritage linked to a long history of fishing. Iceland's fisheries delimited an 'Iceland only' fishing zone as early as 1901. It started as 5 km and by 1976 had increased to 320 km. The fishing industry of Iceland was dependent on cod and haddock in particular, with blue whiting and mackerel becoming increasingly important in recent years. Fisheries are the largest industrial sector in Iceland, reporting contributions of 27% of GDP in 2011.

The natives of Newfoundland known as the Beothuk survived on a diet of fish. Along Newfoundland's long coastal zones, community life revolved around fishing, fish packing, ship building and the manufacture of fishing-related gear. In 1968, at the peak of the cod fishing industry, 810 000 tonnes of cod were landed. This was fuelled by the introduction of factory fishing using new super-**trawlers** that at 85 metres long dwarfed the boats previously used. Super-trawlers landed the same amount of cod in 15 years that had once taken over 100 years to catch.

Marine Stewardship Council

Created in 1996 after the collapse of the Canadian cod fisheries and overfishing on a global scale, the Marine Stewardship Council (MSC) is a **non-governmental organisation (NGO)** focused on rewarding

Commercial fishing vessel off the coast of Iceland

Glossary

Aquaculture Breeding aquatic animals and plants for consumption.

Non-governmental organisation (NGO) An organisation that operates independently of governments.

Optimum sustainable yield The maximum harvest that can be taken without damaging the original stock, thereby allowing the population to maintain itself.

Quota A limited or fixed number.

Spawning mass The weight of young produced by a population in an area.

Stock The total population of a particular species.

Trawler A fishing vessel that uses a trawling mechanism to catch fish. This involves dragging a trawl (a type of net) behind the vessel or between two vessels.

Zoning Dividing an area into different zones, with each having a different set of regulations.

Questions and activities

1 Go to your local supermarket. Can you find a fish product with the MSC label? Where is it from? Compare your findings with others in your class. You could map the source locations and investigate when they received MSC certification.

2 Complete a table to compare the similarities and differences between the management used in Iceland and Newfoundland. Which has been the most successful?

and recognising sustainable fishing industries. Working in partnership with fisheries, governments and retailers, the MSC enables consumers to choose fish products that display its blue label, and allows consumer power to show industry what it wants.

With the growth of the environmental movement in general in the 1960s, with Rachel Carson's *Silent Spring* and other milestones such as the development of the US Environmental Protection Agency in 1970, the power of consumer choice has had a real influence on global industries.

Management

In both Iceland and Newfoundland, the need for management came from dwindling **stocks**. Cod stocks in Iceland decreased from around 2.5 million tonnes in 1950 to less than 600000 tonnes in 2000. Newfoundland's fish stocks collapsed in the early 1990s, with a 99% reduction in the **spawning mass** of the Northern Cod, once the largest cod fishery in the world.

Iceland's management strategy focuses on the application of regulations, following a technocentric use of **zoning** and **quotas**. After the extension of the exclusion zone to 320 km in 1976, Iceland also applied a total catch quota in 1995 of 25% of the estimated stock. This represents an **optimum sustainable yield** approach and focuses on maintaining the spawning stock that will populate the next generation of cod. Stock is monitored twice a year and if the scientists monitoring stock record a drop in numbers then a total ban can immediately be enforced.

Fishing is of such importance to the Icelandic economy and culture that it even played a pivotal role in Iceland's decision to remain out of the European Union, the membership of which would mean giving up its fishing sovereignty. In 2013 Iceland produced its first

Theory of knowledge

1 What roles do emotion, reason and faith play when making management decisions about ecosystems?
2 Are we ethically obliged to manage species?

The use of super-trawlers contributed to the collapse in cod stocks

fish product with the Marine Stewardship Council label, certifying sustainable practices.

Newfoundland was forced into a fishing moratorium in the 1990s following the crash in spawning mass. Started in 1992, this regulatory approach saw 10 years with no significant increase in cod numbers. Discussion at the time suggested that a change in ecosystem structure had occurred as other fish, such as the capelin, had seen an increase in numbers and therefore threatened the growth of juvenile cod, which would now be prey. By 2010 increases were seen but the rate was much slower than had been expected.

The previous lack of administration and foresight was reversed in terms of monitoring of cod populations. WWF Canada put in place conservation efforts that led to the MSC announcing in 2016 that cod populations had grown sufficiently enough for sustainable harvesting to be allowed. This was aided by WWF Canada's Fishery Improvement Project (FIP), launched in 2011, with partnerships between industry, governments and NGOs.

Conclusion

Improvements in fishing technology such as super-trawlers allowed the fishing industry to supply increasingly healthy dietary choices. This increase in the numbers of fish caught, often unregulated, brought a once seemingly inexhaustible industry to its knees. Through regulation, monitoring and the use of technology, Iceland and Newfoundland have developed their fisheries to the point that they have been certified by the MSC.

References and resources

'Newfoundland cod achieves sustainability milestone': **www.tinyurl.com/ya77ebdh**

'Iceland is the success story of sustainable fishing': **www.tinyurl.com/nuoq7k4**

'How the world's oceans are running out of fish': **www.tinyurl.com/ybrtxlxn**

Key points

- The fishing industry is culturally and economically important to Newfoundland and Iceland.
- Overfishing, fed by changes in equipment and increasing consumption of fish, led to the crash of Newfoundland fish stocks in the 1990s.
- Careful management by NGOs, industry and governments has allowed Iceland and Newfoundland to develop their fishing industries in sustainable ways.

Veryan Blake is head of geography at St George's International School, Rome. She has previously worked in the UK, Thailand and Spain.

IB ALUMNI

Making the grade

Two 45-pointers, Tuoyuan Li and Henry Lui, are interviewed by Paul Hoang about their paths to success in the IB Diploma Programme

Time management is key to success in the IBDP

Tuoyuan Li and Henry Lui completed the IB Diploma Programme at Sha Tin College, Hong Kong and obtained the full 45 points in their May 2017 examinations. Currently studying economics and law respectively, the two alumni share their experiences and how they managed to tailor the Diploma to suit their passions.

PH What do you think are the core elements of success in the IB Diploma Programme?

HL We selected different subject combinations, with Tuoyuan's being science-focused and mine being more to do with the humanities and languages. But the skills required to succeed are similar.

TL Many people associate time-management skills with success in the IB and they are right. However, as Henry has alluded to, your subject choices themselves already determine your chances of success. By doing subjects you enjoy, you are far likelier to study more enthusiastically. It would then be much easier to spend time on your work, as you would be doing something you actually enjoy. Hence, you are likely to receive better grades by taking subjects you enjoy.

HL Moreover, passion is also important because the IB can grade you based on how personal your work is, and how engaged you have been in your learning. This is evident in many science and mathematics internal assessments (IAs), where marks are given for personal engagement.

TL For instance, in my physics IA, I was able to talk about how a power plant visit sparked my interest in electricity and magnetism. Due to the importance of personal engagement, it is essential that you choose subjects that you are passionate about. The same applies to the extended essay.

HL Engagement carries huge importance in subjects such as history and English literature too. Especially when taken as higher level subjects, both courses demand an in-depth knowledge of the matter at hand,

even in the timed examination papers where you have no access to any sources other than what you have stored in your head. Hence, it is important to go beyond the textbook and do extra research on your school-provided online databases in order to deepen your analysis and discuss points that are not commonly explored by other candidates.

For history, this meant reading directly from the works of renowned historians, such as A. J. P. Taylor and Ian Kershaw. In literature, this required reading undergraduate-level analytical essays from the Literary Reference Center on the texts I studied. Because there is so much research involved, having a passion in the subject makes the work a lot easier.

PH What advice do you have for IB students who are considering law or economics at university?

HL Although most universities do not require law applicants to take particular subjects in the IB, I chose history, English A literature, Chinese B and economics as higher level subjects because I felt that they would best prepare me for a law degree. Apart from the ability to read large amounts of text in a short amount of time, I felt the subjects also sharpened my critical thinking and analytical skills, both of which are also required in the study of law.

TL Well, even before starting the IB, I knew I wanted to major in economics or business-related subjects, so that led me to picking HL economics and HL mathematics. I also decided to do HL physics because I enjoy science and thought the logical approach of physics would help me in the future, regardless of career choice. Unlike Henry, I decided to do SL English language and literature as it had always been one of my weaknesses.

PH Although you both achieved the maximum 45 points, what challenges did you face along the way?

HL In hindsight, it wasn't such a wise idea to take four HL subjects, but I still thoroughly enjoyed the academically stimulating experience that the IB provided. 'Reasonable optimism' is how I would put it. I came out of my paper 2 English exam disappointed with my performance, but it all turned out all right in the end. Don't let setbacks stop you achieving your potential — it's important to remember that you try to do everything within your ability to achieve the best results possible, and know that you will always get the results you deserve.

TL Although the HL mathematics and physics combo is known to be notoriously difficult, I actually had even more trouble with my group 2 language, SL Spanish B. This was due to two reasons: first, because I lived in Hong Kong, I had no exposure to the language outside of the classroom, which made it hard to improve on my own. Second, because Spanish B is also taken by some students who are already proficient in the language, the grade boundaries were harder for me to reach. Students often think that group 2 subjects are easier, but this is untrue. Other than spending your spare time memorising new vocabulary and sentence structures, you will also have to adapt your lifestyle to fit that new culture if you truly wish to immerse yourself in the language.

PH What other advice do you have for students following the IB programme?

HL It is important to dedicate time for leisure. After all, it is just the IB, not a new season of *House of Cards*, so there is really no need to spend the entirety of your day dealing with it. Though some people moan about the extra hours of work and the challenges that the CAS requirements bring, I feel that it's an excellent opportunity for you to get out of your home to do something different and enjoy your studies. Focusing too much for too long doesn't do anyone any good.

TL My advice would be to do more, and worry less. Ever since lower school, the IB was always described to me by older students as some form of torture. However, many students get too caught up in these rumours and spend more time panicking than studying. Though I was also scared at first, I soon found out it isn't that bad once you get started. Fear can prevent you from achieving your potential. Therefore, it is important to always maintain a positive mentality, as it is always possible for you to succeed where others haven't.

HL All of this is conditional upon you dedicating an appropriate amount of time to your studies each week. The IB is difficult, no doubt, so if you attempt to complete it in much less time than the 2 years given to you, you will most certainly suffer. A steady pace and good discipline are key.

GROUP 1: ENGLISH

Top ten tips for

Lindsay Tandy helps you make the most of your language and literature revision time

1 Know the assessment criteria

Make sure you know the marking criteria. Each criterion is equally weighted:

- Knowledge and understanding of the text; use of evidence.
- Responding to the question (Paper 2).
- Understanding the use and effects of stylistic features.
- Cohesive structure; developed argument.
- Written expression; use of terminology.

2 Plan effectively

Paper 1

- Spend at least 20–25 minutes planning.
- Re-read your chosen text(s) two or three times.
- Make notes on C–GAP (Context–Genre, Audience, Purpose).
- Highlight key ideas and features.
- Annotate: margin notes, arrows showing shifts in tone/perspective, links within and between texts.

Paper 2

- Spend at least 10–15 minutes planning.
- Cross out questions that do not apply to your texts.
- Highlight the key words in your chosen question.
- Repeat key words throughout.
- Apply your knowledge of your texts to the question.

Both papers

- Use bullet points, mind maps and charts when planning responses.
- Order your points carefully. Each point should build up a cohesive argument.
- When discussing multiple texts, write a balanced response with an equal number of points for each text.

3 Structuring responses

Introduction

Briefly explain which text(s) you are exploring, their central idea(s), and what links the two texts (HL paper 1). Briefly explain how the key words/key ideas of the question apply to your texts (paper 2). Briefly comment on context.

Main body: (point, evidence, analysis)

- **Point**: introduce each point with a **topic sentence**. Each topic sentence should help to build your argument and show your response is well thought out. Use words such as: 'Furthermore…', 'However…', 'Moreover…', 'In addition…'. If comparing, use comparative phrases: 'Similar to text A, text B…', 'Unlike text A, text B…'. For paper 2, include key words from the question.
- **Evidence**: usually a short and relevant contextualised quotation that backs up your point.
- **Analysis**: This should be the longest part of your PEA paragraphs. What you analyse will vary depending on the text (paper 1) and the question (paper 2). However, features you could analyse include: lexis (word choice) and lexical sets, literary devices (figurative language, phonological language), stylistic features, colour and visual images. Remember to explain how each feature enhances the reader's understanding of the text's meaning. Embed terminology throughout.

Conclusion

Briefly sum up your main argument.

4 Providing balanced responses

- **Two-halves approach**: first half of essay explores text A, second half explores/compares text B. The biggest danger with this approach is running out of time and under-developing exploration of text B. To avoid this, be rigid with your time management.
- **See-saw approach**: alternating paragraphs on each text. The biggest danger of this approach is a disjointed response. To avoid this, each alternating pair of paragraphs should explore a similar idea/feature.

5 Context

Paper 1

- Use publishing details at the end of the texts to guide your comments regarding historical/geographical/cultural contexts.
- Embed an awareness of how context affects meaning and different reader responses.

Paper 2

- Research each texts' context and each authors' background.
- Research the reception to your texts over time — have readers' responses to your texts changed since they were published? Why/why not?
- Research two or three different critical approaches to your texts: feminist, psychoanalytical, archetypal.

English A exams

6 Learning quotations

- How many? Five per theme, five per main character, two or three per minor character, one for each important device (example of symbolism, dramatic irony, sensory imagery etc.)
- Copy quotations in different fonts/colours — stick to your bedroom wall.
- Replace the lyrics of your favourite song with quotations — sing them.
- Record yourself saying the quotations. Listen to your recordings when on the bus, out shopping, doing exercise etc.
- Leave out a key word from a quotation and get your classmates to fill in the missing word.
- Write a justification for each of your top ten quotations. Share with your classmates.
- Put each quotation in a cloud, surrounded by mini-clouds. Add analysis and relevant terminology in each mini-cloud.
- Remember to contextualise your quotations — where in the text do they come from?

7 Using past papers

- Practise past papers under timed conditions (SL: 90 minutes, HL: 2 hours).
- Team up with a classmate and mark each other's papers using the assessment criteria.
- Highlight key areas in your responses to give you a visual guide of what you need to focus on.

Short on time?

- Spend 20–25 minutes reading, re-reading, highlighting, annotating and planning your response.
- Write topic sentences for each paragraph.
- Write an introduction and conclusion.
- List the quotations you would include.

8 Highlighting

In the exam, highlight:

- contextual details at the end of unseen texts
- quotations and other textual evidence you are going to include in your response
- key words of questions.
- links within and between texts

In practice essays, use a different coloured highlighter to highlight each marking criterion. Use these colours to highlight those sections of your essays that directly relate to each criterion. When you have finished highlighting, your practice essays should be colourful. If they are not, you are not addressing each criterion in enough detail.

9 Good use of language

- Learn your terminology and use it.
- Avoid saying 'this word…' — use the correct lexis: 'noun', 'verb', 'adjective', 'adverb', 'pronoun'…
- Use a range of literary verbs: 'connotes', 'emphasises', 'exaggerates', 'highlights', 'infers', 'implies', 'suggests'…
- Use the writer's surname: 'Ibsen's use of prose suggests…', 'Shakespeare's use of blank verse implies…'
- Use present tense.
- Use formal language.

10 Remember…

- Avoid overly praiseworthy generalisations, e.g. 'Miller's amazing play…'
- Do not paraphrase or retell the story — taking a thematic approach rather than a chronological approach should help you avoid this.
- Do not explain what terminology means — examiners already know this.
- Avoid too much crossing-out and arrows pointing to missing text. Planning should help with this.
- Avoid careless errors: titles of texts and characters'/authors' names start with a capital letter; spell key words in question and terminology correctly; a text written in the 1800s is a nineteenth-century text, not an eighteenth-century text…

IBReviewExtras

Download this poster at www.hoddereducation.co.uk/ibreviewextras

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GROUP 4: DESIGN TECHNOLOGY

The design project

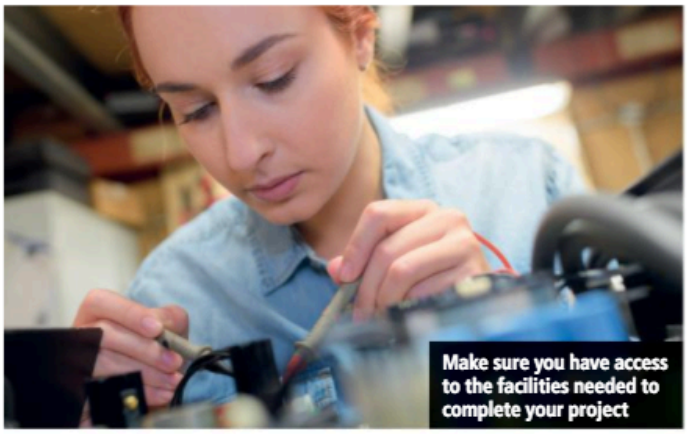
Assessment criteria explained

IA project work is worth 40% of the final mark for design technology, so choosing a suitable problem is vital

Finding an appropriate problem for the design internal assessment (IA) can be a daunting task, as it will need to keep you interested for 40 hours (60 for HL) and meet the assessment criteria. There are some key questions that you need to consider before starting a project:

- Will the project allow you to follow the full design cycle?
- Will you be able to test a physical outcome with meaningful results?
- Is there a real need and market for the product you intend to design?
- What experience do you have with using materials and components?
- Do you have access to a well-equipped workshop? For example, there is little point in choosing a project that will require you to use electronics if you have no previous experience in this area or you don't have access to specialist equipment.

Tasks are supposed to be open-ended and identified by you. Selecting a suitable task can prove difficult, but there are many



Make sure you have access to the facilities needed to complete your project

methods you can use to assist you in identifying a project that fulfils the requirements. Projects focused on personal needs without thinking of others who may have the same problem are not recommended, as this often results in students missing out critical research data, or having one idea in mind that they are keen to make.

Finding a problem

When starting project work with my own students, I ask them to look at trends or items that are becoming more apparent in news stories. A current trend in the UK is the growth of bicycle sales. This could be due to the success of the British cycling team at the Olympics, Chris Froome winning the Tour de France or the government's cycle-to-work scheme. The sector's increased popularity has brought with it some problems, including increased cycle theft, increases in the number of road traffic accidents leading to death, and the decline in golf club memberships as more middle-age people are choosing to spend their leisure time and disposable income on cycling.

In this case the problem most worth focusing on is cycle safety. There are plenty of existing items for product analysis, it is a competitive market and research data are easy to access. When writing a problem, you should where possible include the views of others and support this with literature-based data. In the case of cycle safety, there are plenty of articles in newspapers and on the BBC News website. Photographs of the problem should be analysed to set the scene of the project.

It is at this point in your project that you should consider the market size and opportunities. It would be unrealistic to state that with over 3 million cycle sales in the UK last year, this is the size of your market. Not everyone will ride through cities on busy roads, and some sales will be for children's cycles or for athletes to ride on track. With the cycle accessories market being highly competitive, a more realistic market could be 1% of this. To be able to design, make and sell 30 000 items aimed at cyclists for commuting would still be a success story for such a product if it was to be taken to market.

By starting out on a project that is less familiar, you will be inclined to ask more questions to support data collection. This will also allow you to be far more creative in your approach to ideas and development.

Look at trends, such as the growth in cycle sales, when deciding on your project

Table 1 Design specification for a portable lamp used in car maintenance

Specification	Justification	Testing method
The product must weigh less than 800 g, but due to electronic components weigh more than 300 g	Research shows that users are comfortable holding a weight of 800 g in the hand for a period of 45 minutes. This is ample time before the item can either be positioned on the floor or fixed to an object. The batteries, switch and LED lamp weigh 300 g, leaving a maximum of 500 g for the packaging of components	Use a set of weighing scales to record the weight of the product. Record the results Time how long the user is comfortable holding the product in a hand. Record the results

Data and specifications

Collecting data to help you solve the problem is usually the next stage, but you can also gather extra research material as and when needed. This is especially the case when developing ideas, and selecting materials and processes to realise your design. At the initial research stage, you should:

- include further information about the user in the form of a questionnaire or interviews
- carry out detailed product analyses of existing goods
- consider ergonomics, fittings, safety, dimensional constraints, weight, power methods (if needed), aesthetics and environmental issues

Collect data from both primary and secondary sources. There is no need to include everything you find — the assessment criteria require that you edit data and include elements that will help the formulation of specifications and aid designing. The assessment criterion asks for a summary of data and care needs to be taken to make best use of the pages allowed — a maximum of 38 A4 pages or equivalent overall are allowed for SL and 50 pages for HL. It is worth bearing in mind that if you submit more than this it will not be assessed. If you have 20 pages of work at this stage of the project, you will be restricted in what you can submit later, and you are probably being overly descriptive in what you write. The key is to be concise with explanations and justifications. Use a combination of graphs, tables, statistics and analysed images to make best use of the space available.

When writing a design brief, you should consider user needs, the market, project feasibility, and constraints already known through research. Justification and quantitative information should be included. Remember that you are unlikely to be designing a product that is suitable for everyone.

Table 1 provides a sample specification for a handheld portable lighting device. When writing specifications, it is important to avoid vague, generic terms. Terms such as big, small, lightweight, heavy and cheap should not be used if you want to secure a higher mark. It is at this stage that you will need to use the data collected. If you don't have the specific details, you will need to collect and show evidence of further data.

You should read the assessment clarifications for marketing and design specifications, as these give clear guidance as to what should be included. Each point should also include justification, not simply personal opinion, and when referring to quantitative terms you may want to consider the maximum and minimum requirements. At this point in the project it is also worth considering how you will evaluate and test against your specifications.

Get creative

Assessment criterion B requires you to demonstrate your creative and drawing skills. It is time to think out of the box and not simply copy ideas of existing products. When sketching and presenting ideas, you are advised to use a range of techniques. The use of freehand sketching, perspective and isometric drawings are all encouraged, but most important is that the idea is communicated well, be it through different views, size of drawing, rendering or annotations.

Students usually ask me at this point: 'How many ideas are needed?' This is difficult to answer, as it is straightforward to sketch a wide range of different coffee tables, but less easy to design a mobile phone case. I usually advise a minimum of six and a maximum of 12.

When annotating ideas, try to include information on dimensions, specific materials, finishes, features, fixings, construction and ergonomics, as these will help when it comes to evaluation. The evaluation of ideas should ideally compare each idea against the specifications, taking account of strengths and weaknesses before justifying which ideas it is best to develop further. It is at this point that you are advised to seek the advice of others, especially the opinion of experts. It is far too easy to be engrossed in the project and not see significant weaknesses, leading to you taking an inappropriate idea forward.

Developing an idea or features of many ideas can be time consuming, but this is essential if you are to eliminate weaknesses before manufacture. This is when you need to have a camera, in order to obtain evidence of modelling and ongoing development. You should approach development through an iterative process:

- identify weaknesses
- sketch improvements
- model your design
- test and evaluate it
- identify weaknesses
- sketch improvements

Then start again by identifying weaknesses, and only stop the process when you are happy that the product meets specifications.

When developing an idea, you may want to focus on different aspects of the design. Improving the function of the design is usually more important than aesthetics, but you may also need to consider ergonomics, finishes, materials and construction. Improving one aspect of the design may have a negative impact on another. You will need to prioritise which features are the most important.

Making it

Criterion C requires you to test and select appropriate materials and processes to make your design. The sensible approach here is to have addressed some of this when developing the design. Modelling techniques and materials can be used to make improvements to the design, and also to test whether a material is suitable or the process can be used during final manufacture. Further testing of materials, finishes, fixings and manufacturing processes will be needed and a comparison made, from which you will need to justify your choices.

Remember when testing materials that you need to be specific — generic terms such as 'wood' or 'metal' are not appropriate. On

finalising your decisions, you will need to provide detailed drawings of your design. These should be orthographic, but textile patterns and PCB diagrams are also acceptable depending on the outcome sought. Exploded diagrams are also useful where many parts are to be made and assembled. There are many CAD packages available to aid you with this, including PTC Creo, Solidworks and Google SketchUp. Detailing should be sufficient for third-party manufacture, to include dimensions and scale.

No doubt by this stage you will be eager to start manufacturing your design, but before this you will need to present a cutting and parts list, and develop a sequential plan for manufacture that includes parts, tools, processes, quality control, timings and risk assessment. Gantt charts can be used along with flow diagrams to detail this part of the project, but far too often these lack detail when it comes to processes and specific timings. If you use a Gantt chart, timings should be written in minutes and hours.

The assessment guidelines state that the product can be made in school or outsourced. If making the project in school, make sure you have access to the materials and equipment needed. If outsourcing, make sure the company knows when the product is needed and the cost for making it. Outsourcing will not allow for any further development during making, so it is important your drawings are accurate and have been fully thought through.

Given the time constraints on the project, try and make use of CNC equipment to speed up manufacture and increase accuracy. I suggest no more than 10–20 hours be spent on making an outcome — this is in addition to the 40/60 hours allowed for coursework. Such time is built in to the design technology syllabus through use of teacher-directed activities (TDAs). There is no need to record the making, but a photograph of the finished product is recommended before starting the testing and evaluation process.

Testing and evaluating

Criterion D requires you to devise a strategy to ensure all aspects of your design are evaluated. The key to success here is to ensure you have evidence of the product being tested, ideally by the intended market, an expert and yourself in the environment for which the outcome has been designed. Small-scale models often fall short here, as testing is often superficial.

You will need to complete a thorough test of your design against specifications. Don't use ticks/crosses/yes and no answers in a table in response to whether an outcome meets specifications — this lacks detail. A more critical response is needed and should include quantitative results, explanations and justification.

Don't be afraid of identifying weaknesses in the product. Yes you will have spent many hours designing and making it, possibly even had sleepless nights thinking about what you need to do next, but being overly positive will be your downfall when it comes to the work being assessed. Can you name a product that has no weaknesses? I doubt it. You would be more than critical if you bought something and were not happy with its performance. Now apply the same thinking to your own work.

Through thorough testing and observation of others using the design, you should be able to compile a long list of areas that require improvement. Some weaknesses will be significant and impact the performance of the design. Improving these should be the first task, and remember you need to be specific and justify your decisions. Indicating that the outcome, for example, should be 'lighter, smaller, cost less and have rounded corners' lacks clarity. If you say it needs to be smaller then you need to give the new measurements, sketch the design with any alterations evident and justify this by considering what has been already found through testing. It could be that it needs to be made smaller to fit in a bag, be portable, easier to fit in the hand, or to reduce material usage.

If studying design technology for HL, you also need to consider how the evaluation and potential market will influence significant changes in your design if it were to be commercially manufactured, as well as the most appropriate marketing strategy.

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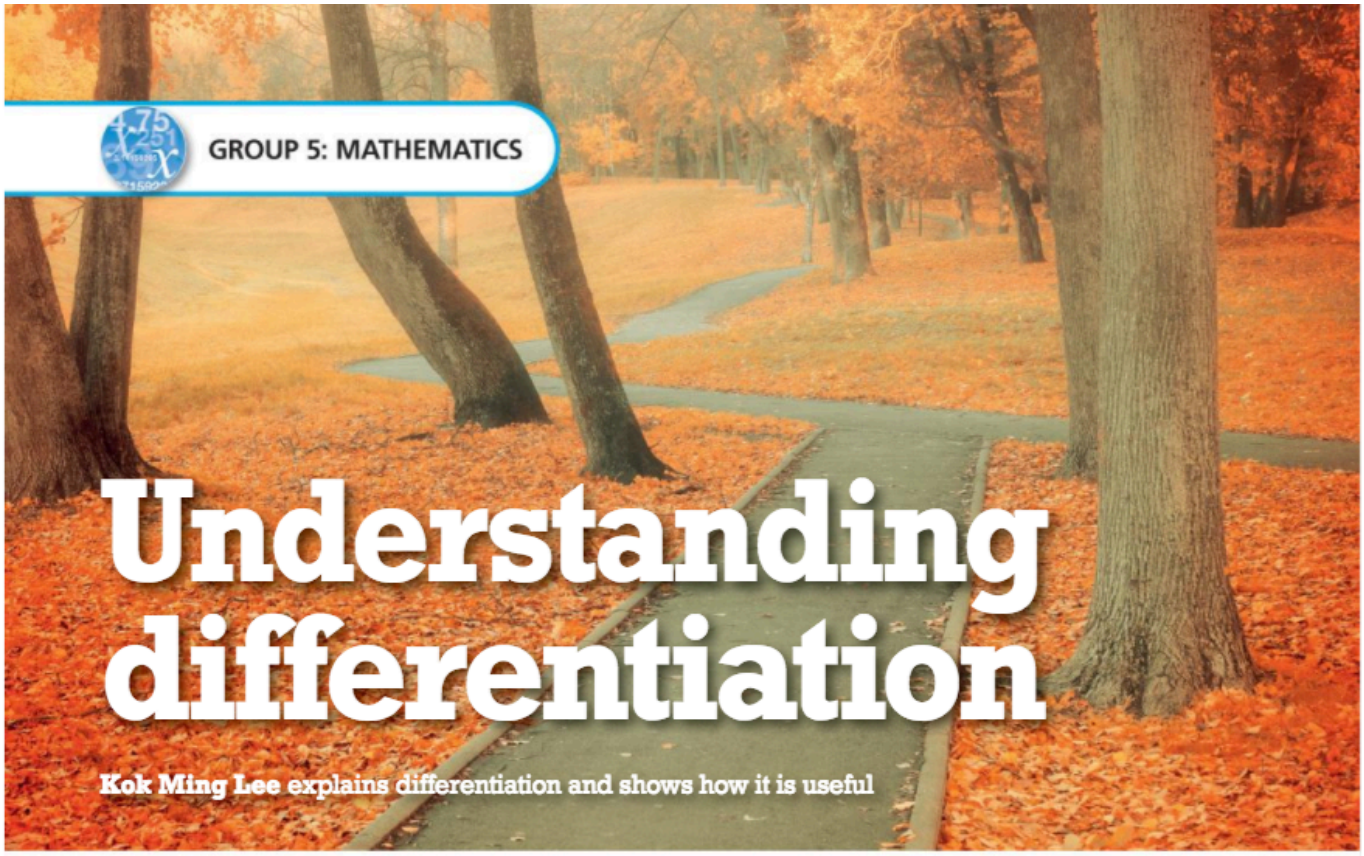

GROUP 5: MATHEMATICS

Understanding differentiation

Kok Ming Lee explains differentiation and shows how it is useful

A student recently complained to me that they 'just don't get calculus'. Through the follow-up conversation, it became apparent that the student did not fully grasp the basic concept of differentiation. In this article, I will revisit some basic concepts of differentiation, with the help of leaves. By the end of the article, you should be able to answer the following questions:

- 'What is differentiation?'
- 'Why is differentiation useful?'
- 'Why is the first derivative of a local maximum or a local minimum zero?'
- 'Why are the first and second derivative tests equivalent?'

What is differentiation?

Differentiation is the process of taking the derivative of a function with respect to a variable. So we need to define derivative first. Derivative can be thought of as the gradient of a function at a point. The gradient of the function y at point A in Figure 1 is the gradient of the tangent line L. The question now is how to measure the gradient of tangent line L.

You may recall that we can calculate the gradient m of the secant line AB where $A(x,y(x))$ and $B(x_B,y(x_B))$ in Figure 1 as:

$$m = \frac{y(x_B) - y(x)}{x_B - x}$$

Recall that $y(x)$ means the output of function y when the input is x. If we consider another point, say C in Figure 1 that is closer to point A, then the gradient of secant line BC is closer to that of the tangent line L. We can approximate the gradient of the tangent line L by considering the gradient of secant line AD, as in Figure 2 where point $D(x+h, y(x+h))$ is as close to point A as possible, with h being a small real value.

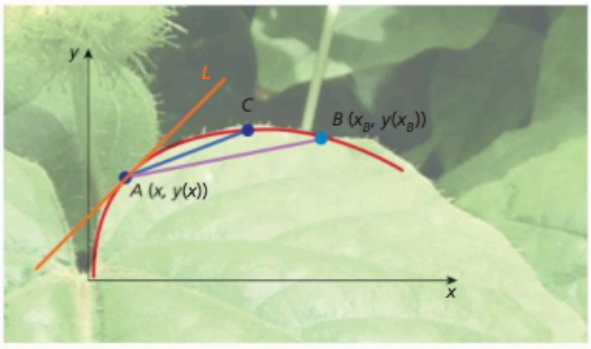

Figure 1 Tangent line L to the function y at point A

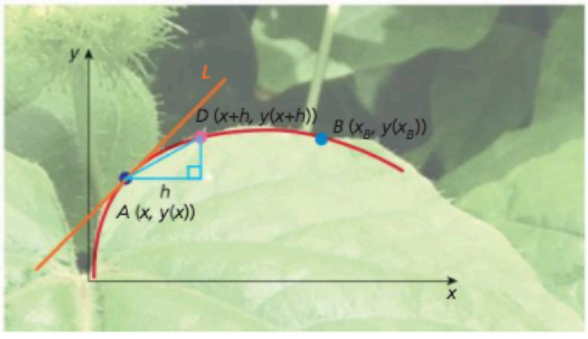

Figure 2 The secant line AD can be used to approximate the gradient of line L as the distance h approaches zero

Next

Therefore:

$$m = \frac{y(x+h) - y(x)}{h}$$

In fact, the gradient of tangent line L is the limit of the gradient of a secant line formed by two points that are very close to each another. In other words, the gradient of the line between A and D (a secant) will have the same gradient as tangent L the closer point D is to point A.

Definition 1

The above concept is formalised into the definition:

> The derivative of a function y is denoted by $y'(x)$ and is defined as $y'(x) = \lim_{h \to 0} \frac{y(x+h) - y(x)}{h}$

The derivative is basically the limit of the gradient function $\frac{y(x+h) - y(x)}{h}$ as h tends to zero.

Why is differentiation useful?

Note that $\frac{dy}{dx}$ which is read as 'the derivative of y with respect to x' can also be used instead of $y'(x)$. Mathematicians often use $y'(x)$ or y' when the function y has only one variable. If we are considering the volume of a cylinder $V = \pi r^2 h$ with base radius r and height h then it is inappropriate to use V'. A gradient tells us how much y changes with a change in x. The symbol V' does not tell us what has to be changed in order for volume V to change. In this case, it is better to use $\frac{dV}{dr}$ for a change in V with respect to a change in radius r. Similarly, a change in V with respect to a change in height h is denoted as $\frac{dV}{dh}$.

The concept of the gradient at a point is used in various fields (see Box 1 and 'Questions and activities' number 1).

Box 1 Extension for SL and HL

Higher level students should be able to manipulate the following example, using the concept of gradient, to obtain a better understanding of related rates. Standard level students can treat this as an application of chain rule.

Example

A cylindrical can has base radius r and height h. Let the volume of the can be fixed. Find the change in radius r given a change in the height h.

Solution

First figure out what the question wants you to do. Then find a formula to link the unknown to the given.

The question basically asks for $\frac{dr}{dh}$ and this can be expressed as:

$$\frac{dr}{dh} = \frac{dr}{dV} \times \frac{dV}{dh}$$

Since $V = \pi r^2 h$ then $\frac{dV}{dh} = \pi r^2$

All other variables, other than the two being analysed, in this case V and h, can be treated as constants or fixed in IB mathematical studies, mathematics HL and SL. Similarly $\frac{dV}{dr} = 2\pi rh$ and $\frac{dr}{dV} = \frac{1}{2\pi rh}$

Substituting the above results into the desired expression gives us:

$$\frac{dr}{dh} = \frac{1}{2\pi rh} \times \pi r^2$$

That is $\frac{dr}{dh} = \frac{r}{2h}$

This method gives us a way to relate one variable to a change in another variable within the system.

Definition 2

The limit of the gradient function in Definition 1 above exists if:

$$\lim_{h \to 0^-} \frac{y(x+h) - y(x)}{h} = \lim_{h \to 0} \frac{y(x+h) - y(x)}{h} = \lim_{h \to 0^+} \frac{y(x+h) - y(x)}{h}$$

The term on the left means the limit when h approaches zero from the left, that is $h < 0$ and h tends to zero. The term on the right means the limit when h approaches zero from the right, that is $h > 0$ and h tends to zero. Graphically, as in Figure 3, the limit of secant line AE as point E tends to point A is the same as the limit of secant line AD (see Figure 2) as point D tends to point A.

There are many functions that do not satisfy Definition 2. The sign of the limit of the gradient function to the left of point a in Figure 4 is negative but that to the right of point a is positive. Thus, the limit of the gradient at point a does not exist. We call such a point a **cusp**. We say that the function is not differentiable at point a (see 'Questions and activities' number 3).

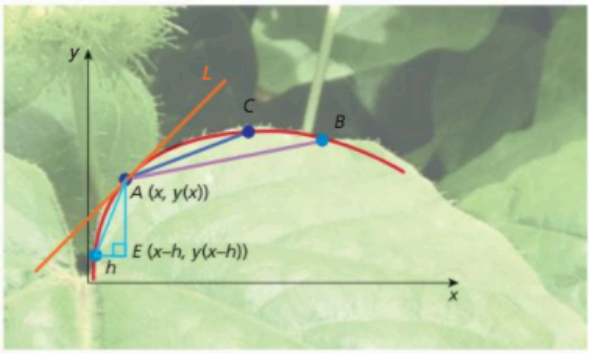

Figure 3 The existence of derivative

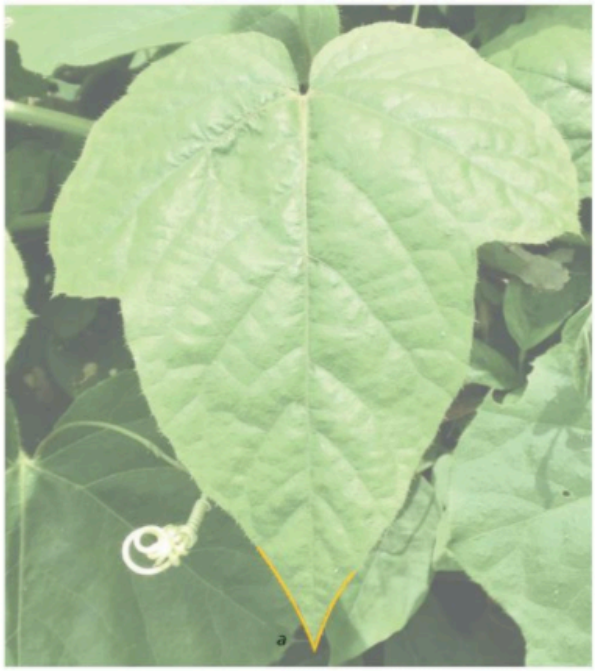

Figure 4 A cusp at point a is not differentiable

One of the common applications of differentiation is to find the maximum and minimum value of a function. A local maximum and local minimum are shown in Figures 5 and 6 respectively:

- In Figure 5, we see that the gradient at the local maximum is zero. The sign of the gradient to the left of the local maximum represented by the green pencil is positive and those to the right of the local maximum are negative as represented by the blue and yellow pencils. When sign of the gradient is positive, as in the green pencil in Figure 5 and the yellow pencil in Figure 6, then the function is *increasing*.
- Similarly, when the sign of the gradient is negative, as in the blue pencil in Figure 5 and the red pencil in Figure 6, then the function in *decreasing*.

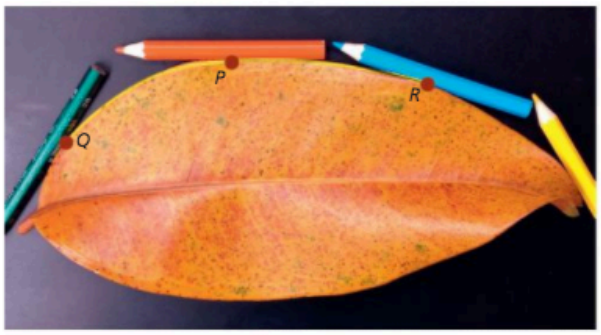

Figure 5 The gradient at the local maximum is zero. Each pencil represents a tangent line to the function at a particular point

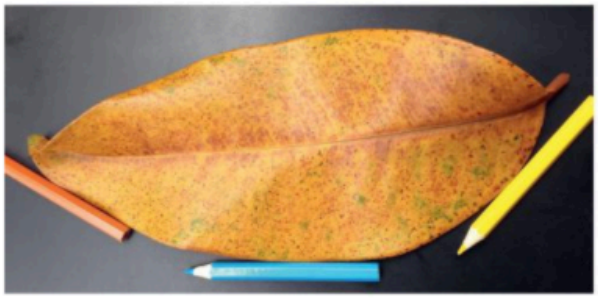

Figure 6 The gradient at the local minimum is zero

Equal to zero?

So why is the first derivative of a local maximum or a local minimum equal to zero? Although the graphical description is adequate for IB mathematics SL and mathematical studies, I find this proof useful in answering the above question in a more rigorous manner.

Theorem 1

A function $y : [a,b] \to \mathbf{R}$ that is continuous on the closed interval $[a,b]$ and differentiable on the open interval $]a,b[$, then if x_0 is in $]a,b[$ and $(x_0,y(x_0))$ is a local minimum or maximum then $y'(x_0) = 0$

The expression $y : [a,b] \to \mathbf{R}$ simply means we let the function be called y that takes input from the open interval $[a,b]$ and maps it to an output in real numbers. Actually, a stationary inflexion point will also produce $y'(x_0) = 0$ but this article will only focus on optimisation. The proof for local maximum here is based on Martin Li's proof (see **www.tinyurl.com/ybtgmrrb**). The proof for local minimum is 'Questions and activities' number 3.

Proof 1

We will assume that $(x_0,y(x_0))$ is a local maximum and that the derivative exists at the local maximum. Our job is to show that this derivative is zero to complete the proof. Since $(x_0,y(x_0))$ is a local maximum then $y(x_0) \geq y(x)$ for all x in $[a,b]$. Thus $y(x_0) - y(x) \geq 0$ for all x in $[a,b]$ (1).

Since the derivative exists then

$$\lim_{h\to 0^-} \frac{y(x_0+h)-y(x_0)}{h} = \lim_{h\to 0} \frac{y(x_0+h)-y(x_0)}{h} = \lim_{h\to 0^+} \frac{y(x_0+h)-y(x_0)}{h}$$

Let us first consider:

$$\lim_{h\to 0^-} \frac{y(x_0+h)-y(x_0)}{h}$$

Since h tends to zero from the left then $h < 0$. The numerator is negative from (1). These two implications mean that:

$$\lim_{h\to 0^-} \frac{y(x_0+h)-y(x_0)}{h} \geq 0$$

Next, we consider:

$$\lim_{h\to 0^+} \frac{y(x_0+h)-y(x_0)}{h}$$

Since h tends to zero from the right then $h > 0$. The numerator is negative. Thus we have:

$$\lim_{h\to 0^+} \frac{y(x_0+h)-y(x_0)}{h} \leq 0$$

Taking these two results together, we can conclude that:

$$\lim_{h\to 0} \frac{y(x_0+h)-y(x_0)}{h} = 0$$

Thus, if $(x_0,y(x_0))$ is a local maximum then $y'(x_0) = 0$.

If $y'(x_0) = 0$ then we call the point $(x_0,y(x_0))$ a **stationary point**. The graphical representation of a local maximum and a local minimum in Figures 4 and 5 respectively can be formalised into the first derivative test. The symbol $y'(x)$ is more accurately read as the first derivative of y with respect to x.

Theorem 2: the first derivative test

A function $y : [a,b] \to \mathbf{R}$ that is continuous on the closed interval $[a,b]$ and differentiable on the open interval $]a,b[$, then if x_0 is in $]a,b[$, δ is a small positive real number, $y'(x_0) = 0$ and

(i) $y'(x_0 - \delta) > 0$ and $y'(x_0 + \delta) < 0$ then $(x_0,y(x_0))$ is a local maximum, as in Figure 5

(ii) $y'(x_0 - \delta) < 0$ and $y'(x_0 + \delta) > 0$ then $(x_0,y(x_0))$ is a local minimum, as in Figure 6

(iii) both $y'(x_0 - \delta)$ and $y'(x_0 + \delta)$ have the same sign then $(x_0,y(x_0))$ is a stationary inflexion point

Theorem 2 gives us a procedure to decide whether a stationary point is a local maximum, a local minimum or an inflexion point. IB students at all mathematical levels should have a conceptual understanding of the first derivative test. Let us consider the case of determining a local maximum, as in Figure 5.

Looking at the outline of the leaf in Figure 5, we see that there is a point P on the outline such that the gradient of the tangent line at the point is zero. This point P is called the **critical point** and the tangent line at that point is represented by the orange pencil. If we find the gradient of the tangent line at a point Q left to critical point is positive, as shown by the green pencil in Figure 5, then the function is *increasing*. If the gradient of the tangent line at a point R to the right of

the critical point is negative, as shown by the blue pencil in Figure 5, then the function is *decreasing*.

That is, to the left of P an increase in x leads to an increase in the value of the function and to the right of P an increase in x leads to a decrease in the value of the function. It is logical to expect at the critical point P where the gradient of the tangent is zero, the function must have the largest value in this specified neighbourhood. Thus, P is a local maximum.

Proof of Theorem 2 part (i)

I will now prove part (i) in Theorem 2. The following proof is mainly for HL students:

- We can assume the function y is continuous on the closed interval $[a,b]$, $y'(x_0 - \delta) > 0$ and $y'(x_0 + \delta) < 0$ and our job is to show that $y(x_0) \geq y(x)$ for all x in the neighbourhood of x_0.
- Since $y'(x_0 - \delta) > 0$ then the function y is an increasing function such that $y(x_0 - \delta) \geq y(x_0 - 2\delta)$
- Since $\delta > 0$ and f is continuous on the closed interval $[a,b]$ then $y(x_0 - 0) \geq y(x_0 - \delta)$
- Thus $y(x_0) \geq y(x_0 + \delta)$ for $\delta > 0$
- We now consider $y'(x_0 + \delta) < 0$
- Since $y'(x_0 + \delta) < 0$ then using the similar argument as above y is a decreasing function such that $y(x_0 + \delta) \geq y(x_0 + 2\delta)$
- Since $\delta > 0$ and f is continuous on the closed interval $[a,b]$ then $y(x_0 + 0) \geq y(x_0 + \delta)$

Theory of knowledge

1 In this article, I have offered two proofs and I claimed that these facilitate conceptual understanding. To what extent can proofs play a role in generating mathematical knowledge?

2 'The rigor of mathematical proof is dependent on the traditions of mathematics.' Discuss this statement with reference to two areas of knowledge.

3 'Language is used to describe concepts in differentiation but concepts can also enrich our language.' Discuss this statement with reference to another area of knowledge.

4 'A good mathematical proof is based on good intuition.' Discuss this statement with reference to two other ways of knowing.

5 'Imagination is the preferred way of knowing in mathematics.' To what extent do you agree with this statement?

- Thus $y(x_0) \geq y(x_0 + \delta)$ for $\delta > 0$
- Taking these two results together we have the desired $y(x_0) \geq y(x)$ for all x in $[x_0 - \delta, x_0 + \delta]$
- Thus $(x_0, y(x_0))$ is a local maximum.

Try finding the proof of part (ii) yourself (see 'Questions and activities' number 4).

Although the above proof is not a requirement at SL nor at HL, a mathematics HL student can be expected to follow the argument

The shapes of leaves can be used to study differentiation

without difficulties. It is good practice to verify whether or not a stationary point is a local maximum, a local minimum or an inflexion point. Both SL and HL students are expected to do this verification. Mathematical studies students can treat this as an additional tool in their mathematical projects.

If you can easily differentiate the first derivative again then it may be more effective to use the second derivative test, which is similar to the first derivative test.

Why are the tests equivalent?

So why are the first and second derivative tests equivalent?

Theorem 3: the second derivative test

A function $y : [a,b] \to \mathbf{R}$ that is continuous on the closed interval $[a,b]$ and twice differentiable on the open interval $]a,b[$, then if x_0 is in $]a,b[$, $y'(x_0) = 0$ and

Questions and activities

1 a The population P of a cultured bacteria in the first hour is known to be $P = 200 + 50t + t^2$, where t is measured in minutes. Find the population growth when $t = 10$ minutes. Note that population growth rate is basically the change of population over time and can be denoted as $\frac{dP}{dt}$

b An economist knows that the demand function for coffee in country Z is $Q = 980 - 150P$, where Q is the quantity demanded in thousands in a week and P is the price in US dollars. Find the price elasticity of demand at $P_0 = 4$ (where P_0 = a specific price and Q_0 = the level of demand corresponding to a price P_0). The (point) price elasticity of demand is calculated as $\frac{dQ}{dP} \times \frac{P_0}{Q_0}$

2 Find another cusp in Figure 4.

3 Complete the proof for Theorem 1 for a local minimum.

4 Complete the proof for Theorem 2 for a local minimum.

5 Let a function $f(x) = \frac{1}{3}x^3 + \frac{3}{2}x^2 - 10x + 10$

a Find all stationary points in this function.

b Verify the nature of all stationary points with an appropriate test.

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(i) $y''(x_0) < 0$ then $(x_0, y(x_0))$ is a local maximum

(ii) $y''(x_0) > 0$ then $(x_0, y(x_0))$ is a local minimum

The symbol $y''(x)$ denotes the second derivative of y. It means 'take the derivative of the result of the first derivative with respect to x again'. This time I will give a justification (not a proof) for the validity of part (ii). We can assume $y'(x_0) = 0$ and $y''(x_0) > 0$. We want to show that $y(x_0) \leq y(x)$ for all x in $[x_0 - \delta, x_0 + \delta]$ where δ is a small positive real number.

Since $y''(x_0) > 0$ then:

$$\lim_{h \to 0^+} \frac{y'(x_0+h) - y'(x_0)}{h} > 0$$

Since $y'(x_0) = 0$ then:

$$\lim_{h \to 0^+} \frac{y'(x_0+h)}{h} > 0 \quad (2)$$

Since $h > 0$ and the limit is also positive then this suggests $y'(x_0 + h) > 0$. Similarly we have:

$$\lim_{h \to 0^-} \frac{y'(x_0+h) - y'(x_0)}{h} > 0$$

Since $h < 0$ and the limit is positive then this suggests $y'(x_0 + h) < 0$. The assumption $y'(x_0) = 0$ along with the two implications above is basically part (ii) of the first derivative test. The result of the test points to a local minimum. Note that this is not a rigorous proof. Observant HL students may be tempted to replace the numerator in (2) with a result from the converse of the mean value theorem. I invite you to explore whether or not such a converse is valid.

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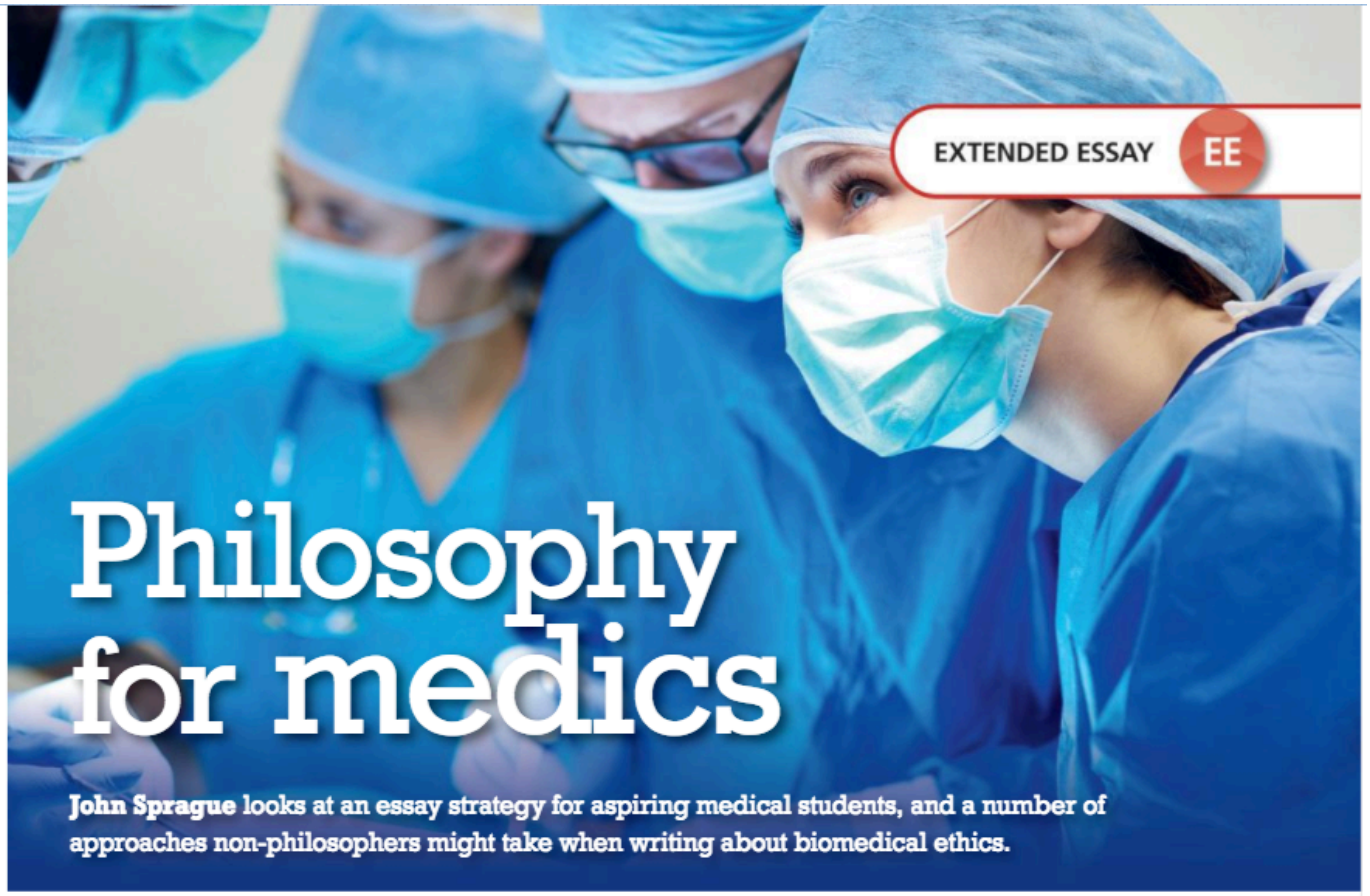

Philosophy for medics

John Sprague looks at an essay strategy for aspiring medical students, and a number of approaches non-philosophers might take when writing about biomedical ethics.

Many schools struggle to manage the number of future medical students writing their extended essays in the natural sciences. Experiments take time and lab time is precious. One option for future medics is to broaden your focus and shift to philosophy. Exploring an issue in biomedical ethics might offer you a valuable insight into the medical world, and give you an advantage in your college applications.

When making choices about what topics you might write about in your extended essay (EE), you should first and foremost consider what interests you. Also important, however, is what sort of experience you want to have, particularly when thinking about future college applications. For students hoping to enter the medical profession, writing an EE in biomedical ethics might be the thing that distinguishes your application from the many others from students with an excellent background in the sciences. Everyone will have strong scientific credentials, but will they have the added edge of additional expertise in the tricky issues surrounding biomedical ethics?

Biomedical ethics EEs

Writing an EE in a subject you are not taking as part of your IB Diploma can be a risky strategy. Some schools won't allow it, but one of the strengths of the IB programme is its breadth, and the EE is a crucial element. Competition at top medical schools is tough and in many cases medical programmes are inundated with incredibly gifted and successful students. Admissions officers will be expecting to see HL biology and HL chemistry, and while an EE in one or the other will certainly give you a high level of expertise, it is the sort of expertise that will be also shown by all the other gifted students. But while every student will come with a strong background in the sciences, few will have demonstrated expertise in ethics. Giving yourself a slightly different background, therefore, might give you the edge you need.

Students often return from interviews for medical programmes with tales not of being presented with difficult scientific questions, but rather with challenging ethical questions about the practice of medicine:

- How would you decide which patient deserves a limited resource?
- Is it ever right to treat a patient when they explicitly do not wish you to do so? On what grounds would you override their wishes?
- How long should we continue to treat a patient in a persistent vegetative state when the likelihood of recovery is zero?

Already, having some expertise in thinking through these or related questions will give you an edge. Also, if you have made it clear in your personal statement or application essay that you have written an EE in biomedical ethics, it is far more likely that interviewers will ask you specifically about your research, rather than some other random ethical question about which you might know very little.

My goal here is not to develop a deep analysis of what such an essay might look like, but point a non-philosopher in the right direction, one that hopefully will be fruitful.

Make a choice

The most effective philosophy EEs take the form of a sustained argument. This is often quite a challenge for students who have immersed themselves in the sciences. Nobody really needs to have an opinion about whether or not the level of oxygen influences photosynthesis (it just does) or an opinion about the relationship between dopamine production and Parkinson's disease, or the effect of genes on metabolism. These questions are solvable through research and don't require an opinion.

Ethical questions such as the ones mentioned above, however, are not *determined* by facts, though they might be *supported* by them. Two healthcare professionals might know all ther
biological processes still present in a patient in a
state, and still disagree as to whether withdra
treatment is warranted. This suggests that in ethical questions related to medical treatment, there are choices, and a student writing a philosophy EE must explore those choices and make a choice, defending it with facts and reasoned argument.

I remember a student who, after completing months of reading about the main ethical theories and applying them to euthanasia, came to me complaining that he still didn't know the answer. In other words, he mistakenly thought ethics was like the sciences, whereby so long as you've asked the right question and have the right experiments set up, you can settle the case through *observation*. However, to borrow concepts from TOK, ethics is quite distinct in its scope/application and methodology from the natural sciences. Choosing a position and defending it against challenges is the key to a successful philosophy EE.

Finding a theory

The challenge faced by students new to philosophy is learning the key frameworks and concepts required to derive answers to tricky biomedical issues. To offer an answer to any ethical issue, philosophers must apply some sort of framework or model that gives guidance on how to go about answering these sorts of questions. Just as scientists must approach a scientific question using a certain method, so too must philosophers.

The most straightforward approach if you are new to philosophy is to learn about one or more or the traditional normative ethical theories (generally *utilitarianism*, *deontology* and *virtue ethics*) and explore the biomedical issue through the lenses provided by these theories.

A research question (RQ) along these lines might be something like: 'Does a utilitarian (or other) perspective offer a successful approach to this issue?' In an RQ like this you would have to establish just what a successful approach might be in relation to the ethical perspective,
e whether some theory met those criteria. To improve this
you might ask which theory is better suited to answering
dilemma. This creates an evaluative comparison (comparing two theories with respect to a particular issue) and avoids an overly descriptive philosophy essay (which often score badly).

The key, if you are not entirely comfortable with philosophy, is to find a text that is accessible, but which also carries with it enough bite to be genuinely useful when thinking about biomedical issues. Avoid initially anything like an article in a academic philosophical journal, and stick with texts designed for medical students or medical practitioners. I've suggested some below.

Alternatively, if you are more comfortable with philosophy, I suggest that you identify some key philosophical issue or concept within the biomedical dilemma and offer a conceptual analysis of it. Concepts like *autonomy*, *consent*, *rights* and *quality of life* or *sanctity of life* are good candidates for this sort of approach. Here, you can shift beyond the entry-level application of an ethical theory and begin to investigate the concepts that underpin the theory.

Top tips for biomedical ethics EEs

Analyse a genuine ethical dilemma

Consider focusing as a starting point on a particular and real case, then develop a philosophical analysis of it. Good cases can be found in newspapers, medical journals or ethics textbooks. Using a genuine case will give you the opportunity to extract the sort of ethical issue you want to discuss. You might focus on patient autonomy, or the issue of limited resources or quality of life, or any number of other issues, depending on your interests and the specifics of the case.

You might then develop a research question specifically around particular philosophical issues pertaining to that case. If you have less experience in philosophy, this might be a viable option. The *Principles of*

Biomedical Ethics text mentioned below offers a number of real, though anonymous cases to explore, but examiners would prefer to see you struggling with a genuine case not masked by anonymity.

Some examples of interesting cases are:

Terry Schiavo

Mrs Schiavo was in a 'persistent vegetative state' and had previously told her husband that she would never want to be kept alive in such a circumstance. Her husband petitioned for withdrawal of treatment, but her parents were fighting it, raising interesting questions about patient autonomy and what others might feel is 'in the patient's best interests'.

Tony Bland

In the 1989 Hillsborough disaster in the UK, 19-year-old Tony Bland was crushed at a football stadium. He suffered severe brain damage and was being kept alive artificially.

Mary and Jodie

In 2000 a couple from Malta were brought to Manchester, UK for specialist care because the mother was about to give birth to conjoined twins. The babies were born but would be unlikely to survive, but one could be saved if they were separated. The parents didn't want the separation but the hospital petitioned the courts to allow it, and prevailed. The babies were separated. Mary died, but Jodie survived.

In each of these cases the specifics of the case raise far more profound questions than a straightforward utilitarian approach: questions of patient autonomy vs best interest, of whether or not feeding is considered 'medical treatment' and parental rights quickly bubble to the surface. In each case, EE students should find and read the actual judgements from the courts, as they contain a wealth of genuinely rigorous philosophical reasoning.

Evaluate a biomedical concept

You might also choose to start with a particular theory or position and explore it in the context of medical treatment. You could try to uncover the issues pertaining to measuring utility in the context of end-of-life issues, or explore the nature of virtue in the context of the healthcare practitioner, or the nature and role of autonomy as a fundamental philosophical principle in the doctor–patient relationship. This requires quite a bit of in-depth understanding of philosophical concepts and arguments, and is rewarding.

Develop an argument

Whatever approach you decide on with your supervisor, the importance of a genuine argument cannot be overemphasised. I've had many students who are extremely gifted in the sciences find this particular element a challenge. Whatever the facts of the case, the crucial point is that you must take the facts and apply them in support of an argument, understanding, however, that those same facts might be used in an argument for the opposite conclusion.

This is most noticeable when the approach calls for the application of an ethical theory (most often utilitarianism) to a scenario. While one utilitarian might wish to measure pain vs happiness in one way, another utilitarian might see the same set of circumstances, but measure it in another. You must show awareness of these alternative approaches and make a decision about which you will defend.

Recommended texts

The best approach for anyone writing a philosophy EE in biomedical ethics is to start reading. Philosophy is about reading, analysing, evaluating then (especially in the field of ethics) acting. Reading a wide range of ethical treatments of dilemmas in medicine will give you the content and knowledge, but also show you the skills you should try to emulate in your own essay. Here are a number of useful texts to consider. There are many more, but these might serve as a starting point. Pay attention to the texts these authors cite, as they will give you hints about what to read next.

- Glover, J. (1990) *Causing Death and Saving Lives*, Penguin. First published in 1977, it might be dated, but this text is excellent for a grounding in medical ethics. It provides a good summary of a number of issues and would be an excellent start to your research programme.
- Beauchamp, T. and Childress, J. (2013) *Principles of Biomedical Ethics* (7th edn), OUP. This text is slightly different in that the authors seek to define and establish a set of 'principles', which they suggest are useful in the day-to-day ethical practice of healthcare practitioners. This text also offers an excellent list of difficult and intriguing case studies to explore.
- Dworkin, R. (1993) *Life's Dominion: An Argument about Abortion, Euthanasia, and Individual Freedom*, Knopf. This text focuses on beginning- and end-of-life issues, but provides a sophisticated handling of the philosophical issues that can be used to develop a sophisticated understanding of the philosophical concepts available in the topic.
- *Medical Ethics Today.* The British Medical Association's handbook of ethics and law is used in a number of medical programmes, offering analyses of a wide range of specific ethical dilemmas found in the clinical setting.
- Harris, J. (1985) *The Value of Life*, Psychology Press. This text offers an in-depth exploration of several issues and provides a clearly evaluative stance, which might serve as a model for analysis.

Opening activities

Identify and learn an ethical dilemma that you've seen in the news. Think about whether you would agree or disagree with the outcome. Note your reasons and evidence for your view.

Try to articulate what you think are the main facts that are relevant in the case. Research these facts in a medical ethics textbook or online, and identify the ethical principles that are used to explore these facts.

While learning about these principles, keep thinking about whether you find yourself in agreement or disagreement. These ideas could form the beginning of an *evaluation* of the case. Here you can decide whether you want to focus on the case (developing an analysis and evaluation of the ethical theories involved) or whether you want to focus on the *principles* (using the case you've started with and others as evidence in your analysis).

Theory of knowledge

1 In what ways do the scope/application of the medical sciences and ethics overlap?
2 What role does knowledge constructed in the sciences (both human and natural) play in the development of ethical principles?
3 Is it possible to identify what 'healthy' means in medicine without incorporating value judgements?

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GROUP 6: THEATRE

Shaping a director's vision

Tom Rosevear looks at a number of ways of examining play texts to reveal their meaning and message

Once you have learned some of the methods below, you can start as a director to craft a vision for your own scenes, including deciding how to choose two moments to create from within a play.

> If the director can place the very heart of the playwright within his own breast, he will more successfully express the playwright's intent.
>
> Ball, W. (1984) *A Sense of Direction*

Here are some general truths that I have come to believe in as a director:

- All directors should be or have been performers. You need some experience of acting before you can become a director.
- To understand the text, the director must understand what is demanded of the characters. Try imagining how you would feel if you had to play this character.
- Actors and directors are students of life — open your eyes to the ways people around you move, talk and act.
- Remember that body, face, gesture, movement and voice are the principal means by which a performer communicates. Production elements such as make-up, costume, lighting, sound and set help to accentuate these.

Context and language tools

Your personal context

Try an activity suggested by Peter Brook: close your eyes and recall a live theatre performance you saw recently. Brook mentions an 'acid test' where certain 'frozen' moments are etched clearly on your mind.

Make a list of two or three of these moments. How could you use these moments in your own work? What were the performance elements that contributed to the moment? How were these complemented or highlighted by production elements such as lighting, make-up, sound, set and costume?

Choose one or two moments and try staging them with the help of your classmates. Shape the performers into a tableau working on the aspects of body, face and gesture (you could add movement and voice to create a more believable moment). Have the rest of the class describe what they see and feel. Were they able to explain why the moment might have been so memorable? Explain to the class how the production elements not visible in your tableau contributed to the moment.

Consider the extent to which selecting the moments was influenced by your own social or cultural background.

Social context

Remember the need to learn about the social or historical context in which the writer created the play, including theories that may have influenced them.

Should you study this before or after reading the play itself? I would argue that the best place to start is with the play itself. You may be able to determine something about the social context from your own reading. These impressions will need confirming: in *The Crucible* Arthur Miller was not interested in the Salem witchcraft trials per se but in the way the events could be used to express his fears about Senator Joseph McCarthy's anti-communist purges.

Language tools

Create a glossary of technical terms that will help you identify and explain onstage actions or production needs, e.g. 'blocking', 'unit', 'objective', 'tempo-rhythm', 'mise-en-scène', 'given circumstances' (see William Ball's *A Sense of Direction* for a more comprehensive list). Understanding technical terms helps you to focus on them as you read a script.

The text

As an IB theatre student, you will examine a play text as a piece of theatre. This means you will need to consider how to action or bring to life the words on a page.

Remember that discovering the given circumstances of the text is a priority. This means being able to answer the following:

- Who are these people?
- Where is the play taking place?
- When is this happening (time of day, month, year)?

Envisioning

One skill to develop is **envisioning**. This means using your mind's eye as you read to see dramatic possibilities. Ask yourself, where is the scene happening, what details are you given? What do you want to add? How does each character look to you? How are their bodies held? What do you see on their faces? How are they behaving? What clues are there in the text about this? Start to construct a 'mental movie' for the scene. Envisioning is one of the most important steps in interpreting a text.

Theory of knowledge

1 How are we able to understand the subtext in a person's communication? How is it that we do not always want to share our feelings or speak our minds?
2 How important is imagination in creating a mental picture of the mise-en-scène?
3 To what extent is acting an intuitive process? How do we 'act' in our daily lives?

The interactive text

Have a blank page facing each page of text, giving you plenty of space to record notes and make drawings and diagrams. Or use your journal to record notes. Don't underestimate the value of drawings and diagrams to show the positions of characters onstage — an angry face, a gesture such as hands on hips to express frustration. Stick figures can indicate groupings — where will the actors be placed in relation to the audience or in relation to each other? You may indicate movements (blocking) that you see with arrows and stage directions. These sorts of visual prompts are vital parts of the envisioning process.

Hearing the play

Read the play aloud within or outside the class by assigning roles (or on your own). Observe punctuation and use it. Hearing the words really helps you to understand and feel what is being said. It will also open up ambiguities in how a line should be delivered. Where you

***The Crucible* provides commentary on anti-communist purges through its depiction of the Salem witch trials**

notice this, try reading a line in more than one way. Decide which makes better sense. Assign one member of the group to read the stage directions aloud. How important are they in understanding character or action?

Language and diction

Be aware of the language the writer uses, whether formal or informal. Contrast the noble blank verse of Shakespeare's courtly characters with the earthy prose of the ordinary people. What speech characteristics typify certain characters?

Embedded stage directions

Unlike many modern writers, Shakespeare used no stage directions. Yet embedded in Shakespeare's text are plenty of clues as to what the director needs to consider. For example, in *Macbeth*, Banquo's comments in Act 1 Scene 3 about the witches not only gives us a clue about their unnatural appearance (and how they should appear on stage) but is a humorous reference to the convention where male actors at the time played female roles:

> …you should be women,
> And yet your beards forbid me to interpret
> That you are so

1.3.45–47

Later in the scene, Banquo observes:

> Look, how our partner's rapt.

1.3.142

Shakespeare not only shows Macbeth's reaction to the witches' news but gives the actor playing Macbeth clear guidance about how to action this part of the scene. All good writers give clues either directly or indirectly to show their characters' actions and feelings. As a director, you are free to use the stage directions as given, change them, or add your own. Always justify your changes.

Objectives

Uncovering the objectives of each character scene by scene is an important approach. William Ball sees plays as transactions where a character tries to achieve his or her objective by getting something from another character. Ball creates lists of 'actable' verbs with increasing power to strengthen the objective:

> I want to FLATTER him becomes I want to PRAISE him becomes I want to STRENGTHEN him becomes I want to GLORIFY him.

To understand the transactional nature of a character's objective, Ball describes how a director will challenge the actor to consider at

The text of *Macbeth* provides clues as to the witches' appearance

any point 'What are you trying to get from him?' and 'What are you trying to get him to do?'

As you read each scene, consider these questions for each character. Record your answer in the notes/response section of your script.

The achievement of an objective (say Lady Macbeth's successful persuasion of her husband to kill King Duncan) marks the end of a unit (see below). Once this has happened we might expect her character to change in some way — maybe to find another objective to follow.

Subtext

Stanislavski claimed that the reason people come to see a play is to hear the subtext. He maintained that we only speak 10% of what we are thinking. The rest is subtext (Merlin). Shakespeare used the asides in his plays to allow the characters to share with the audience what they couldn't share with the characters onstage. As an interpreter of text, you need to be listening for the subtext. Try having two actors work together on a scene. The first reads the character's lines as written, the second improvises what they believe the character is really thinking. Mark cases where the character may be thinking more than they are saying and decide how this can be communicated to your audience.

Units and beats (bits)

Stanislavski divided plays into units of action, both within and across scenes. A unit may represent the achievement of one character's objective or the start of a new section occasioned by the entrance of a new character, or an event that changes the course of the play. Beats are the smallest divisions of actions and there may be several within a unit. Identifying possible units can help the actors and director focus on a particular section through emotion, tension or atmosphere. As Ball says, 'The most intense visual or physical relationship between the actors usually occurs towards the end of each beat.'

Tempo

Stanislavski describes the tempo of a scene as dictated by the environment in which the scene is happening. Reading a variety of texts will show you the contrasts between different tempos: contrast the languid lifestyles of Chekhov's *Three Sisters* with the fast-paced movement of a French farce or a dance or fight sequence from *West Side Story*.

Tempo-rhythm

The tempo-rhythm is that of the individual within the scene. Stanislavski described tempo-rhythm in this way using a scale of one to ten. 'One' describes a person on their deathbed barely breathing, 'ten' describes the tempo of a person in a burning building desperate to escape.

This may depend on a variety of factors. A waiter in a busy restaurant may have an *outer* tempo-rhythm of eight or nine as they bustle from one table to the next, however, their *inner* tempo-rhythm (they can handle this job, no problem) may be a calm three. Being aware of these two in any one scene is an important clue to the way characters respond to their setting.

Decide on a tempo-rhythm for each character in a scene. Try having your classmates reading it at different tempo-rhythms. How does that work? Realise that a character's tempo-rhythm may change as the circumstances around them change (Merlin).

Character contrasts

Stanislavski advised his actors when playing a role to look for the old in the young and the young in the old, the humorous in the serious, the good in the bad and so on. As you read the text, note down examples where characters appear to go against their predominant personality traits. These moments can enlighten and surprise an audience.

Traditional forms

Theatre can often be categorised as belonging to a particular form: tragedy, melodrama, high farce, comedy, vaudeville, puppetry (see *A Sense of Direction*). Many of these have conventions that the would-be director needs to understand. The presentational form of melodrama, for instance, includes conventions for the audience, such as interacting with the characters, while tableaus and established body language gestures were used by the actors to convey the emotions the characters were feeling. An excellent resource for further exploration is Bella Merlin's book (see 'References and resources'). Make sure you read many play texts from different traditions and cultures to compare the way that playwrights build moments of tension and emotion.

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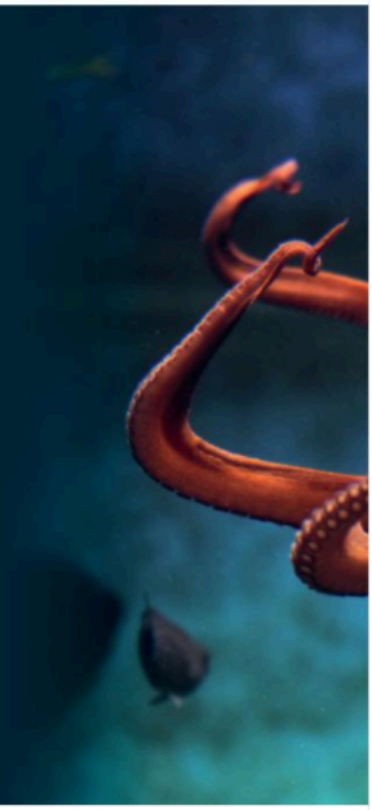
TOK THEORY OF KNOWLEDGE

Mechanisms for making knowledge

Ethical underpinnings



Carolyn Henly examines how ethics shape knowledge making

The scientific method is widely considered to be *the* way that scientific knowledge is made. One might, therefore, consider the scientific method as an end in itself, and, consequently, the arbiter of what is and isn't ethical for scientists to do. However, that idea is backwards. The scientific method is what it is because of the ethical underpinnings of scientific inquiry.

The same can be said of all areas of knowledge: the methods arose as means for practitioners to work in a manner that has the best chance of producing reliable knowledge. Hence, we can investigate the methodologies of any area of knowledge and infer from them the ethical value system that underpins them.

The aim of any given area of knowledge inevitably helps shape — and is shaped by — the ethical principles associated with it. The aim in turn also shapes the methodology, as the ethical principles do. Those relationships are equally useful for you to study as part of your TOK experience, but for the purposes of this exploration, I will simply accept those claims as given. You should note, however, how closely intertwined the aims, ethics and methods are in any area of knowledge.

One final important point before I demonstrate how methodology reflects ethical principles: in TOK, when we talk about the professional practitioners in the areas of knowledge, we mean those people who are working on groundbreaking knowledge, unlike students, who spend most of their school careers largely retracing work which has already been done. When you consider the nature and function of methodologies, you must do so in the context of understanding that the methods were developed as the best means of generating brand-new knowledge that nobody has ever known before.

Scientific knowledge

The new knowledge being generated in the natural sciences is knowledge about the physical properties of the universe. Those properties are recognised as being fundamentally real, that is, they exist independently of the existence of *Homo sapiens* (except when the properties being explored are the physical properties of *Homo sapiens*). The aim of the natural sciences, in other words, is to discover as much as it is humanly possible to know about real objects whose properties are not determined by opinion, perspective or will. Note that perspective, opinion and will may either hinder or help us to discover those properties, but that fact is different from the aim to find out that which is inherently outside of us.

Knowledge making in the natural sciences involves many mechanisms, including (but not limited to) direct observation, controlled experimentation, and peer review. I do not have space here to examine all of the means by which scientists make knowledge, but I will demonstrate one in detail, and then you can use the model as a basis for your exploration of the relationship between ethical principles and other aspects of scientific methodology.

Hypotheses

One specific mechanism used both by scientists doing lab experiments and by scientists doing field observations is the hypothesis. A hypothesis is a tentative answer to a particular question, and it forms the basis for designing an experiment or for focusing field observations.

Given the aim of the natural sciences, a hypothesis is necessarily a statement that aims to reflect a real-world fact. A hypothesis is, however, also fundamentally a human construct — a person's idea about what the real world is like. Hypotheses can be wrong. If, moreover, one were too wedded to one's hypothesis, one might design an experiment that was slanted in its favor, interpret data favorably, or ignore data that did not support the hypothesis. Such an experiment would likely result in a failure of the aim of natural science: if a scientist discovers what he wants to discover instead of what is really there, then that 'scientist' did not properly engage in science. We can, therefore, quite easily see that it is a matter of ethical principle that hypotheses be rigorously developed and tested by processes that eliminate as much as possible any potential personal investment or bias.

Indeed, we find that the expectation among scientists is just that: As Carl Sagan said:

> If there's something to be explained, think of all the different ways in which it *could* be explained. Then think of tests by which you might systematically disprove each of the alternatives.

Sagan explains that development of a single hypothesis is insufficient. A professional, ethical scientist actively tries to find explanations other than his own and must disprove all of those before he can be satisfied that his is the best answer it is possible to know at the present time.

Octopus hypothesis

An example of this process can be found in the work of Julian Finn and his colleagues at Museums Victoria in Melbourne, Australia. On observing an octopus stacking and carrying coconut shells to use as shelters, the research team hypothesised that this was an example of tool use — something not previously observed among invertebrates.

Finn and his fellow researchers identified and negated these other explanations for the octopus's behaviour:

- stimulus response (such as ants using leaves to carry food)
- simple behaviour around an object that is present all the time (such as a hermit crab using a discarded shell for protection)

They identified as evidence of actual tool use the facts that:

- the octopus had to manipulate the coconut shells in a particular way (stacking them inside each other) in order to carry them
- the carrying of the shells over considerable distances, despite the fact that 'This unique and previously undescribed form of locomotion is ungainly and clearly less efficient than unencumbered locomotion (i.e. costly in terms of energy and increased predator risk compared with normal walking or the faster jet swimming escape)'
- the shell is carried for future use, which the researchers observed

At no point did the researchers claim that their idea was unequivocally right — they offered a hypothesis and they gathered evidence that supported it, as well as trying to determine whether alternative explanations might make more sense given that evidence. To violate this process would be ethically wrong because it would result in 'knowledge' that did not describe or explain what actually happened in the real world.

The formulation and testing of hypotheses in the natural sciences, in other words, is bounded by the ethical principle that actual truth exists and that the charge of the sciences is to discover and explain it, not to distort or misrepresent it.

The aim of the arts

The aim of the arts is not as easy to define as the aim of the natural sciences. However, we can safely say that artists aim to express some truth about human life and experience through a medium other than objective proposition. The material that artists work with is not circumscribed like the material that scientists work with — where the latter must focus on physical objects in nature, the former can focus

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'Liquidising goldfish "not a crime"': **www.tinyurl.com/y99kz2qr**

'Books Can Take You Places Donald Trump Doesn't Want You to Go': **www.tinyurl.com/k4j3aj4**

'Can jumbo elephants really paint?': **www.tinyurl.com/byswd7**

'Elephant "self-portrait" on show': **www.tinyurl.com/4xoje3**

The material that artists work with is not circumscribed like the material that scientists work with

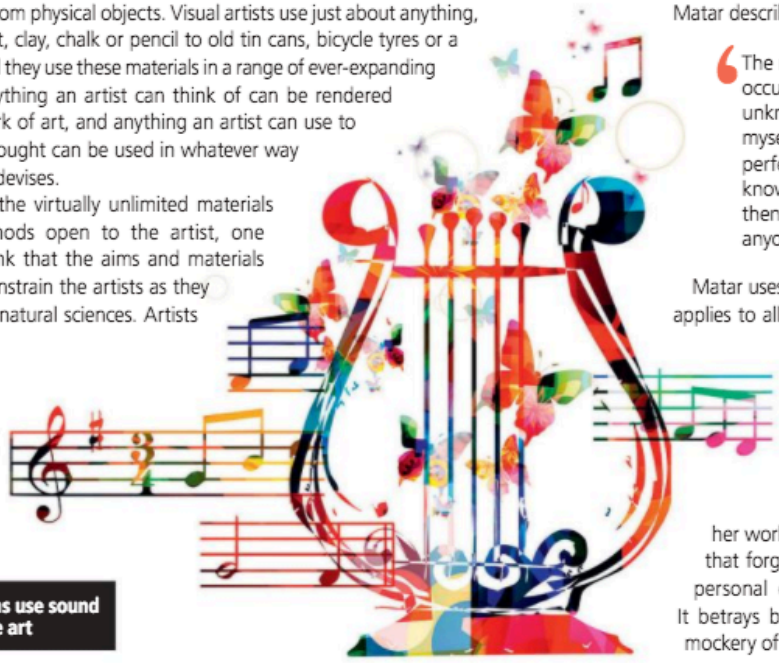
attention on anything that interests them. Art can be about physical objects, mental abstractions, mathematics, history, religion, personal relationships, and much more.

The mechanisms artists employ are similarly unlimited. Dancers use their physical bodies to make art. Musicians use sound, either from vocal cords or from physical objects. Visual artists use just about anything, from paint, clay, chalk or pencil to old tin cans, bicycle tyres or a urinal, and they use these materials in a range of ever-expanding ways. Anything an artist can think of can be rendered into a work of art, and anything an artist can use to convey thought can be used in whatever way the artist devises.

Given the virtually unlimited materials and methods open to the artist, one might think that the aims and materials do not constrain the artists as they do in the natural sciences. Artists are, nevertheless, constrained in significant ways. First of all, the arts are deeply, essentially, personal. Any work of art is a reflection of the individual vision and viewpoint of the artist. When art has a powerful effect on an audience, it is because that person experiences a mental and emotional connection to another human being: the artist. Hisham Matar describes the moment of discovery:

> 'The most magical moments in reading occur not when I encounter something unknown but when I happen upon myself, when I read a sentence that perfectly describes something I have known or felt all along. I am reminded then that I am really no different from anyone else.'

Matar uses literature as his example, but the point applies to all art. We respond to art that reveals to us in a visceral way that another human being is fundamentally like us in some, perhaps unexpected, way. Art must, therefore, be original. Forgery is unethical in part because forgeries decrease the artist's financial reward for his or her work. However, the more significant reason that forgery is wrong is that it appropriates the personal discovery and creation of the artist. It betrays both artist and audience by making a mockery of that human bond.



Musicians use sound to create art

'Elephant art' is created by the mahout directing the elephant by pulling its ear

Non-human artists

The recognition that the aim to share and shape worldview is inherent in art is behind the argument over whether 'artists' that are not human can truly make art. In Thailand, for example, paintings made by elephants are sold to tourists, who are amazed at the sight of elephants apparently drawing recognisable objects — such as elephants. Zoologist Desmond Morris explains what really happens:

> You will notice that, with each mark, the mahout tugs at his elephant's ear. He nudges it up and down to get the animal to make a vertical line, or pulls it sideways to get a horizontal one... . So, very sadly, the design the elephant is making is not hers but his. There is no elephantine invention, no creativity, just slavish copying.

While such endeavours are not as obviously unethical as forgery, they nevertheless violate the aims of art because they lack the individual insight into the world. The 'art' created is purely mechanical. We might enjoy the novelty of the process and we might marvel at how similar the actual product is to objects created by great human artists. However, there is no possibility of our experiencing that powerful moment of connection to another mind. Perhaps one day elephants will be shown to be able to express an idea or emotion in a work of art, at which time, we can talk about elephants as artists. Until then, however, without the potential for the meeting of minds between artist and audience, knowledge cannot be made from the art.

A final consideration is that social ethical mores also constrain the making of knowledge, and practitioners can be punished or even imprisoned for art or science that transgresses too far from social codes of ethics. Legal constraints limit how scientists and artists can use animals in their work. Canadian artist Rick Gibson was arrested and fined for offending public decency with his work *Foetus Earrings*. The director of a museum in Denmark was fined 2000 kroner for cruelty to animals after displaying an exhibit featuring fish in blenders, though the fine was later overturned in court. No society would stand for the actual murder of a person for the sake of pursuing knowledge in either the arts or the sciences — consider the controversy that still exists over the scientific knowledge gained by the Nazis during the Second World War.

The ethical constraints imposed by societal values on the making of knowledge in all areas of knowledge are real and significant. They provide the most obvious ways in which ethics shape knowledge making. However, the constraints imposed on methods by the nature of the areas of knowledge themselves are equally real and significant. The practitioners of each area of knowledge have a set of standards to which they must adhere if the knowledge generated is to be considered viable. That which is ethical in the areas of knowledge, in other words, is that which allows for the aims to be met.

In your TOK essay

When you write your TOK essay, you will be expected to compare and contrast at least two areas of knowledge around some concept. I have shown how you might compare and contrast the arts with the natural sciences around the concept of how ethics shape methodology in the areas of knowledge.

More sophisticated essays will explore contrasting areas of knowledge rather than similar ones, because being able to show contrast means that you know more, and in a more sophisticated way, than students who cannot. In the case of the relationship between ethics and methodology, for example, an exploration of the human sciences and the natural sciences would be virtually the same discussion. You can practise for your essay by choosing divergent areas of knowledge, and brainstorming the similarities and differences using old essay titles or any knowledge questions that you devise.

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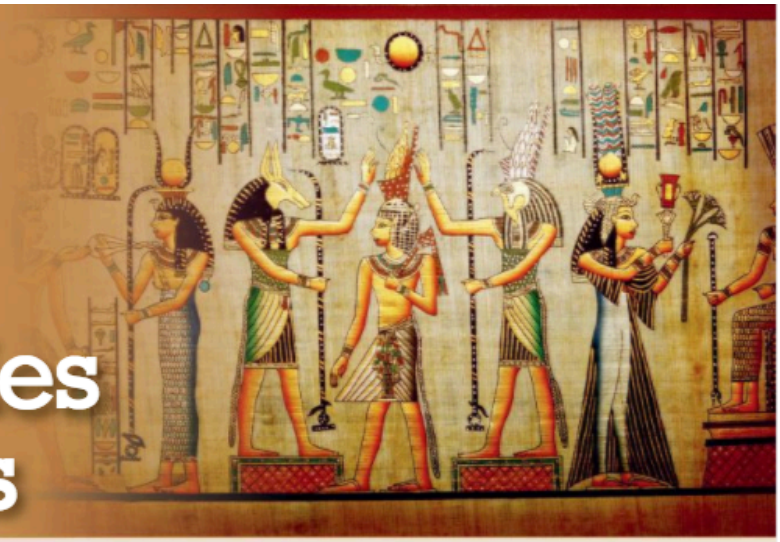
TOK THEORY OF KNOWLEDGE

AOKs as communities of knowers



The fact that TOK is in the core of the IBDP suggests it is meant to help bring the various strands of the Diploma together. In TOK we explore several frameworks — areas of knowing (AOKs), ways of knowing (WOKs), the knowledge frameworks — within which we can structure our discussions about the construction of knowledge. You are meant to think of your learning as engaging in these AOKs, but I've found that too often students lose themselves in the process — they think of the knowledge they gain in their subjects as *out there*, and they only *observe* it from afar.

Rather than thinking of AOKs as *bodies of knowledge*, perhaps we can gain much from thinking of the AOKs as *knowledge communities*. History as an AOK, for instance, isn't a thing out there waiting to be observed. Historians are a group of people who have joined together in relation to a set of issues, questions, approaches and values. The same would work for any of the AOKs. This would mean that IB history students shouldn't consider themselves to be peeking through some lens and seeing a 'body of knowledge' and learning it, but instead being *apprenticed* into the community of historians. At the end of the IB history experience, they should be closer to the core of that community, in terms of being able to ask the types of questions they ask and use the methods that the community has decided as being appropriate.

This puts the individual knower back at the centre of the TOK experience, where students begin to ask questions like 'As a *scientist*, what is it that I know?' or 'What are the rules that the scientific community offers me to guide my development of new knowledge?'

AOK communities

The knowledge framework is an excellent way of structuring this discussion. You might explore the central questions and applications of an AOK community through *scope/application*, or explore the shifts and changes an AOK community has undergone over time through the framework of *historical development* (have the methods changed? Has the available data changed due to technology?).

You might also think about how individuals engage with the wider community through *links to personal knowledge* (e.g. how do my data impact the theories held by the scientific community?). Using *methodology*, you might ask 'what are the general rules that the experts in the community follow when constructing knowledge?' Finally, you might ask 'what are the central *concepts and language* that I must understand and be able to use to be part of this AOK community?'

Why do this?

There are three advantages to using this approach to AOKs. First, it puts you back at the centre of your learning, but not in a way that is overly individualistic. You can consider your learning as a process whereby you are *joining* a community or at least learning to engage meaningfully with that community. In my case, for instance, I want my students to know a bit about philosophy when they are done, but really I want them to know how to be philosophers: how to engage with the community of people calling themselves 'philosophers'.

Second, it gives teachers and students the opportunity to discuss what would keep someone *out* of the community. For instance, Richard Dawkins makes clear his reasons why he thinks homeopathic medical practitioners should not be included in the AOK community of 'natural scientists': because their *methods* break the established rules of that community. The interesting point here is not necessarily whether Dawkins is correct, but that there is a controversy. Exploring this controversy of who gains membership to the community will encourage good second-order analyses of the AOK itself.

Finally, thinking of knowledge as something communities engage in might encourage you to think of a wider variety of knowledge communities, including cultural, linguistic or political communities. It could also encourage discussion of the *procedural elements* (the 'knowing how') important in various communities. For example, knowing how to employ AOK-based analyses, or how to perform certain skills in wider cultural communities.

This approach doesn't contradict the focus or purpose of the AOKs as they stand, but thinking of them in this way might create new opportunities for second-order discussions and approaches, and highlight the use of the knowledge framework.

John Sprague teaches philosophy and TOK at Tanglin Trust School, Singapore. He is the lead editor of IB Review and is the author of *TOK: Skills for Success* (Hodder Education).

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