

Links

This content links to Section 5.2C Diversity and discrimination.

Gender, gender expression and sexuality

When babies are born, doctors assign a gender based on their biological features. While there are exceptions (about 0.1% of births), babies are usually classified as either male or female. While this initial classification is biological, society places different expectations and norms on individuals based on their gender.

Race and ethnicity

Race is usually defined by physical traits and characteristics such as skin colour or hair texture.

Ethnicity is the cultural expression and identification shared by large groups of people with a common racial, national, religious, or any other identity marker (or a combination of them). People of the same ethnicity may speak the same language, share cultural beliefs or have common values, while racial identity is often defined by what makes a person's appearance distinct. Race is a purely social construct and has no basis in genetics, however it still has an influence on how one experiences (digital) society. Racial prejudice and bias in the West tends to favour people with white skin over people with darker skin.

◆ **Race:** A social construct based on people's physical traits and characteristics.

◆ **Ethnicity:** The cultural expression and identity shared by people with a common racial, national, religious, or any other identity marker.

Inquiry

To what extent can digital technology, due to the way it works, perpetuate historical (and present) biases and inequities in society?

Support your answer with findings from at least two real-world examples, for example racial and ethnic colour bias in facial-recognition software and in image-editing software.

Ability status

The term **non-disabled** is used to describe someone without a physical disability (which could be seen or unseen). While a person with a **disability** may, for example, use a wheelchair, have difficulty seeing, or be missing a limb.

Invisible or hidden disability is used to describe disabilities that cannot be immediately observed, such as a hearing impairment or mental health condition. Many devices such as cell phones or computers have **accessibility** settings that enable users with a disability to engage with digital technology. This could include text enlargement, voice commands, text-to-speech features and more.

◆ **Disability:** A conditions that limits a person's movement or senses.

◆ **Accessibility:** The quality of being easy to use.

ATL ACTIVITY

Research

Research how **immersive reader technologies** in software such as word processors can help people with accessibility issues.

Links

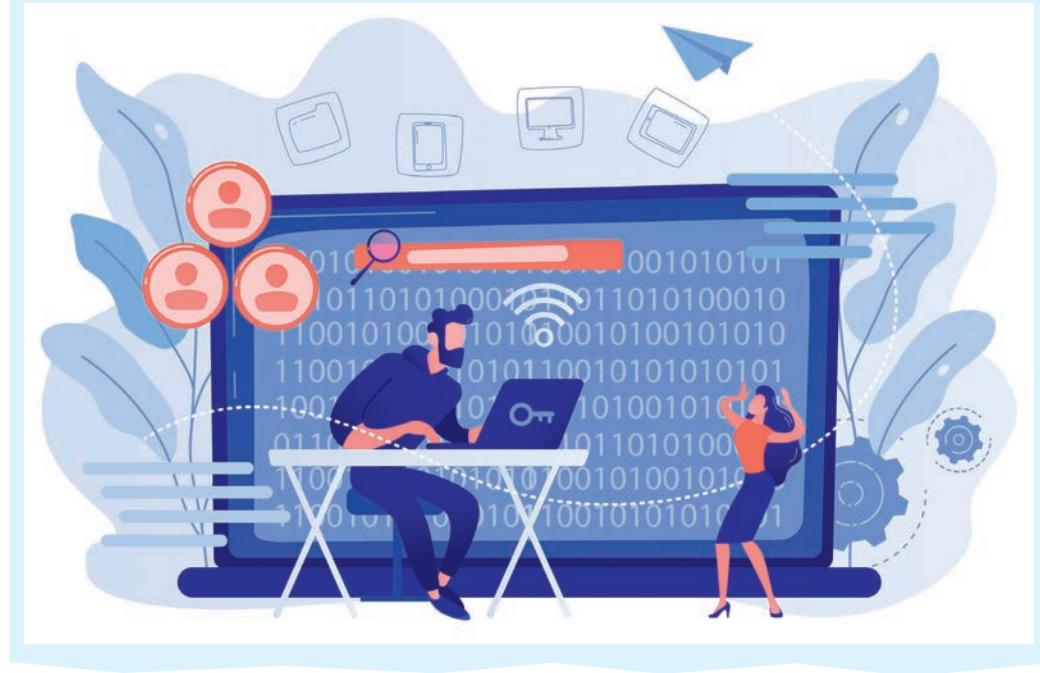
This content links to Section 4.4B The human body.

Religious beliefs and practices

Religious beliefs may or may not be a central part of one's identity. While many nations permit and encourage a diverse range of religious activities, many also have a national religion or policies that are aligned with religious traditions. Even within the same religion, there is a wide range of diversity in how members practice their religion and even how they choose to connect with it. Common religious practices may include prayer, rituals and dietary guidelines. Major life events such as births, deaths and weddings have often religious components and traditions.

REAL-WORLD EXAMPLE

Gamergate



ATL ACTIVITY

Research

Research how religious practices are changing, and beliefs are being promoted, through the use of digital technologies.

In fall 2014, thousands of people in the gaming community began a campaign of systemic online harassment targeted at several outspoken feminist gamers. It grew into 'an internet culture war' when a collection of misogynists, trolls, cyberbullies and more began using social media to target professionals advocating for the greater inclusion (of women) in games and gaming.

Once a target was selected, often due to their advocacy for progressive changes to the gaming industry, or even for covering other attacks in a non-positive light, they would become the recipient of a barrage of harassment ranging from online harassment, threats and even **doxing** – the publication of personal and/or private information such as addresses, phone numbers and photos.

Gamergate participants used niche and anonymous social media tools such as 4chan and 8chan to turn Gamergate into a sexist challenge to the integration and growing presence of women in the male-dominated gaming industry. Social media was weaponized to silence the voices of women and progressive gamers advocating for more inclusion in the shared culture of gamers.

The Gamergate participants are most likely representative of only a small extreme percent of gamers. For example, Andreas Zecher received thousands of sign-ups from gaming professionals showing their support in response to his open letter to the gaming community, where he stated:

We believe that everyone, no matter what gender, sexual orientation, ethnicity, religion or disability, has the right to play games, criticize games and make games without getting harassed or threatened. It is the diversity of our community that allows games to flourish.

Source: <https://medium.com/@andreaszecher/open-letter-to-the-gaming-community-df4511032e8a>

While the gaming subculture is just one example, it encapsulates the trend toward the systemic use of online harassment and political bipolarism that has emerged (in the US and in many parts of the globe) and the use of social media tools and spaces to amplify the power and voice of a small group with extreme views to silence the voices of others.

[https://en.wikipedia.org/wiki/Gamergate_\(harassment_campaign\)](https://en.wikipedia.org/wiki/Gamergate_(harassment_campaign))

www.vox.com/culture/2020/1/20/20808875/gamergate-lessons-cultural-impact-changes-harassment-laws

www.washingtonpost.com/news/the-intersect/wp/2014/10/14/the-only-guide-to-gamergate-you-will-ever-need-to-read

◆ **Doxing:** The publication of personal and/or private information such as addresses, phone numbers and photos.

Inquiry

Investigate further details about Gamergate to determine the range of issues that it exposed.

ATL ACTIVITY

Research

Research the comments that have been posted in response to online articles about some recent controversial news and current issues. Examine them to see if you are able to identify any trends in the demographic indicators – this could include race, ethnicity, gender, ability, age and more.

ATL ACTIVITY

Thinking

Examine your social media community with a critical eye on the types of posts and people that you are interacting with.

- Visit a social media platform that you use regularly.
- Visit the news feed or wherever you receive information.
- For 10 to 20 items, identify the age, gender, race and political views of the people you are receiving content from.
- Look at the list to see if your platform is providing you a diverse range of sources, or if most of your information is coming from a **filter bubble** of similar sources.
- Are the majority of the posts you interact with coming from people who share your demographic information?

◆ Filter bubble:

When information only comes from a narrow range of sources due to algorithms designed to personalize your online experience.

Inquiry

Research the following terms and provide examples:

- social media filter bubbles
- social media echo chambers
- diversity, equity and inclusion initiatives
- cancel culture
- confirmation bias.

To what extent is social media effective in fostering cross-cultural interactions or perpetuating exclusivity, privilege and power?

4.7B Social class

■ Organization, role and impacts of social class

Social class is a method of classifying people and communities according to their social status. This distinction is driven by three forms of capital:

- economic – material wealth
- social – connections and networks with people in power
- cultural – well-educated and socialized in order to engage with the dominant culture in society.

◆ Social class:

A method of classifying people and communities according to their social status.

Those with the greatest access to this capital would be in the upper classes. An examination of UK non-internet users (or limited users) in 2015 showed that most come from lower economic households. As a result, there is a correlation between lower socio-economic status and access to digital society.

While digital technology has helped to provide new tools and greater connection to people across all classes, those who are already wealthier have more access to the benefits and opportunities created by it due to greater access and training, which has widened the gap between classes. The interplay between digital technology (automation of jobs), the labour force and the education system (unequal implementation) has also widened the disparity between the ‘haves’ and the ‘have nots’.

■ Intersection of social class in major areas of life, such as employment, education, health and illness, housing

The **digital divide**, or inequitable access to technological tools and resources, is drawn along class lines. Many jobs in a digital society rely on computer literacy, so those who have access to technology and the skills to use it effectively are more likely to get better jobs and obtain even more resources.

Additionally, the growth of online education and training gives those with access to digital technology more capacity for gaining qualifications, and hence good jobs, through online courses. As more parts of society integrate digital technologies such as online banking, distance medicine and remote working, the digital divide has the potential to further widen the gaps between social classes.

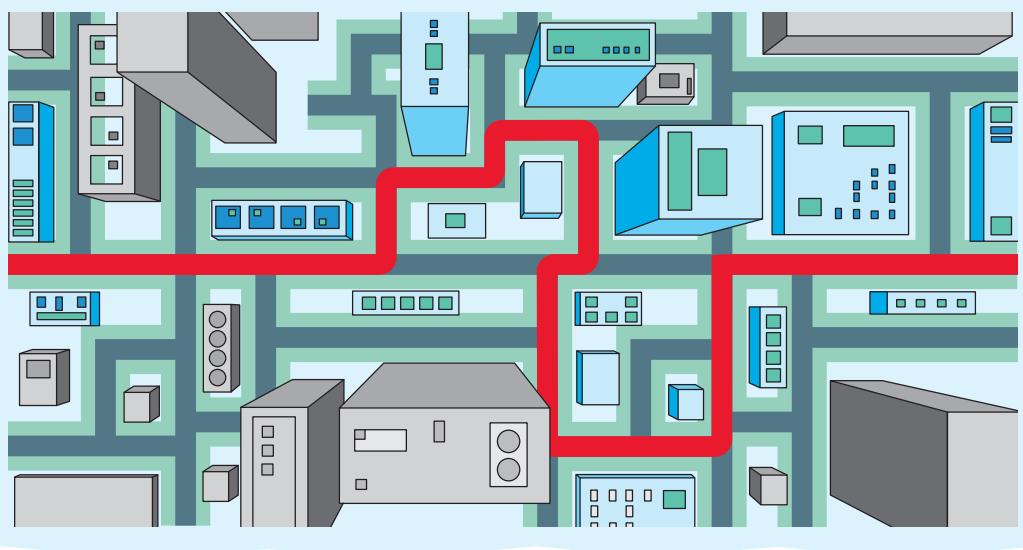
REAL-WORLD EXAMPLE

Digital redlining

In the USA, where you live has a significant impact on many of the opportunities that you are afforded in life. Property taxes are used for school funding in the district, which means that areas with low-income housing often have less money allocated toward their schools than in higher-income areas.

Historic **redlining** (the systemic denial of services to specific communities) also made it difficult for people, mostly living in non-white communities, to access banking, insurance, health care and even supermarkets. As a result, social mobility has been limited in many communities, while wealthy communities have continued to accrue more capital and a higher social class.

Many of these neighbourhoods lack infrastructural resources to ensure access to clean air, pure water, healthy food options, safe streets, public transportation, and more. They are also often situated close to refineries, factories, freeways, resulting in higher instances of respiratory illnesses. This, combined with a more densely populated area as more families/people share smaller living spaces, creates a greater risk for spreading illness (notably COVID-19).



Digital redlining continues this practice in the digital landscape by creating content that caters to specific groups, or by offering connectivity services to specific geographical areas. For example, the internet service provider AT&T received multiple complaints for failing to invest in infrastructure in lower-income city neighbourhoods. These neighbourhoods may be considered less profitable, and this creates an additional challenge for those living there.

The widespread collection of data through the use of digital technologies creates a **proxy discrimination**, where legitimate indicators such as zip code or responses to specific questions can provide high correlation to indicators such as race, disabilities or socio-economic status in situations like job/university applications where those factors are not meant to be considered.

https://thehill.com/policy/technology/352267-att-hit-with-second-complaint-of-discrimination-against-low-income?mc_cid=9646f90f27&mc_eid=e00c29a42c

◆ **Digital redlining:**
The systemic denial of digital services to specific communities.

◆ **Proxy discrimination:**
Discrimination that occurs due to correlations to indicators such as race, disabilities or socio-economic status.

ATL ACTIVITY

Research

In your neighbourhood, town, city, region or country, find statistics about reliable access to the internet. Where there is a greater or lesser ability to access the internet? Investigate the reasons why. Do this for broadband access and mobile phone access.

Inquiry

Research the impact and implications of the digital divide in:

- employment
- education
- health
- housing.

Explain how these impacts and implications are connected to each other.

ATL ACTIVITY

Thinking

From your research in the previous activities, evaluate:

- ‘Everyone has a smartphone now. It is nearly impossible to live in a digital society without one.’
- the potential for digital technologies to be part of the solution for differences between the social classes, and for mobility between them.

REAL-WORLD EXAMPLE

Biased algorithms in the criminal justice system

Predictive policing uses algorithms in an attempt to forecast criminal activities.

Computer systems are used to process the large amounts of data that are collected and recorded by police units. Predictive policing may include analysing historical arrest data to help decide where to assign police officers, or determining the likelihood that someone will commit or be a victim to a crime.

While predictive policing aims to increase the accuracy in predicting crimes, there are concerns about transparency and bias in the algorithms used. While using an algorithm may seem unbiased and neutral, the fact that it relies on historical data means that it will recreate and reinforce any biases existing in the data set. So, if a neighbourhood has had many arrests in the past, then the algorithm will send more police there, which will result in more arrests in that neighbourhood, creating a feedback loop where the result of the algorithm further perpetuates the bias in the data.

◆ **Predictive policing:**
The use of algorithms in an attempt to forecast criminal activities.

Algorithms are also used when calculating the risk of **recidivism**, or repeated offense. The algorithm uses a range of data including zip code, social media contacts, survey responses and more. One investigation in 2016 found that both black and white defendants had similar accuracy results (around 60%), but the mistakes the algorithm made were very different between the two demographic groups: white defendants were almost twice as likely to be predicted as less risky.

◆ **Recidivism:** The tendency to reoffend.

In the USA, social class and crime are interconnected as those from lower classes are more likely to be arrested or imprisoned for crimes than affluent individuals. Prisoners are more likely to be unemployed, with less access to economic capital and, once released, are ineligible for many jobs. While criminal activity (usually termed 'white-collar crime') by the wealthier classes can pose a greater cost to society, these crimes are less likely to be processed and convicted than 'street crimes'. As a result, the criminal justice system reinforces class inequity by more significantly diminishing the access to capital in lower-class areas. The implementation of predictive policing and recidivism prediction furthers this inequality and reinforces the status quo, further marginalizing lower-class communities.

www.businessinsider.com/harvard-mathematician-reveals-algorithms-make-justice-system-biased-worse-black-people-crime-police-2017-6

www.brennancenter.org/our-work/research-reports/predictive-policing-explained

www.propublica.org/article/how-we-analyzed-the-compas-recidivism-algorithm

Concept connections

- **Change:** How different is the digital divide between social classes now from the wealth divide of the past?
- **Expression:** The way we express ourselves is closely tied to the social class we were born into, but this is now changing due to digital technologies; as a famous cartoon once said: 'On the internet, nobody knows you are a dog.'
- **Identity:** Our identity is not as confined to the social class we were born into now that we have access to the whole world through our smartphones.
- **Power:** The power of the social classes depends on privilege and wealth. Where is this challenged and reinforced in a digital society?
- **Space:** The spaces social classes live in are often restricted, but the use of digital technologies is providing greater access to a large variety of 'spaces' to live and operate in, both real and virtual.
- **Systems:** The way societies are being connected and integrated using digital technology systems, locally and globally, is having a large impact on social class.
- **Values and ethics:** Governments should place a high priority on providing digital technology resources and tools to all social classes because of the positive impact that removing the digital divide would have. It would be ethically wrong not to do so.

4.7C Families and relationships

■ Ways of understanding, forming and connecting families

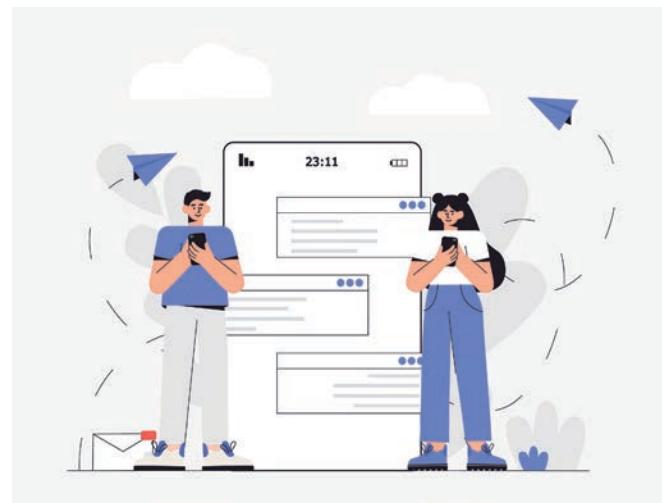
Family communication is evolving. Parents can keep tabs on the locations and activities of their children; day care centres can provide regular updates and video access as toddlers eat, learn and play; and getting their first cell phone gives pre-teens the ability to communicate with their family and friends 24-7.

Data about families is also growing. New technologies allow DNA analysis so that you can see what countries and nationalities your family comes from. Tracing families back through the generations is now much easier, and the amount of information that can be found is growing as more past records are scanned and made available for searching over the internet.

In addition to social media platforms, families are connecting and using technology to collect and document memories, track chore completion and manage their homes in smaller, more private chats and social media networks.

Video messaging and internet calling has significantly reduced the cost of keeping families connected across the globe. Friends and families can also monitor and share information and location data by updating social media or just keeping their phones on. For example, apps such as Apple's Find My Friends allow users to share their GPS locations in real time, so you can always know where your friends and loved ones are.

The power of digital technologies to connect families and friends is great, but they can also be abused if one person in the relationship becomes too controlling. There are many stories of jealous and controlling friends, parents and partners using digital technologies to spy on activities and to track the movements of friends, children and partners.



ATL ACTIVITY

Thinking and research

At what stage would the use of apps such as Find My Friends become surveillance and an invasion of privacy for you, rather than an aid to keeping in contact with family and friends?

Design and conduct a survey, preferably an anonymous one, about the use of such apps by family and friends.

ATL ACTIVITY

Research

Design and conduct a survey of family and friends, preferably using an online survey app, to gather their opinions about the positives and negatives of using online video meetings between family members and between friends. Focus especially on questions about the impact on the quality of the relationships.

Inquiry

Research cases in the news where digital technologies have been used for controlling purposes in a relationship. Report back to your class with examples, including explanations of how the digital technologies were used, the impacts and implications, and solutions that individuals and society can put in place.

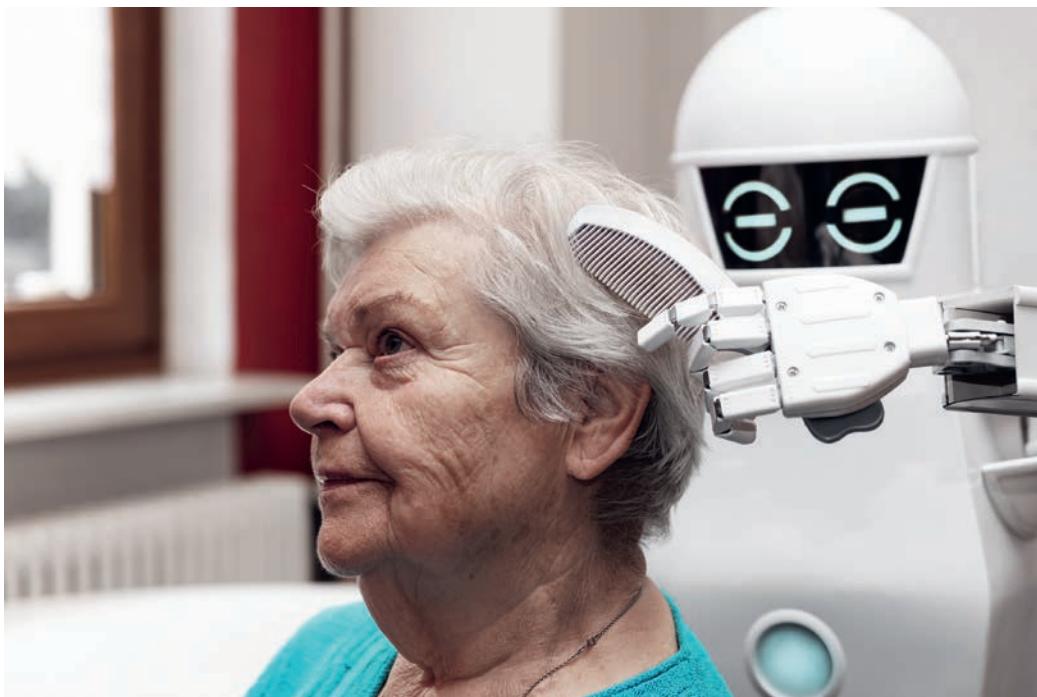
ATL ACTIVITY

Research

Visit a site that can help you investigate your family history (you may need to sign up for a trial period), and be mindful of what details you choose to provide and how those may be used or sold by the site, or discuss the usefulness of such sites with a member of your family that uses them.

Friendship, companionship and personal relationships

Digital tools are being used to provide social and emotional support to certain populations. For example, ElliQ robots will play games and simulate social interactions with elderly people, while collecting and sharing essential information with their doctors and caregivers. Another robot, Milo, specializes in helping children with autism to develop their social-emotional skills by teaching them skills such as recognizing facial expressions and being aware of others' emotions.



ATL ACTIVITY

Social

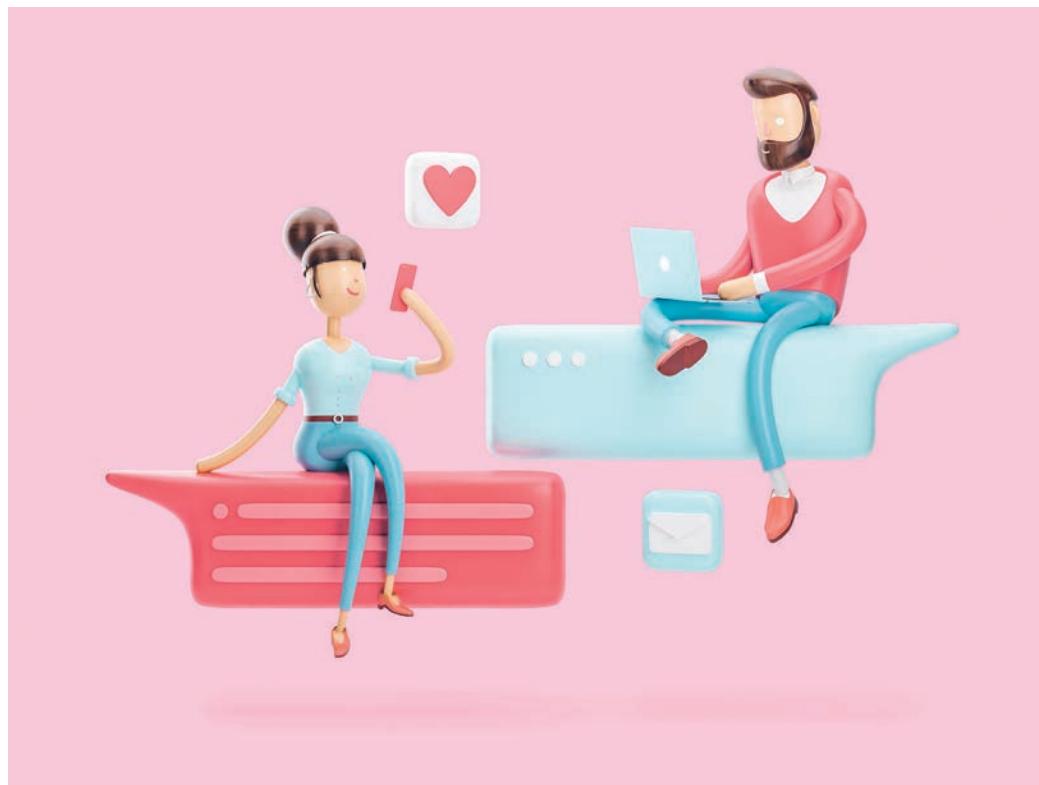
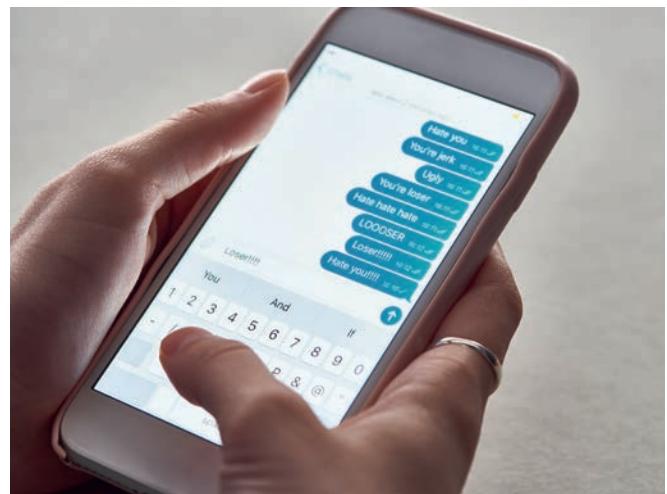
Investigate how companion robots are being used.

- In groups, research how companion robots (for example, ElliQ, Milo, Moxie, Woobo and Pepper) are being used in each of these situations:
 - elderly people living at home or in care homes
 - children living in care or being at home by themselves while parents work
 - social isolation or loneliness for adults living alone or in isolated situations
 - anyone living with a medical diagnosis (depression, autism, dementia) who has difficulties maintaining social contacts.
- Create a poster with images showing:
 - how the robots are being used
 - their benefits/limitations.
- Share your findings with each other in the group and in the class.
- Hold a discussion to evaluate how companion robots are impacting the quality of life of the people who use them.

■ Online relationships and group memberships

Communities who share a common identity, practice or belief are becoming more and more prevalent. These can be found everywhere from local Facebook groups and political activism groups, to refugee support groups. Proponents argue that digital technology creates spaces for people to connect and learn about others who belong to specific subgroups. Critics argue that this phenomenon is a form of a cultural silo (a reluctance to share information with people outside of the group), which may actually mean that we are becoming less social, that society is fragmenting, and that a lack of familiarity means lack of compassion.

Friends and connections are being formed in digital spaces and forums across the internet. Social media enables people to find like-minded individuals and groups, and to connect with forums, resources and even real-world events. A range of apps exists to help people connect with other people, often uniting or targeting people who share common identity markers. Dating apps may target a specific religion or ethnicity, while meet-up applications may use your location to help you find people with similar hobbies and interests in your area.



REAL-WORLD EXAMPLE

Mystic Messenger dating simulations

The Mystic Messenger app was released in 2016. It is a text-driven visual novel with a strong romantic component. As the player opens the app, they are immersed into an 11-day real-time, role-playing experience where they receive texts, chats, emails and calls from the characters. While interactions are limited to multiple choice responses, players must be attentive to emotional cues to earn affection from the different characters. Success in the game comes from building relationships and successfully 'wooing' the artificial intelligence characters.

When games like Mystic Messenger became popular, sceptics and media outlets reported from a stance of disgust, appalled by the obsessive way fans played, substituting virtual relationships for human ones. In Japan, these games were blamed for the low fertility rates their nation faced. One Chinese commentator claimed that people are drawn to these games because their real lives are 'brutally lacking' in love.

However, one self-proclaimed addict to Mystic Messenger reported that the game made her emotional life feel more stable and fulfilling. She felt she could explore and process her unmet emotional needs in a safe environment. Furthermore, for most players, the game is not a substitute for human-to-human love – it is just a fun game.

www.theguardian.com/technology/2018/sep/26/mystic-messenger-dating-simulations-sims-digital-intimacy

www.vice.com/en/article/78k7qe/mystic-messenger-review

ATL ACTIVITY

Research

Design and conduct a survey for family and friends that asks them about the types of online communities that they belong to. Include questions about the benefits that come from, and issues that arise from, being members of these online communities. Remember, an online group can be small or large, local or global.

Inquiry

Research the benefits and issues associated with online dating sites.

Concept connections

- **Change:** Computer games are much more developed and enhanced than many of the games we play with real objects.
- **Expression:** Do you think humans will choose to interact with artificial intelligence instead of other humans? Could bots and digital simulations ever be a replacement for real human connection?
- **Identity:** Some players of computer games get so involved that their identity in the virtual world can become more important than their identity in the real world. This can lead to game addiction.
- **Power:** The power of computer simulations/games is large and we need to be aware of this power.
- **Space:** Living in a virtual world can disconnect some people from the real world.
- **Systems:** Computer simulations are very complex systems, which is the reason they can be so real. But reality is always more complex and unpredictable than any system the human mind can create.
- **Values and ethics:** The ethical decisions we make and values we display in computer simulations and games can be different from those in our real lives. This can create problems if they are transferred.

Creativity, activity, service (CAS)

Minecraft build battle

- Set up a competition at school for students to design and build in Minecraft under a given theme.
- Research how to host the Minecraft environment and what students will need to do to join.
- Get permission from school to run this competition.
- Invite friends to join in the organization of this project.
- Discuss and agree on the criteria for judging the competition
- Participants will be using their skills and imagination in Minecraft to construct their build, using critical and creative thinking in the process.
- Promote the competition to students in your school.

TOK

Computer simulations and games are models of the real world. To what extent are they close to the real world? When meeting people online, what evidence can they provide to prove to you that they are who they are?

Extended essay (EE)

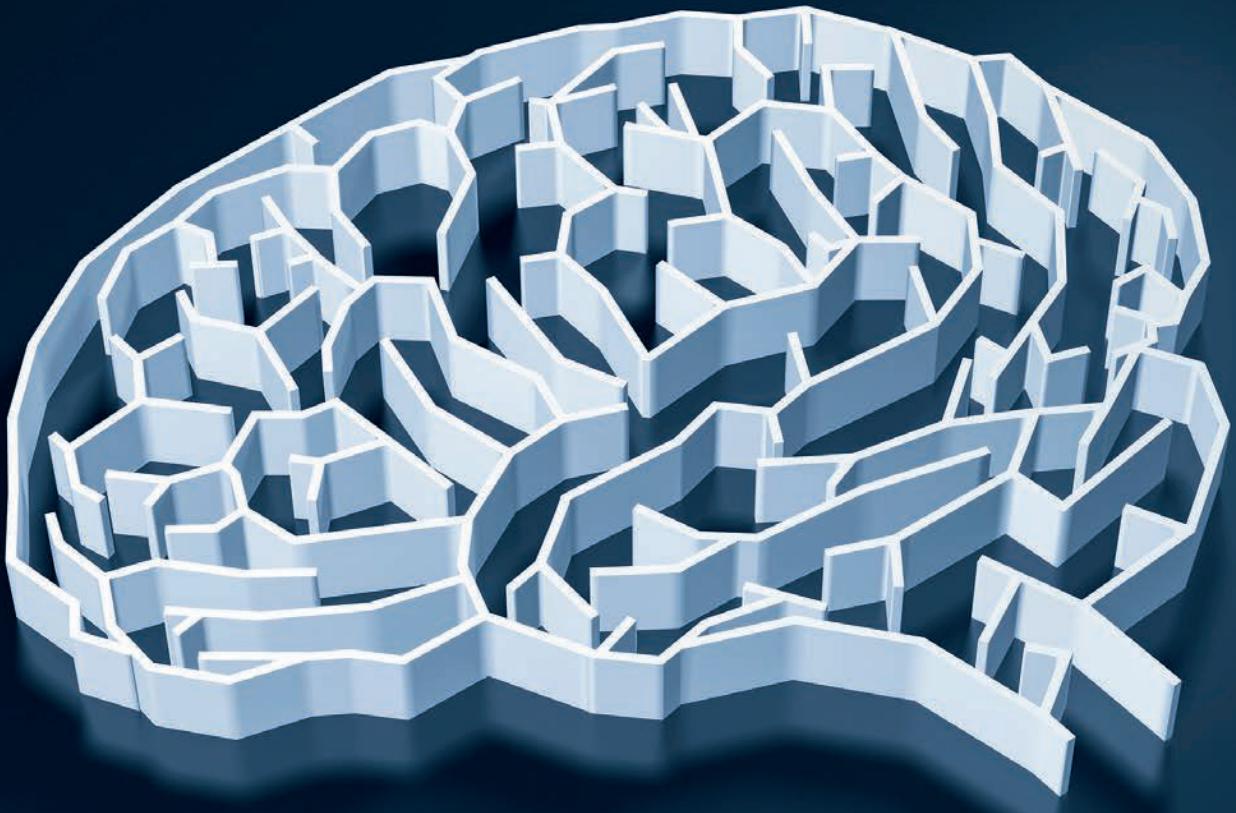
Research video game addiction, causes, impacts and solutions in specific contexts including countries, specific games and player involvement.



Reflection

Now that you have read this chapter, reflect on these questions:

- Reflect on your age, gender, race, religion, ability status and other identity markers.
- Reflect on how many of these you display and use when you are online.
- Think of something you like to do online with others. How might someone with different identity indicators have a different perception/experience than you in that experience?
- How do you experience the digital divide? Do you feel you have increased or limited access and opportunity to digital tools, systems and resources? How does your experience compare with other communities in your region, particularly those with more or less wealth?
- How does your family use technology to stay in contact?
- To what extent is it normal to meet people in real life that you met online?
- Can you have meaningful friendships and relationships with people in purely digital spaces?



Section 5

HL extension: Challenges and interventions

5.0

Overview of the HL extension

By the end of the Digital Society course, you must be able to identify, analyse and evaluate an intervention related to a real-world example for each challenge topic and the related subtopics, and recommend steps for future action.

The next chapters cover the scope and content of the challenge topics, and model extended inquiries. These can be used to guide your own extended inquiries based on relevant issues you have found within the areas of inquiry for each challenge topic.

Please note, you will not be able to cultivate an in-depth knowledge of every issue and type of intervention relevant to each challenge topic. Instead, the HL extension focuses on developing your inquiry skills, which can be applied to any challenge topics and interventions.

Introduction

In the HL extension, students conduct extended inquiries to address challenges and **interventions** in digital society.

You will explore challenges that involve the impacts and implications of complex issues in real-world situations. In a digital society, challenge topics are related to various digital systems. You will explore and investigate various challenge topics throughout the course.

You will also explore interventions that attempt to mitigate, intercede, support or resolve aspects related to a challenge topic. You will be required to identify, analyse and evaluate interventions for each challenge topic and your prescribed areas of inquiry, and provide recommendations for future development involving various digital systems.

HL students must use the HL extension framework to identify, analyse and evaluate interventions for each challenge topic in order to recommend steps for future action. Interventions may be explored and investigated individually and collaboratively. The interventions studied must involve digital systems in some way, of course. A change in policy, practice or law, for example, may be considered as an intervention that involves digital systems.

An intervention can be used with reference to a specified challenge to:

- **mitigate** (reduce) the negative impacts
- **intercede** (intervene) in an existing process to reduce negative impacts
- **enhance** (improve) the positive impacts
- **resolve** (eliminate) any negative impacts.

◆ **Intervention:**

A digitally-based solution and/or innovation that addresses the impacts and implications for people and communities in the challenge topics.

There are three HL extension challenges and interventions topics in the Digital Society course. Each topic has three prescribed areas for inquiry. Consequently, each challenge and related intervention(s) will be categorized in one of the nine prescribed areas for inquiry.

The three topics for HL extension challenges and interventions are:

- global well-being
- governance and human rights
- sustainable development.

The steps in the extended inquiry for the interventions

As you explore the inquiry process and apply it to both the HL challenges and interventions, you are required to provide recommendations for future development involving various digital systems.

Extended inquiries align with the inquiry process template introduced in Chapter 1.4. You will further develop, analyse, evaluate and make recommendations for the interventions related to the challenges.

There are four steps in the extended inquiry process for interventions.

1 Determine inquiry focus:

- area for inquiry
- inquiry focus
- current challenge
- intervention(s)

2 Explore and investigate challenges:

- Details of the challenges and intervention – the 3Cs:
 - concepts – areas of impact of the challenge and how they are connected to the challenge
 - content – the digital technology in the intervention
 - contexts – people and communities, stakeholders, local/regional/national level.

- Primary research
- Secondary research

3 Analyse interventions:

- Negative impacts
- Positive impacts
- Types of interventions:
 - mitigate (reduce) the negative impacts
 - intercede (intervene) in an existing process to reduce negative impacts
 - enhance (improve) the positive impacts
 - resolve (eliminate) any negative impacts

4 Evaluate interventions and recommend steps for future action

As part of the HL extension framework, you must **evaluate** at least one intervention for the prescribed area for inquiry and **recommend** steps for future action:

- **Equity:** Does the intervention address the needs, claims and interests of those affected by the challenge?
- **Acceptability:** Do specific affected people and/or communities view the intervention as acceptable?
- **Cost:** What are the financial, social, cultural and environmental costs associated with the intervention?
- **Feasibility:** Is the intervention technically, socially and politically feasible? What are some of the barriers?
- **Innovation:** Is the intervention innovative in its approach? Has it been attempted before?
- **Ethics:** Is the intervention ethically sound, and who determines the ethical status of the intervention?



■ HL extension: Challenges and interventions

5.1

Global well-being

UNDERSTANDINGS

By the end of this chapter, you will understand:

- ▶ the meaning of global well-being in a digital society
- ▶ how global well-being is a significant challenge in our digital society
- ▶ challenges faced with food insecurity and access to health care
- ▶ impacts of population growth and shifting demographics
- ▶ the impacts of automation on the future of work
- ▶ how digital technology-related interventions are being used to respond to this challenge.

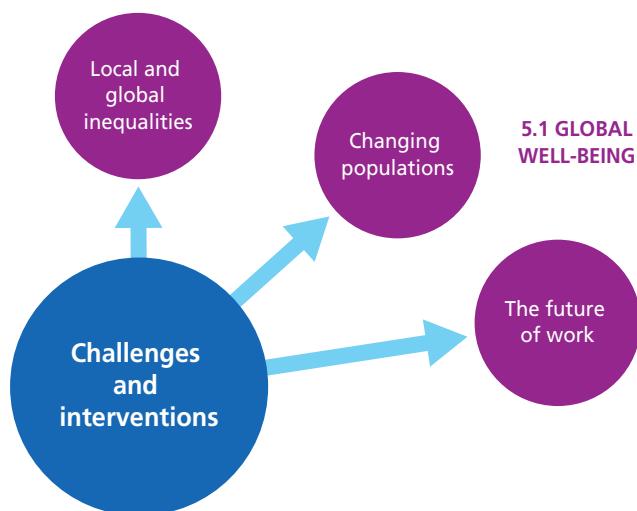
What is global well-being?

Global well-being is a significant challenge involving diverse issues and concerns. Global well-being intersects in important ways with many digital systems as they are used to address the challenge.

Digital technologies expand the boundaries of information available to people and enhance human productivity, but they also carry risks for people's well-being, ranging from job losses and cyberbullying to breaches of online security and privacy.

In this chapter, we will look at three main areas of inquiry for global well-being:

- local and global inequalities
 - economic inequality and stratification
 - food insecurity and access to safe, nutritious and sufficient food
 - access to health care and medicine
- changing populations
 - population growth
 - shifting demographics (for example, aging and youth populations)
 - migration and the movement of people
- the future of work
 - automation and employment
 - ensuring meaningful and secure employment
 - addressing the collective needs of workers.



Life in the digital age

Digital technologies continue to push boundaries and provide new opportunities, but with it comes significant concerns about people's overall physical and mental well-being. Some argue that our well-being will be improved by these digital technologies, while others believe they will do more harm than good. Those who contend that digital technologies undermine human well-being will also admit that they can improve certain areas of our daily lives, however. As technology continues to advance and integrate further into our lives, we must recognize the benefits and find ways to mitigate the problems.

Looking at how digital technologies can be helpful, we see how they connect people, locally and globally, providing the opportunity to share knowledge and gain educational insight. These technologies can also have a huge impact on our economy, opening up businesses to a world of opportunities. They also provide health resources and services to those who would not otherwise have access. Using these digital technologies has enabled people to improve their lives, allowing them to discover opportunities, socialize and meet other people, make a difference in the world, and expand the quality of digital life.

However, we cannot ignore some of the concerns that arise from the abundant use of these digital technologies. People's cognitive abilities will be affected in a variety of ways, such as their ability to think analytically, their memory, focus and mental resilience. The increase in digital addiction, information overload and the constant interruptions caused by various technologies are also contributing factors to a rise in anxiety, depression, stress and lack of sleep. The pace of digital change is of concern to many as human interactions, privacy, security and more are all at risk.

It is up to us to regulate how these digital technologies are used and to find solutions to potential problems. Governments and industries can help by creating reforms on standards and guidelines, as well as by passing new laws and regulations. Educating people about the impacts of digital technologies on their well-being, understanding the way technology functions, and encouraging healthy usage, are just some of the ways to support the existence of these technologies and strive for a healthy sense of well-being.

www.pewresearch.org/internet/2018/04/17/the-future-of-well-being-in-a-tech-saturated-world

ATL ACTIVITY

Research

- Research and discuss in class a range of factors related to digital well-being.
- Use them to design and conduct a school survey of your classmates about their digital well-being.
- Present the results to your IB coordinator.

5.1A Local and global inequalities

Inequalities are still present in our rapidly developing and changing digital society. The three areas of inequality to be focused on are

- **Economic inequalities and stratification:** In our world, it seems that many people are getting richer and have higher economic well-being than others. The economic gap between social levels in society is increasing, creating economic well-being inequalities.
- **Food insecurity and access to safe, nutritious and sufficient food:** Inequalities in food access cause many problems. There is not enough food of the right type and variety to ensure personal well-being.
- **Access to health care and medicine:** This directly impacts everyone's well-being and is linked to economic and food inequalities, often as a cause and/or effect.

Economic inequality and stratification

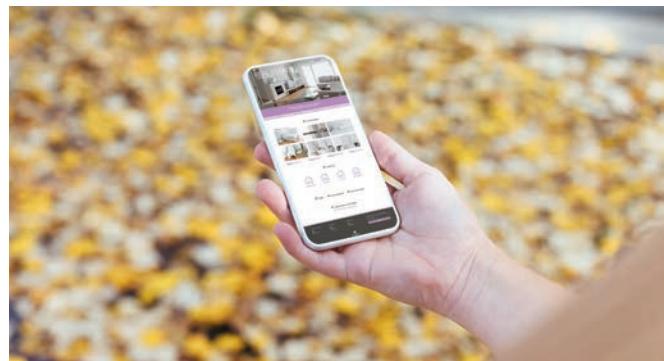
Global stratification

While **stratification** often refers to the unequal distribution of resources between people, global stratification refers to unequal distribution among nations. There are two dimensions to this stratification: gaps between nations and gaps within nations.

Global stratification is often thought of as economic inequality, for example, if we compare one country's average worker's wage to another country. Social inequality, however, is just as harmful as economic discrepancies. Discrimination against race, ethnicity or religion can also create conditions of economic inequality, both within and between nations. Think about the inequity that existed for decades in South Africa. Apartheid, one of the most extreme cases of institutionalized and legalized racism, created social inequality.

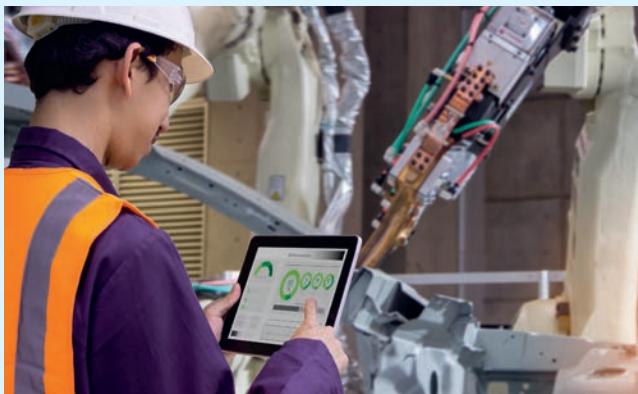
Advances in digital technology are revolutionizing our economy. The economic gains from digital technologies are vast and growing, but with these new technologies come new challenges. The rise in economic inequality has increased as digitization has changed the world of business around us. Today's advances in computer systems, software, mobile telephony, digital platforms, robotics, cloud computing and artificial intelligence are growing at rapid speeds. These advances contribute significantly to local and global economic inequalities.

◆ **Stratification:** The unequal distribution of resources between people/nations.



REAL-WORLD EXAMPLE

Is technology increasing inequality?



There is increasing concern around the automation of jobs, especially for those with low-skilled, routine jobs. However, those with low skills have been on the receiving end of almost every change in the labour market over the last 10 years. Since the financial crisis of 2008, employment levels have bounced back, with income rising at a similar pace. This is not true, however, for low-skilled work: their income levels have barely moved in over 50 years. Furthermore, when jobs return after an economic shock, they nearly always require

greater skills than before. So, rather than destroying jobs, technology seems to increase the inequality between people with skills and those without.

A recent study from the University of California explored how technology affected wages between 2000 and 2009. It found that while technology coincided with an increase in wages across the board, the average employee saw a rise of just 2.3% while those in managerial positions gained a 9% rise. Those in the boardroom received a substantially larger 19% boost. The researchers suggested that the new technology had allowed the more productive workers to become even more productive, which widened the income gap.

Most new technologies have tended to improve the relative position of skilled workers, carrying out routine tasks while allowing highly-skilled workers to focus on non-routine, more abstract tasks. As these routine tasks are usually carried out by lower-skilled workers, new technology harms them disproportionately.

www.forbes.com/sites/adigaskell/2019/05/03/technology-isnt-destroying-jobs-but-is-increasing-inequality/?sh=7cbf1d5f5e78

Technology has been blamed for a lot recently. Automation and artificial intelligence have supposedly led to substantial job losses, reduced bargaining power for workers, and increased discrimination. It is blamed for growing income and wealth inequality. As a result, demands are being made for the global regulation of technology, and there are attempts to slow down its spread through trade policies and political lobbying.

Rather than blame technological innovation for all of these social problems, perhaps we should look at other factors. We shouldn't be trying to obstruct technological innovation, rather, we should face up to the challenge of bringing entrepreneurship, innovation and business dynamism back to Western economies, characteristics that prevailed in the years after the Second World War, when growth was also more inclusive.

Germany is a particularly useful case to study. In recent decades, inequality has risen fast, and to unprecedented levels since unification. But, unlike in the US, there has been little financialization of the economy and no significant outsourcing of jobs due to globalization. While the US runs a huge trade deficit, Germany runs a large trade surplus. Importantly, evidence shows that automation has created more jobs in Germany than it has destroyed. So, why is inequality rising so rapidly in the EU's largest economy?

For further reading, see:

- <https://oecd-development-matters.org/2019/02/28/can-digital-technologies-really-be-used-to-reduce-inequalities>
- www.mckinsey.com/featured-insights/employment-and-growth/technology-jobs-and-the-future-of-work

Links

This content links to Sections 3.6E AI dilemmas and 3.7D Robots and autonomous technologies dilemmas.

Activity: HL Extended Inquiry

Evaluate	Evaluate the impacts, implications and interventions. <ul style="list-style-type: none">● Have you evaluated the extent of the impacts and implications?● Have you highlighted the most important impacts and implications that need to be addressed by the interventions?● Have you evaluated the interventions using the six intervention criteria?
Recommend	Make recommendations. <ul style="list-style-type: none">● Have you recommended changes and additions to the interventions?● Have you recommended other steps for future actions to address the challenge and its issues?

Challenge: reducing inequality by providing broadband access to all citizens, which has large economic impacts.

- Research and evaluate one real-world intervention related to a digital system that addresses this challenge using the HL extended inquiry process.
- Recommend steps for future action.

Challenge: increasing labour productivity through access to digital technologies and providing training.

- Research and evaluate one real-world intervention related to a digital system that addresses this challenge using the HL extended inquiry process.
- Recommend steps for future action.

Food insecurity and access to safe, nutritious and sufficient food



Global food security implies that everyone has access to sufficient amounts of safe and nutritious food at all times. **Food security** is something everyone should have access to, regardless of their technical, economic or social development. Food security isn't always possible in many countries, however, due to factors such as lack of education, political instability, government policies, economics, lack of technology development and other controlling factors.

Technology in this respect is defined as the collection of techniques, skills, methods and processes used in the production of goods. The technology required to be food secure is country-specific. It depends on the physical environment, infrastructure, climate, culture, literacy rates, economic conditions and governance.

Developing countries often have food security strategies that follow different paths and processes from those adopted by developed countries. In developing countries, technologies extend over a wide range of areas that include land preparation, soil and water management, seed production, weed management, pest and disease control, farm management and harvesting practices, which includes storage, processing, packaging, marketing and distribution.

Technology can help provide basic food options to vulnerable populations. It can help restore political stability by ensuring that the production of food is based on efficient agricultural activities, sustainable practices, high productivity, dynamic employment, and generating revenue for large numbers of people. Technology can support improved economic growth and social well-being with effective harvest practices to minimize food loss, using effective storage to increase the value of harvested products and ensure long shelf-life, as well as enhancing the marketing of available food at competitive prices, based on effective government policies.

◆ Food security:

Reliable access to sufficient amounts of safe and nutritious food.

ATL ACTIVITY

Research

Challenge: Food security can be responded to by increasing the efficiency of the transport of food.

Interventions: The use of IoT sensors, blockchain tracking and smart packaging are being introduced to meet the challenges of providing more efficient and effective access to safe, nutritious food.

Research: How successful these digital technologies will be using a real-world example.

ATL ACTIVITY

Research

Challenge: The need for higher crop productivity.

Intervention: The use of digital technologies used to decrease the use of water and pesticides.

Research: How successful these digital technologies will be in keeping food prices down and evaluate how much they reduce the impact on natural ecosystems.

EXAM PRACTICE QUESTIONS

Paper 1 (Section B)

- 1 Digital innovations are providing access to safe, nutritious food. Discuss a real-world example in which new digital innovations support this claim, referring to a real-world example. [12 marks]



Links

This content links to Section 4.3D Agriculture.

How digital innovation enables food security

Digital technologies have been used in numerous ways to promote food security. Digital technology enables farmers and other people to connect with institutions and information that eventually help in decreasing risk and uncertainty. With access to markets, data and financial services and the help of specific digital technologies, the efficiency of fertilizing, planting, harvesting and selling products increases.

At present, most hunger-alleviation strategies do not feature such types of technologies prominently, but the number is gradually increasing as more people show an interest in emerging economies. These technologies fall under the **SaaS** (software as a service) model. SaaS is already being used in many parts of the world, so we will now examine how SaaS can help to enable food security.

What is SaaS?

SaaS is one of the three components of cloud computing. It is a software distribution model in which a third-party provider hosts the applications, and the end-users can access the software through the internet. We can understand this better with the help of an example. If we go to a restaurant to eat, we order our food and pay for it. We do not pay for the food cost, rent of the restaurant or space, service, cleaning and cooking directly – the restaurant itself handles all of these factors. SaaS works in the same way and offers similar ready-to-use solutions for particular business needs.

◆ **SaaS:** Software as a service; a software distribution model in which a third-party provider hosts the applications with end-users accessing the software through the internet.



■ Software as a service helps to enable food security

How SaaS helps in enabling food security

SaaS technology and solutions can help to resolve issues of access to food, availability of food and climate-smart farming. In the first instance, it can help to prevent a waste of resources such as fertilizers, water and pesticides during the crop cycle, to make sure that the environment that supports food production does not get depleted.

SaaS technology uses data-driven decision-making, which helps with supply chain management, precision farming, warehouse management and climate-smart agriculture. All of these factors contribute to increasing food security by decreasing damages during the production and post-harvest stages. Smart farming enabled through SaaS is a resource-efficient method that can deliver sustainability and higher productivity in agricultural production. Ground truth (real) data is processed through advanced machine learning or artificial intelligence algorithms and combined with satellite data to achieve these features.

Benefits of SaaS technology in food security

- **Multi-tenancy architecture:** This means that a single instance of the software can serve multiple customers. Thus, each application and user share a joint code base and infrastructure that is maintained centrally. Moreover, the multi-tenancy feature reduces the upfront costs of SaaS because of lower maintenance costs and shared infrastructure.
- **Scalability:** If you are an entrepreneur, you will always look for a scalable option. With SaaS applications, you have the opportunity to choose the model that fulfils the requirement of the infrastructure. Moreover, the infrastructure can be scaled up or down whenever required.
- **Seamless integration:** With SaaS, all the necessary and required applications can be integrated easily with each other. This will help in extending functionalities and maximizing revenue.
- **Cost saving:** Lower costs overall is known to be the second most significant driver of SaaS adoption. SaaS does not charge any up-front license fees, and it is often subscription-based. The cost depends on your level of use. If you are using more services and components, the costs increase; if you are using fewer services, the cost decreases.

How food safety helps in promoting food security

The concepts of food security and food safety are mutually connected, and both have a significant impact on daily life but, rather than dealing with the quantity of food, food safety concerns the quality of the food.

If a person has a lot of food but it is not edible, or it is of bad quality, then there is no food safety (as the quality of the food is not acceptable). If there is no food safety, then there is no food security.

ATL ACTIVITY

Research

Research how SaaS can contribute to food security if it is used in a food processing plant.

Access to health care and medicine

Health inequalities are systematic differences in access to health care between different groups of people and the status of people's health. Health inequality is also often referred to as the differences in the care that people receive. It can involve differences in areas such as health status, life expectancy, the prevalence of health conditions, access to care, availability of treatments, quality and experience of care, and even quality of housing.

Differences in health status experienced by people can be determined by a range of factors including:

- socio-economic factors (for example, income)
- geography (for example, region)
- specific characteristics (for example, gender, ethnicity or disability)
- socially excluded groups (for example, homeless individuals).

Links

This content links to Chapter 4.4 Health.



Activity: HL Extended Inquiry

Evaluate

Evaluate the impacts, implications and interventions.

- Have you evaluated the extent of the impacts and implications?
- Have you highlighted the most important impacts and implications that need to be addressed by the interventions?
- Have you evaluated the interventions using the six intervention criteria?

Many people do not find it easy to access health care. The development of different types of e-health has increased to meet this challenge. Consider the following factors of health inequity that digital technologies can help address:

- inequitable access to trusted, reliable health information, which can be addressed by information websites provided by governments, businesses and other organizations
- inequitable access to medical expertise and commodities such as medicines, vaccines, diagnostics and devices, which can be helped with online services.

Investigate some real-world interventions and evaluate their effectiveness.



EXAM PRACTICE QUESTIONS

Paper 1 (Section B)

- 1 Examine how digital technologies are being used to address health care inequality.
In your response, refer to a real-world example. [12 marks]



Activity: HL Extended Inquiry

Evaluate

Evaluate the impacts, implications and interventions.

- Have you evaluated the extent of the impacts and implications?
- Have you highlighted the most important impacts and implications that need to be addressed by the interventions?
- Have you evaluated the interventions using the six intervention criteria?

Recommend

Make recommendations.

- Have you recommended changes and additions to the interventions?
- Have you recommended other steps for future actions to address the challenge and its issues?



Below are possible challenges and interventions to show how an extended inquiry can be approached.

In each extended inquiry, several interventions should be considered.

- 1 Using the table below, research and discuss at least one additional real-world intervention for each challenge.
- 2 Recommend steps for future actions.

■ Prescribed areas for inquiry: 5.1A Local and global inequalities

Supporting topic	Possible challenges – inquiries	Possible interventions – extended inquiries
Economic inequality and stratification	Social disruption and increased poverty caused by many factors, including lack of access to digital technologies.	Provide affordable broadband access for all citizens as a right with little cost, as many efforts to reduce inequality use digital technologies. Zero-rates service – a lack of disposable income is a major factor that prevents many from gaining internet access. A zero-rates service would provide equal opportunity. Diversifying content – English is the predominant language of the internet, which excludes millions of people from using it. If content was in their native language, it would diversify and expand the range of content.
Food insecurity and access to safe, nutritious and sufficient food	Food insecurity arises from a lack of education and skills, political instability, government policies, economics and trade issues, lack of technology, environmental and climate factors and a lack of communications.	Using digital technology in the production, harvesting, storage, processing, packaging, marketing and distribution of food. IoT sensors, cloud computing, blockchain tracking and smart packaging are being developed to increase efficiency and reduce wastage and prices.
Access to health care and medicine	Health inequalities can involve differences in areas such as access to care, availability of treatments, quality and experience of care, and even access to quality housing.	A large range of e-health interventions are being developed to reduce inequalities in these areas.

5.1B Changing populations

In the modern world, population numbers are still growing, changing in composition and moving around. These changes have both positive and negative implications and impacts, and will be the focus of inquiries in this section. The three areas of changing populations to be focused on are:

- **Population growth:** The number of people in the world is still growing, which creates problems for their well-being.
- **Shifting demographics:** The increase in aging and youthful populations creates economic and social pressures that have an impact on well-being.
- **Migration and the movement of people:** People move from area to area in nations, between nations and between continents to try to enhance their well-being.

Population growth

Most population growth over the last few decades has been in the development of large cities, and megacities (cities of over 10 million people) as people move from rural areas. This places a large burden on governments to ensure the well-being of these populations. Digital technologies are increasingly used to meet this challenge.

The digital technologies mentioned in the following report are well known, and need to be used to mitigate the problems created by megacities. The term smart city is used to describe a city that makes use of these technologies. Examples of these digital interventions can be found here:
www.thalesgroup.com/en/markets/digital-identity-and-security/iot/inspired/smart-cities

Activity: HL Extended Inquiry

Evaluate

Evaluate the impacts, implications and interventions.

- Have you evaluated the extent of the impacts and implications?
- Have you highlighted the most important impacts and implications that need to be addressed by the interventions?
- Have you evaluated the interventions using the six intervention criteria?

Recommend

Make recommendations.

- Have you recommended changes and additions to the interventions?
- Have you recommended other steps for future actions to address the challenge and its issues?

The challenge of population growth has led to very large cities. Research the use of digital technologies in a city near you – both those that are in place and those that are planned (future recommendations). Examples might include traffic control systems or use of CCTV networks. Investigate the extent to which they have, or have not, been successful.

Shifting demographics

Digital well-being

Young people today are growing up in a world where technology has always been present. This can have both positive and negative impacts on their lives. While engaging online, connecting with friends, sharing experiences and learning new things can be positive experiences, they can also pose challenges. With the online world being such a huge part of young people's lives, it is important that they become good digital citizens who understand how to use it safely and are aware of how it can impact them.

Our overall well-being is often determined by the physical and emotional experiences we encounter. As technology continues to be a huge part of our lives, it also has an impact on our well-being. This is often referred to as your digital well-being.

Technology and the internet should be there to enhance and simplify our lives, not to cause distraction, worry or upset. Some online experiences can have a negative impact on how young people feel about themselves, their friendships and relationships, and even how they see the wider world.

Links

This content links to
Section 4.4C Mental
health.

The impacts of technology on aging populations

Technology has the potential to play a significant role in helping older people as they age. Advances in automation and artificial intelligence can be used to assist older workers, reducing the negative effects of aging. For example, automation makes the same task less demanding manually and physically, and hence the workplace can better accommodate older employees.

Smart home devices, such as sensors, cameras, alarms and voice-activated speakers like Google Home or Amazon Alexa can make everyday life more convenient, safer and more sociable.

Research in the field of Internet of Things (IoT) development has recognized several challenges and limitations associated with past smart technology designed to assist in the lives of older people living at home, in particular the need for user-centredness and better integration with broader systems.

Technologies such as IoT support the role of the built environment and caregiving to produce outcomes that enable older people to remain autonomous, independent, safe and well at home.

However, negative aspects of technology identified by researchers include issues of maintenance, cost and ease of use, and willingness to use, which are all potential barriers to the benefits of smart technology.

Smartwatches

With the exception of smartwatches and fitness trackers, most wearable technology devices for elderly people are health care-related. Medical alert companies, which offer a monitored service for a monthly fee, have begun to offer multifunction wearable devices integrated with their monitoring services. Several companies have introduced a wrist-worn combination medical alert and smartwatch.

Smartwatches are becoming the dominant wearable technology due to the increased utility over other categories. The Apple Watch Series 4 and above includes an electrocardiogram monitor with atrial fibrillation detection and fall detection. While some of these features require cellular service, those not requiring cellular include heart rate data with alerts, fitness tracking features, Siri conversational assistant and water resistance. Smartwatches also offer valuable apps that can be used in case of emergencies, fall detection and detection of potential medical problems.

Smart technologies and chronic conditions

Medical device technology can collect biometric data such as heart rate (electrocardiogram and heart rate variability), brainwave and muscle bio-signals from the human body to provide valuable information to address chronic and other health-related conditions.

Four of the top 10 conditions for adults aged over 65 are heart-related, and heart disease is the number one cause of death in the US, with high blood pressure and high cholesterol being two of the top risk factors. Fortunately, many smartwatches and fitness trackers include heart monitoring technology.

Other smart devices are being developed to help monitor health conditions in elderly people, including cholesterol, arthritis and chronic pain, as well as cognitive conditions such as dementia or Alzheimer's disease.

Links

This content links to Chapter 3.4 Networks and the internet and Section 3.7A Types of robots and autonomous technologies.

Links

This content links to Section 4.4A Medicine and health.

ATL ACTIVITY

Research

You are worried about your grandparents and have heard that IoT can help them with their routine chores as well as monitor them.

Select one room in the house, for example a bathroom, bedroom or kitchen, and suggest what technologies you could buy for them and for what purpose.

ATL ACTIVITY

Research

If elderly people and people with disabilities are relying on digital technologies to communicate, socialize and operate in society, it could also have negative impacts on them, such as increased stress, anxiety and depression.

Research the extent to which less face-to-face, in-person interaction and more digital communication impacts people.

REAL-WORLD EXAMPLE

AI helps to overcome key aging-related challenges



Artificial intelligence such as assistive robots, self-driving vehicles, voice assistants and intelligent homes have the potential to address many aging-related challenges, including the desire to age in place; caregiver burden, including the shortage of professional caregivers; diminished mobility; financial wellness; sense of purpose; health and end of life choices. However, these technologies must consider privacy and consent, balance the needs of autonomy and safety, and protect data against misuse, minimize social isolation, the risks of over-reliance and system failures, to name a few.

www3.weforum.org/docs/WEF_AI_and_Ageing_Workshop_Report_2021.pdf

EXAM PRACTICE QUESTIONS



Paper 1 (Section B)

- 1 The use of digital technologies in the care of elderly people is increasing, either within a care home setting or in their own home. Examine the use of these digital technologies, referring to a real-world example. [12 marks]

Activity: HL Extended Inquiry



Evaluate

Evaluate the impacts, implications and interventions.

- Have you evaluated the extent of the impacts and implications?
- Have you highlighted the most important impacts and implications that need to be addressed by the interventions?
- Have you evaluated the interventions using the six intervention criteria?

One intervention designed to respond to the challenge of older people living alone are robots that they can interact with, be entertained by, and which have some capability to monitor them and remind them of tasks that need to be done.

Investigate some real-world digital technologies designed for older people and evaluate their effectiveness.

Migration and the movement of people

When there is a crisis due to conflict or natural disaster, many people may have to leave their homes, often without identity documents. Technology plays a significant role in the lives of refugees and internally displaced persons (IDPs). It has influenced how international organizations respond to refugee and IDP situations, but it can also be used by refugees and IDPs to access information such as financial or social networks.

Many digital technologies can help displaced populations by providing resources for refugees and IDPs, giving them the opportunity to support themselves. Technologies such as biometric identifiers and mobile apps can provide support in areas such as the distribution of food rations and can help refugees and IDPs find work. New technology applications are being created all the time that can help provide these individuals with the services they need at different stages of their lives.

Educational platforms are available to help displaced people and refugees update or acquire new skills so that they can potentially return home and support themselves or their families.

While technology can help support refugees and IDPs, it can also be a threat to their well-being. It may empower individuals to take advantage of the refugees and IDPs for profit. These technologies can also cause privacy and security concerns, as the compilation of sensitive data may put refugees and IDPs at risk. In order to make the technology more secure for these individuals to use safely, decentralized data storage systems need to be used rather than traditional databases.

To achieve better outcomes, political will and public opinion must be mobilized. While social media can exacerbate fears and prejudice toward refugees, it can also be utilized effectively to organize political will. Young people are more inclined to mobilize online via social media than through established political routes, for example. Refugees and IDPs often share personal information on YouTube and Facebook, generating exposure and raising awareness. On a positive note, these technologies can also enable refugees to connect with others in meaningful ways. If these groups come together with the use of technology, they may be able to overcome institutional hurdles and build social trust.

REAL-WORLD EXAMPLE

The Stanford Immigration Policy Lab algorithm

The Stanford Immigration Policy Lab is an international group of educators dedicated to innovation in immigration policy. They evaluate and create policies that encompass the integration of immigrants and refugees around the world. Their work has the potential to improve immigrants' lives and strengthen their surrounding communities. Through the use of large datasets and leading analytical tools, they provide evidence regarding the urgent problems faced. By providing information to those who set public policy, as well as those who serve immigrant communities, their research can impact many lives. The Stanford Immigration Policy Lab uses an algorithm to aid in the human decision-making process of relocating refugees to communities where they can thrive. Technology may increase cooperation and responsibility-sharing by expanding opportunities for interactions and increasing refugee integration.

ATL ACTIVITY

Research

Smartphones are an important tool for refugees to keep in contact with their friends and families, to communicate and share information, for finding important information from government and other sources, to share and publicize their experiences, and to be in contact with people and organizations that want to help. This leads to increased safety and a better chance of finding solutions to their problems.

Research to what extent these benefits are achieved, and to what extent smartphones can create problems through disinformation and targeting by criminal networks and unscrupulous operators.

Activity: HL Extended Inquiry

Evaluate	Evaluate the impacts, implications and interventions. <ul style="list-style-type: none">• Have you evaluated the extent of the impacts and implications?• Have you highlighted the most important impacts and implications that need to be addressed by the interventions?• Have you evaluated the interventions using the six intervention criteria?
Recommend	Make recommendations. <ul style="list-style-type: none">• Have you recommended changes and additions to the interventions?• Have you recommended other steps for future actions to address the challenge and its issues?

Below are possible challenges and interventions to show how an extended inquiry can be approached.

In each extended inquiry, several interventions should be considered.

- 1 Using the chart below, research and discuss at least one additional real-world intervention for each challenge.
- 2 Recommend steps for future actions.

■ Prescribed areas for inquiry: 5.1B Changing populations

Supporting topic	Possible challenges – inquiries	Possible interventions – extended inquiries
Population growth	The challenge of population growth has resulted in very large cities including some megacities.	Making cities smarter through the use of digital technologies will help large cities to be managed and run more effectively and efficiently. Much of this will happen through the use of data collection and processing across the cities.
Shifting demographics, especially the aging population	The increasing number of elderly people in our populations creates a challenge for their care, especially those who live by themselves.	A variety of interventions have been developed and experimented with, such as having sensors and cameras in the home that can be used to monitor activities, especially for those with disabilities who may struggle to look after themselves. Other interventions include robots that can interact and entertain, and which have some capability for monitoring people and reminding them of tasks that need to be done.
Migration and the movement of people	When there is a crisis due to conflict or natural disaster, many people have to leave their homes, often without having identity documents. Locating refugees is not easy for family and friends either.	Organizations that work with refugees can use digital technology to meet this challenge. They can record their details and items that can be used to prove their identity for access to emergency aid, for work, and can use it to reunite families that get split up. Standard databases are often used but blockchain is now being used as well.

5.1C The future of work

The nature of work and the way work is performed is changing all the time – at local, national and global levels – and this has had several impacts on well-being. While new jobs are being created every day, many are changing significantly and others do not exist anymore. These changes happen for a range of reasons including economic, population and technological changes. The three areas for the future of work that we will focus on are:

- **Automation and employment:** The nature of work is changing due to increasing automation and the use of advanced technologies. Changes in the type of work done impacts the ability of people to maintain and enhance their well-being through work.
- **Ensuring meaningful and secure employment:** A person's well-being is usually connected to the meaningful work they do and the security of their employment.
- **Addressing the collective needs of workers:** In addition to the well-being of individuals, changes to the way we work also impacts groups of workers, often across whole industries and towns, cities, regions and nations.

■ Automation and employment

Automation technology is becoming an integral part of many modern businesses. While some fear that further automation is a threat to jobs and the economy, others believe that it can advance companies and help to keep workers safe on-site.

Artificial intelligence continues to make automation more efficient and productive, but many people worry that robots are taking our jobs. It is estimated that 50% of jobs could theoretically be automated by current technologies, although only 5% of jobs can be fully automated.

Links

This content links to Sections 3.6E AI dilemmas and 3.7D Robots and autonomous technologies dilemma.

A Brookings Institute report states around 36 million jobs are susceptible to automation. But it's not only automation that is having a dramatic impact on traditional working habits. Advanced manufacturing is integrating new, innovative technologies into the production process, as well as in the final products, and is thus posing similar existential questions about the utility and nature of human capital. All of these factors are set to change the nature of work during the coming decade, which means workers from virtually every industry will have to prepare accordingly.

Advances in artificial intelligence and machine learning may shape the future of work dramatically:

- **Job destruction:** Many expect that job destruction will accelerate under the current pace of technological changes.
- **Quality of jobs:** The rise of non-standard forms of employment in recent years – for example, the gig economy – has major repercussions for the future of work, raising concerns about job security and the quality of working conditions. Employers might benefit in the short term, however, through greater worker flexibility and cost savings, especially if these arrangements are exempt from tax contributions and other employee benefits.
- **Social protection:** The gig economy has changed the traditional definition of 'employment'. The lack of security, protection and legal certainty associated with it will take some time to be resolved.
- **Wage and income inequalities:** Inequality may worsen as lower-income households may find it most difficult to adjust to the new world of work.
- **Social dialogue and industrial relations:** In many countries today, workers can negotiate wage increases, better access to health care and better working conditions through unions. Will these organized institutions be less effective in achieving these objectives as more work is shifted to machines? The increasing use of industrial machines and globalization has made it difficult to regulate work.

Activity: HL Extended Inquiry

Evaluate

Evaluate the impacts, implications and interventions.

- Have you evaluated the extent of the impacts and implications?
- Have you highlighted the most important impacts and implications that need to be addressed by the interventions?
- Have you evaluated the interventions using the six intervention criteria?

Recommend

Make recommendations.

- Have you recommended changes and additions to the interventions?
- Have you recommended other steps for future actions to address the challenge and its issues?

As technology increases productivity and reduces the load on workers doing repetitive tasks, it can have a huge impact on employment.

Research and evaluate one real-world intervention and recommend steps for future actions.

Many of the tasks that workers do now have the potential to be automated. Job-matching sites such as LinkedIn and Monster have changed how people look for jobs and how businesses recruit employees. Self-employed workers are using digital platforms such as Upwork, Uber, and Etsy now more than ever to showcase their skills and challenge traditional concepts about how and where jobs are done in the process.

Since the Industrial Revolution, the workplace has been revolutionized by technological advancements, but the rate at which automation technologies are evolving presently, and the extent to which they may disrupt the workplace, is unprecedented. The use of automation continues to increase as robots gain more advanced performance capabilities that match or exceed those of a human. However, just because automation is technically feasible does not mean it will be adopted in the workplace or that all jobs will be automated.

Digital talent platforms offer the potential to improve the matching of employees to various jobs, bringing transparency and efficiency to the labour market. With their vast search capabilities and superior screening algorithms, online talent platforms can help speed up the recruiting process and minimize the amount of time people spend looking for work, resulting in lower unemployment. By gathering data on people and job vacancies across entire regions, these platforms could ease some geographic mismatches and enable matches that would not have occurred otherwise.

ATL ACTIVITY

Research

As digital technology increases productivity and reduces the load on workers doing repetitive tasks, what is the impact of technology on employment? Research the types of work that are impacted.

Links

This content links to Section 4.2B Employment and labour.

EXAM PRACTICE QUESTIONS



Paper 1 (Section B)

- It is claimed that new generations of intelligent machines, powered by continuing advances in artificial intelligence and robotics, will replace a significant number of current human jobs, but will ultimately lead to more jobs being created.

Discuss this claim, referring to a real-life example.

[12 marks]

Meaningful and secure employment

Advances in technology may contribute to eliminating certain occupations, but they also create new jobs and new opportunities. In fields including technology development, hardware manufacturing and app creation, many of the new occupations generated in the US in recent years did not exist or hardly existed previously. As such, new technologies can have a large, positive impact on employment.

New and innovative entrepreneurial opportunities can also be made available as these digital technologies advance, giving small businesses more options to make more money. As technology continues to grow and more intelligence is integrated into these systems, less-skilled employees will be able to work with little training. Google, for example, launched its Internet Saathi (Friends of the Internet) programme in India in 2015, in which women were taught how to use the internet and were then employed to provide services in their communities using internet-enabled technologies.

ATL ACTIVITY

Research

Research new jobs that have been created in the last five years that involve digital technology. Make a list of the top 10 jobs and their incomes.

EXAM PRACTICE QUESTIONS



Paper 1 (Section B)

- 1 Artificial intelligence has enhanced the way we work in many types of jobs. Discuss this claim with reference to a real-world example. [12 marks]

REAL-WORLD EXAMPLE

Algorithmic auditing and AI bias in hiring



Artificial intelligence is often described as a solution to bias and discrimination in hiring. There is growing concern, however, that artificial intelligence itself can be

biased, putting companies that use algorithms to drive hiring decisions at risk. The challenge for companies is to figure out how to spot and eliminate discrimination in artificial intelligence.

One possible solution is algorithmic auditing, a process for verifying that decision-making algorithms produce the expected outcomes without violating legal or ethical boundaries. However, algorithmic auditing has come under fire from policy advocates – because it is so new, it lacks standards and is open to vendor influence.

It raises the question: if companies can't trust the process for auditing artificial intelligence, how can they use it at all?

www.techtarget.com/searchhrsoftware/feature/Why-algorithmic-auditing-can-t-fully-cope-with-AI-bias-in-hiring



Activity: HL Extended Inquiry



Recommend

Make recommendations.

- Have you recommended changes and additions to the interventions?
- Have you recommended other steps for future actions to address the challenge and its issues?

In a group, conduct a role-play activity on introducing working from home for employees.

- Assign roles: the co-manager, the human resources manager, the tech support manager and the employee working from home.
- Everyone is to research their role with regard to:
 - how their job has changed to enable working from home
 - the technology being used
 - how they will maintain productivity – research the role that each person has at a time when employees are working from home
 - the challenges faced, for example monitoring staff
 - possible interventions for the challenges faced.
- Role play a meeting in which working from home is introduced to the staff. Allow everyone an opportunity to contribute to the meeting and ask questions.
- Discuss recommendations for working from home.

EXAM PRACTICE QUESTIONS



Paper 1 (Section B)

- 1 Digital innovations are disrupting the nature of work in many organizations and companies. Using a real-world example, discuss the benefits of digital innovation compared to the negative impacts for employees. [12 marks]

Addressing the collective needs of workers

Digital technologies such as artificial intelligence and automation have radically changed the nature of work and employment. The extent and types of change and the issues arising from them are still developing, and no clear end is in sight. The need to address this challenge does not lie solely with the developers and users of these technologies, but needs to include the workers themselves.

A range of interventions are needed, including policies, regulations and laws, as well as technology-based solutions, such as communications tools and digital media. The Digital Society course concepts can be used to investigate this challenge and to evaluate the various interventions.

Specifically, a ‘power’ imbalance has developed between workers and companies that needs to be addressed; ‘values and ethics’ are also part of the problem and part of the solution; and ‘systems’ ideas are embedded in the use of the digital technologies and how they are used.

ATL ACTIVITY

Research

Firstly, investigate the range and types of issues that arise from the increased use of digital technologies, such as the increasing number of people working in the gig economy.

Secondly, investigate efforts to resolve, mitigate and intercede in the issues, and to enhance the use of digital technologies. This includes legal and political interventions (laws and regulations) as well as technology-based solutions.

Activity: HL Extended Inquiry



Evaluate

Evaluate the impacts, implications and interventions.

- Have you evaluated the extent of the impacts and implications?
- Have you highlighted the most important impacts and implications that need to be addressed by the interventions?
- Have you evaluated the interventions using the six intervention criteria?

Recommend

Make recommendations.

- Have you recommended changes and additions to the interventions?
- Have you recommended other steps for future actions to address the challenge and its issues?

Below are possible challenges and interventions to show how an extended inquiry can be approached.

In each extended inquiry, several interventions should be considered.

- 1 Using the chart below, research and discuss at least one additional real-world intervention for each challenge.
- 2 Recommend steps for future actions.

■ Prescribed areas for inquiry: 5.1C The future of work

Supporting topic	Possible challenges – inquiries	Possible interventions – extended inquiries
Automation and employment	Automation of work has impacted low-skilled and routine workers – reducing the range and type of work.	Education and retraining of workers in STEM knowledge and skills. Automation will create new types of employment as has happened in some advanced countries.
Ensuring meaningful and secure employment	Working from home has been welcomed by many people, including those working for companies and those starting their own businesses. There are issues such as monitoring the work done and the intrusion of work into home life, however.	A variety of digital technologies can be used to monitor work being done. Regulations and agreements are being used to keep work separate from home life.
Addressing the collective needs of workers	The advantages and challenges of the gig economy are now becoming much clearer for workers, businesses and society.	Efforts to meet these challenges will not only use digital technology – there will be legal and political interventions involving laws and regulations.

Activity: HL Extended Inquiry



Interventions address challenges through actions. In extended inquiries, you will work with interventions that involve digital technologies. To illustrate how an extended inquiry might be approached, review the following interventions and recommendations for the given real-world scenario.

After reviewing the interventions and recommendations below, investigate other possibilities.

- **Real-world example:** Barrier to internet access
- **Intervention:** Mitigates
Implement policies to mitigate the digital divide.
- **Possible recommendation for future action:** Cost
Zero-rates service – a lack of disposable income is a major factor that prevents many from gaining internet access. A zero-rates service would provide equal opportunity.
- **Possible recommendation for future action:** Equity
Diversifying content – English is the predominant language of the internet, which excludes millions of people who could use the internet if content was in their native language.
Diversifying content and expanding the type of content would increase access.

Reflection



Now that you have read this chapter, reflect on these questions:

- How can cyberbullying impact the well-being of individuals?
- What does your digital footprint look like?
- What role does machine learning play in the future of work?
- What types of job automation have happened in your local area?
- How can technology mobilize political will, and increase accountability?
- How will major technological communities transform themselves to reflect the diversity of the populations they serve?
- How can technology be used to facilitate greater responsibility when sharing?
- How can technology assist in mobilizing new sources of funds and improving the efficiency of existing funding?

5.2

Governance and human rights

UNDERSTANDINGS

By the end of this chapter, you will understand:

- ▶ the relationship between governance and human rights in a digital society
- ▶ the challenges faced by governments in an evolving digital world
- ▶ the impact technology has on human rights
- ▶ how digital technology-related interventions are being used to respond to this challenge.

Human rights in a digital age

In this chapter, we will look at three main areas of inquiry for governance and human rights:

- conflict, peace and security
 - wars and civil conflicts
 - regional, national and global security
- participation and representation
 - political speech and activism
 - access and representation in governing bodies and institutions
- diversity and discrimination
 - gender equality
 - racial and ethnic discrimination
 - ability, access and inclusion
 - tolerance for religions and cultural differences.



5.2A Conflict, peace and security

There is a constant challenge to peace and security in the midst of many conflicts. The challenge of wars and conflicts in and between nations is being impacted by the use of digital interventions, both positively and negatively. Meanwhile, the desire for, and maintenance of, security is being enhanced by the use of digital interventions, but this is not without its own issues.

As new technologies drive change around the globe, new opportunities arise for change in the areas of government relations, conflict, peace and security. However, with these opportunities comes the challenge of keeping up with these changes.

New technologies, including everything from the internet to drones and big data, can help prevent conflict by reducing the gap between warning and response. They can facilitate peacekeeping through new tools to be used in increasingly complex environments, and by empowering local stakeholders.

Peace and conflict

Innovative technologies provide opportunities to collect data surrounding crime and conflict. Crisis mapping, social media mapping and crowdsourcing techniques can all aid in the collection of conflict data. This data can be used to detect trends related to war and peace to better inform efforts to prevent conflict or human rights violations.

However, employing new technologies to avert conflict still faces substantial challenges. These strategies may not be appropriate in every situation. For instance, big data comes with significant risks, such as jeopardizing individual security and privacy if the data were to fall into the wrong hands. It can also intensify conflict if the digital divide coincides with conflict cleavages.

Despite the fact that new technologies have revolutionized the way wars are fought, UN peacekeeping missions have been hesitant to incorporate them. Monitoring and surveillance technology, such as unarmed unmanned aerial vehicles (UUAVs), video monitoring systems and satellite imaging, are some of the technologies being used for peace operations. As the use of new technology in peacekeeping operations grows, governments are paying close attention to the impacts. While UUAVs can help with tasks such as data collection and transportation, they can also become part of the conflict dynamic. In areas such as intelligence gathering, these new technologies are often found to be controversial and can lead to further conflict.

On the other hand, new technologies can provide opportunities for conflict resolution. Data collecting and analysis can empower communities to resist violence and rehabilitate after conflicts. These technologies can be used to generate non-violent, positive attitudes. Unfortunately, access to these technologies is limited and often subject to government manipulation, while individuals confront privacy and security concerns. Furthermore, the same technologies that can be used to distribute peace messages can also be utilized to spread hate messages and misinformation.

Security

Concerns have been raised about the use of communication technology, particularly in relation to how to control the internet and cybersecurity awareness. Cybercrime and cyberattacks can threaten internet users' safety, impede economic and commercial activities, and jeopardize military capabilities. Furthermore, violence in the cybersphere frequently replicates conflict around the globe. As new technologies transform warfare, the cybersecurity situation becomes even more complicated. New technology has given rise to new uses of force, such as armed unmanned aerial vehicles (UAVs) or drones. Although there is widespread agreement that the use of armed drones is not unlawful, there is no agreement on how to apply international law on the use of force by drones, and there is a possibility that they will increase the geographical and temporal boundaries of force used.

Links

This content links to Chapter 4.6 Conflicts and war.

REAL-WORLD EXAMPLE

Unmanned aerial vehicles



Unmanned aerial vehicles (UAVs) are military aircrafts that are either guided autonomously or by remote control.

They can carry sensors, target designators, weapons or transmitters designed to interfere with enemy targets. Without the need for a human crew, their life-support systems and safety requirements, UAVs are incredibly efficient and have a significantly wider range than their equivalent manned systems.

UAVs were developed from the target drones and remotely piloted vehicles used by the military after the Second World War. Modern UAVs are small drones that resemble model airplanes. Their quiet engines and small size mean that they are virtually undetectable, making them highly effective for battlefield surveillance and determining potential targets.

www.britannica.com/technology/unmanned-aerial-vehicle

ATL ACTIVITY

Research

Challenge: How to monitor and control the use of artificial intelligence when being used in conflict.

Intervention 1: The use of AI technology policies set by international organizations, governments and military forces.

Intervention 2: The use of AI technology is limited when being used in conflicts.
Research both options.

ATL ACTIVITY

Research

Challenge: How to develop and program artificial intelligence with an agreed set of ethical principles when being used by law enforcement.

Research the type of ethics used and evaluate their effectiveness

EXAM PRACTICE QUESTIONS



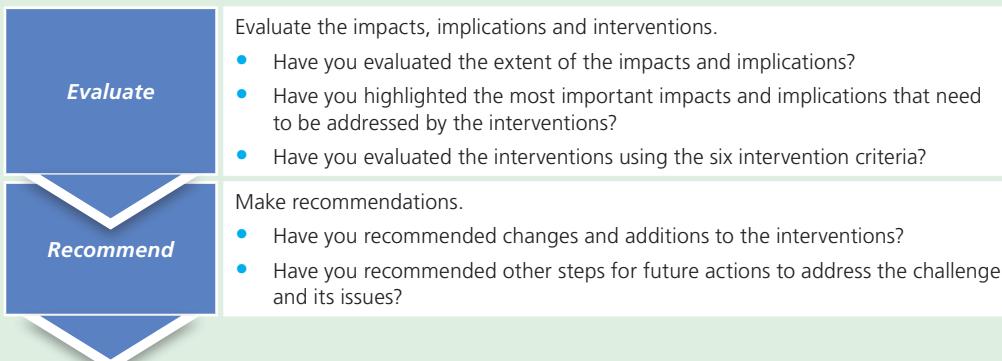
Paper 1 (Section B)

- 1 Lethal autonomous weapons systems raise serious questions about the conduct of modern warfare. The artificial intelligence decision-making process at the core of these systems is becoming more and more autonomous, with little to no human intervention, so accountability for the actions of the systems becomes more difficult to determine.

Using a real-world example, discuss the impact on society for peace and security from the use of these systems.

[12 marks]

Activity: HL Extended Inquiry



Below are possible challenges and interventions to show how an extended inquiry can be approached.

In each extended inquiry, several interventions should be considered.

- 1 Using the chart below, research and discuss at least one additional real-world intervention for each challenge.
 - 2 Recommend steps for future actions.
- **Prescribed areas for inquiry: 5.2A Conflict, peace and security**

Supporting topic	Possible challenges – inquiries	Possible interventions – extended inquiries
Wars and civil conflicts	Removing the digital divide to prevent conflicts. Monitoring conflicts.	Satellite-based internet. UAVs (drones), satellites.
Regional, national and global security	Ransomware attacks and cyber warfare. Control and use of artificial intelligence in military and police equipment.	Protection software. Attacking the sources. Policies for use, programmed ethics.

5.2B Participation and representation

Governments at all levels are using digital interventions to communicate with people and communities. This is mostly positively with people and communities wanting to participate and be represented in their local government. Communication of political ideas and activism of all types is being impacted by digital interventions.



This content links to Chapter 4.6 Political.

Political speech and activism

Digital activism

The internet and digital media are used in **digital activism** to mobilize individuals to take political action. Online activists frequently use the internet as a tool to distribute information and as a location for protest that amplifies offline protests in a more sophisticated way due to its ability to reach enormous audiences throughout the globe instantaneously. Digital activism includes email and social media campaigns, virtual sit-ins and **hacktivism**.

Online initiatives can be critical in countries where public spaces are regulated or controlled by the military. Online actions are preferable to in-person activities in these circumstances. While much digital activism falls under the umbrella of electronic civil disobedience, some activists argue that these online political gestures should represent a communal interest rather than an individual agenda, and that their goals should be made public so that they are not misinterpreted as acts of cyberterrorism.

◆ **Digital activism:**

Activism that uses the internet and digital media as key platforms for mass mobilization and political action.

◆ **Hacktivism:**

Hacking into a computer system for socially or politically motivated purposes.

Commonly used digital tactics include email campaigns, text messaging, social media postings and online petitions. Virtual sit-ins – where a networked community meet to carry out a digital act of defiance using web-based software – can disrupt server functionality, and be carried out by protestors based all around the world. The repeated requests/clicking of the protesters on the targeted web page generates so much traffic that the targeted site's server is overwhelmed. The bandwidth is clogged, causing the website to slow down and eventually shut down.

ATL ACTIVITY

Research

Challenge: Digital technologies, such as dedicated websites and social media, can help people to participate in local affairs and issues. They can be used to connect authorities with their communities digitally to foster trust and transparency, as well as to facilitate communication.

Research the use of these digital technologies for this purpose in your local area.

ATL ACTIVITY

Research

Challenge: Government control of mainstream media and communications, often to the exclusion of other sources of news and information, often to the exclusion of other sources of news and information, such as social media e.g. Facebook, Instagram and Reddit.

Intervention: The use of communications apps (especially those with encryption capabilities), such as WhatsApp, Messenger and Signal.

Research: The use of these interventions for digital activism in various countries around the world.

ATL ACTIVITY

Thinking

Governance of the internet is a controversial topic, in part due to its multi-stakeholder nature. Public authorities have not played a major role in regulating the internet, leaving it largely to private companies by engineers and experts who have made major decisions through unstructured procedures.

To what extent does the government in your country control the internet and how are citizens impacted?

REAL-WORLD EXAMPLE

How social media amplifies political activism and threatens election integrity



From online boycotts to offline gatherings, social media is a proven tool for political activism. It has captured public attention and enabled meaningful political action and protests and, thanks to its decentralized nature, activists are better able to evade censorship and coordinate their actions.

Up to 25 million Americans participated in protests following the death of George Floyd in May 2020, in part due to the widespread attention and coordination on social media.

Social media also has positive and negative implications for political campaigns. It can be used to promote campaigns and target specific voters, but it can also be used to misinform and manipulate voters, making the electoral process vulnerable.

Activists have also used social media to disrupt campaigns. A political rally held by President Trump in June 2020 in the US was pranked by an army of K-pop fans who reserved large numbers of tickets for the rally, leading to a lower-than-expected attendance.

<https://theconversation.com/tiktok-teens-and-the-trump-campaign-how-social-media-amplifies-political-activism-and-threatens-election-integrity-141266>

Access and representation in governing bodies and institutions

Impact on governance

Crowdsourcing provides opportunities to empower citizens and transform the governance relationship. It has the potential to augment more traditional routes for participation, such as elections and referendums, and can make government decision-making processes more inclusive and transparent. It also allows citizens to assess their outcomes, indirectly increasing their legitimacy. Many countries have experimented with online participation in governance, for example, through websites where citizens can provide feedback to virtual town hall meetings. These approaches can promote a move from vertical towards horizontal power structures.

Mobile phones and social media also present opportunities to empower citizens and transform their relationships with governments. Real-time photos and videos uploaded to social media can expose government corruption or abuse and increase government responsiveness to citizen concerns. These technologies have also revolutionized people's ability to organize and coordinate protest movements. However, some technologies, such as mass surveillance, contribute to the break down of trust between governments and citizens.

The rapid spread of ideas, facilitated by new technologies, can have both positive and negative consequences. The easy manipulation of information and sources, and the risk of viral dissemination without verification, can propagate misinformation. Moreover, social media users risk finding themselves in a position where they are not exposed to differing opinions – an echo chamber – potentially increasing political polarization.

ATL ACTIVITY

Research

Challenge: One main function of a government is to provide information and services for the public. Government information websites are one development in the way this information can be provided.

- For the country that you reside in, and one other, investigate a government website that offers information and services to the public.
- Compare the information that is shared and the level of interactivity of the website.
- How accessible and easy to use were they?

EXAM PRACTICE QUESTIONS



Paper 1 (Section B)

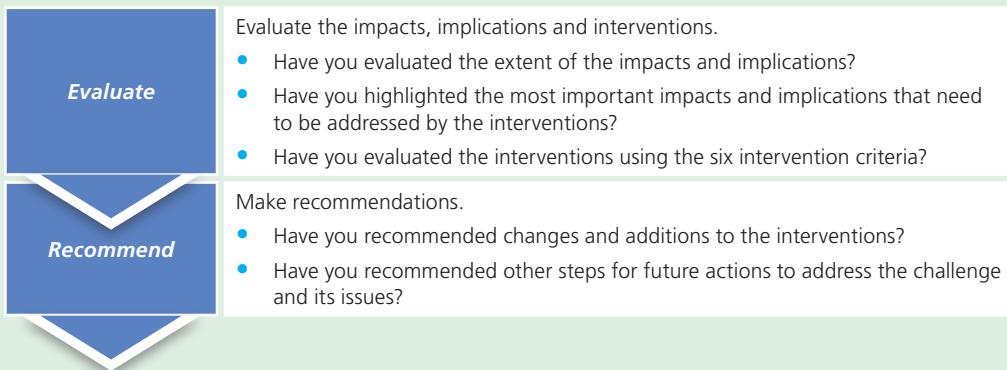
- 1 Smartphone apps have been used in local, regional and national elections by a range of political parties and interest groups to provide information and to influence voters.

Discuss the impacts of this use of smartphone apps. In your response refer to a real-world example.

[12 marks]



Activity: HL Extended Inquiry



Below are possible challenges and interventions to show how an extended inquiry can be approached.

In each extended inquiry, several interventions should be considered.

- 1 Using the chart below, research and discuss at least one additional real-world intervention for each challenge.
- 2 Recommend steps for future actions.

■ **Prescribed areas for inquiry: 5.2B Participation and representation**

Supporting topic	Possible challenges – inquiries	Possible interventions – extended inquiries
Political speech and activism	Misinformation on social media. Trolls attacking public people. Government control of the internet and social media, including censoring.	Laws to remove/censor misinformation. Author identification of social media posts. Use of VPNs, and encrypted messaging.
Access and representation in governing bodies and institutions	Decreasing participation in local affairs and voting.	Dedicated websites and social media for public debate, including polling of ideas. Use of online voting.

5.2C Diversity and discrimination

Most people and communities want their human rights to be respected, an end to discrimination and an acceptance of diversity. Digital interventions can be used to reduce discrimination due to gender, race, ethnicity and ability, but can also be the source of bias. Likewise, religious and cultural tolerance can be enhanced or reduced depending on the digital intervention.

The potential of new technologies to support economic development is widely recognized. However, access to these technologies, or lack thereof, can create a digital divide as access remains highly unequal between developed and developing countries, between the rich and poor, and between men and women within countries.

While 43% of people have access to the internet globally, only 35% in developing countries, 11% in Africa, and 9% in the least-developed countries have access, compared to 82% of people in developed countries. According to the UN's Millennium Development Goals Gap Task Force: 'As long as more people are offline than online, it is not possible to talk about a global information society.' This divide is further exacerbated by lack of content in languages other than English.

Improving access to these technologies in developing countries requires investment, the transfer of technology to the developing world, and increasing the capacity of developing countries to develop new technologies.

Data can be used to establish sustainable development and determine which policies are underperforming and whether new efforts should be introduced. Monitoring and assessing effective policies is incredibly challenging without high-quality data to provide the necessary information. In developing countries, the lack of resources, capacities and opportunities that hinders broader internet access generates similar differences in data quality. The lack of data has the greatest impact on underdeveloped countries. Nonetheless, obstacles in data collection can hinder sustainable development in all countries, regardless of income level.

Collecting data at the national, global and local levels is essential. The use of open data may help to expand the community of analysts and policymakers dedicated to integrating and expanding solutions to meet the UN's Sustainable Development Goals (SDGs). The goal of big data for development is to turn imprecise, complex and frequently unstructured data into meaningful information, but it is currently an unexplored resource for long-term development. Big data's success in assisting development is contingent on government backing and collaboration between governments, the corporate sector and academics. It also hinges on the creation and implementation of new standards for using and sharing big data ethically.

BIG DATA & THE SDGs

How data science and analytics can contribute to sustainable development

1 NO POVERTY
Spending patterns on mobile phone services can provide proxy indicators of income levels

2 ZERO HUNGER
Crowdsourcing or tracking of food prices listed online can help monitor food security in near real-time

3 GOOD HEALTH AND WELL-BEING
Mapping the movement of mobile phone users can help predict the spread of infectious diseases

4 QUALITY EDUCATION
Citizen reporting can reveal reasons for student drop-out rates

5 GENDER EQUALITY
Analysis of financial transactions can reveal the spending patterns and different impacts of economic shocks on men and women

6 CLEAN WATER AND SANITATION
Sensors connected to water pumps can track access to clean water

7 AFFORDABLE AND CLEAN ENERGY
Smart metering allows utility companies to increase or restrict the flow of electricity, gas or water to reduce waste and ensure adequate supply at peak periods

8 DECENT WORK AND ECONOMIC GROWTH
Patterns in global postal traffic can provide indicators such as economic growth, remittances, trade and GDP

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
Data from GPS devices can be used for traffic control and to improve public transport

10 REDUCED INEQUALITY
Speech-to-text analytics on local radio content can reveal discrimination concerns and support policy response

11 SUSTAINABLE CITIES AND COMMUNITIES
Satellite remote sensing can track encroachment on public land or spaces such as parks and forests

12 RESPONSIBLE CONSUMPTION AND PRODUCTION
Online search patterns or e-commerce transactions can reveal the pace of transition to energy efficient products

13 CLIMATE ACTION
Combining satellite imagery, crowd-sourced witness accounts and open data can help track deforestation

14 LIFE BELOW WATER
Maritime vessel tracking data can reveal illegal, unregulated and unreported fishing activities

15 LIFE ON LAND
Social media monitoring can support disaster management with real-time information on victim location, effects and strength of forest fires or haze

16 PEACE, JUSTICE AND STRONG INSTITUTIONS
Sentiment analysis of social media can reveal public opinion on effective governance, public service delivery or human rights

17 PARTNERSHIPS FOR THE GOALS
Partnerships to enable the combining of statistics, mobile and internet data can provide a better and real-time understanding of today's hyper-connected world

GLOBAL PULSE

www.unglobalpulse.org
@UNGlobalPulse 2017

ATL ACTIVITY

Thinking

Challenge: Who should oversee the collection of big data? Some think that the UN should be the depository and safe-keeper of big data by gathering, collecting and storing data from regions where the infrastructure is not safe or sufficient.

Discuss this proposal.

Links

This content links to Section 4.7A Social components of identity.

Gender equality

We are witnessing huge changes in the way we live, work and interact with each other as we progress through the fourth industrial revolution. The world is becoming more connected as a result of technological advancements. While this momentum is being used to make data-driven advancement on the UN's SDGs, it also jeopardizes SDG success because women and girls are unable to participate equitably and meaningfully in the digital world.

One of the principles of the 2030 Sustainable Development is to leave no one behind, and this includes gender equality. Unfortunately, limited access to digital technology for women is expanding the significant gender divide. While we know there is a digital divide between men and women, we require more data to understand the significance of the problem, as there is a significant lack of gender-based data, particularly in developing nations.

In some countries, women's opportunities to employ these technologies to improve their social and economic mobility are limited. Furthermore, as technology advances and becomes more expensive, gender divides will likely increase in favour of men. The global employment market is one area where this tendency will have considerable implications. Artificial intelligence is reshaping employment, displacing many of the administrative occupations that were traditionally performed by women in many nations. As such, efforts to develop a more inclusive digital society must not only improve women's access to technology but also teach them flexible digital skills for future careers in engineering and computer programming.

School and community programs are offering STEM (science, technology, engineering and mathematics) education to encourage girls to learn these digital skills. Historically, girls have had less interest in STEM courses in many parts of the world, resulting in only a third of women pursuing these disciplines in higher education. Research into strategies to help young women and girls overcome the social and psychological hurdles that hinder them from pursuing technology-related occupations is ongoing. Programmes such as computer camps, robotics, makerspaces and massive open online courses (MOOCs) are just a few examples that can assist women in gaining expertise and confidence in technology-based skills.

Female role models play an important role in fostering an atmosphere in which women are able to develop their digital talents. Currently, women make up less than a third of technology-related roles and are more likely to have smaller support roles, with less possibility for promotion. Women are also underrepresented at the top levels of technology decision-making positions. The absence of women in these leadership roles results in a lower diversity of opinions, which affects the quality of decision-making throughout the industry. While further study is needed, women must be encouraged to overcome gendered barriers in science and technology jobs.

ATL ACTIVITY

Thinking

Challenge: Women and other minority groups can create specific, safe digital spaces to discuss and deliberate matters that are important to them.

Which intervention is better: creating special apps, or using established apps such as Instagram?

Links

This content links to Section 4.7A Social components of identity.

Racial and ethnic discrimination

In 2020, the UN reported on the need to eliminate racism globally at the 44th session of the UN Human Rights Council. According to the report, Big data algorithms are reproducing discriminatory systems and emerging digital technologies are compounding existing racial and ethnic inequalities.

The report emphasized that emerging technologies do not exist in a cultural vacuum, but rather reflect racial and ethnic discrimination in today's society. Additionally, it was noted that it will be necessary to impose significant restrictions on digital technologies that fail to meet the criteria outlined in international human rights legal frameworks against racial discrimination.

Technologies such as artificial intelligence are among those that exhibit these racial and gender biases, which can distort the way that facial-recognition systems work. Similar studies have shown how natural language production tools and other machine learning applications can cause discrimination. However, artificial intelligence isn't the only technology that might intensify racial discrimination. Others include:

- targeted internet shutdowns by governments to suppress specific communities and government gatherings
- digital processing of people's biometric data linked to public services such as food rations and unemployment assistance.

These systems can often exclude people from minority groups, who already face significant challenges in gaining access to these benefits. The UN may need to reconsider its use of biometric data in identifying and monitoring people whose human rights are already under threat as it could result in the further exclusion of refugees and displaced people.

REAL-WORLD EXAMPLE

Facial recognition



Protests in the US over racially discriminatory policing have brought attention to the widespread but unregulated use of facial recognition technology. The FBI and other federal agencies are being investigated to see if the monitoring software has been used in these situations, and several states are considering legislation to outlaw police use of the technology. Major technology companies such as Amazon and IBM are also re-evaluating their facial-recognition research projects due to concerns about human rights.

Face analysis is a particularly powerful, and sometimes troubling, tool used by law enforcement to make their jobs simpler. Facial analysis systems can be used for a variety of tasks, such as unlocking your iPhone, allowing someone into a building, assessing a person's sex or race, or see if their face matches a photograph. The issue is that facial recognition technology is flawed. While this doesn't matter hugely for a locked mobile phone, it is

a significant problem when it is used to identify human suspects. For example, Amazon's face-ID technology, Rekognition, once mistakenly recognized female television star Oprah Winfrey as a man.

According to an MIT study of three commercial gender-recognition systems, dark-skinned women had inaccuracy rates of up to 34%, approximately 49 times higher than for white men. Another study found that African people had 100 times greater error rates than Eastern Europeans, who had the lowest rates. When this experiment was repeated using a US database, Native Americans, as well as Asian and black women, had the highest rates of algorithm inaccuracy.

The inaccuracy and bias in these systems are the result of the way they have been developed. Algorithms 'recognize' human faces after being shown millions of images. Unfortunately, if the faces used to train the algorithm are mostly white men, the system will have a harder time recognizing anyone who doesn't match that profile.

Algorithm bias can be eradicated with enough artificial intelligence training and exposure to a large, representative database of individuals. However, experts warn that even a system that identifies people with perfect precision can be hazardous. A system that can correctly identify any individual could mean the end of privacy for everyone. As a result, an increasing number of people are advocating for legislative restrictions on when and how such technology can be utilized.

www.cbsnews.com/news/facial-recognition-systems-racism-protests-police-bias

EXAM PRACTICE QUESTIONS



Paper 1 (Section B)

- 1 Police and other authorities need to identify people accurately in a variety of situations. However, facial recognition technology has been found to be inaccurate and biased, especially for people of colour.
- Examine the claim that the use of facial recognition technology will have an overall negative impact. In the response, discuss a real-world example. [12 marks]

ATL ACTIVITY

Research

Facial recognition technology has been found to be inaccurate and biased, especially about people of colour.

- Research two solutions that would address the problem of racial bias in facial recognition. One should be technology-based and the other policy-based.
- Evaluate each solution.
- Draw conclusions and make a recommendation.

Ability, access and inclusion

How AI can influence accessibility

Many AI-powered technologies were developed with people with disabilities in mind, while others were created to improve digital inclusion in general. This includes:

- voice control software that converts speech to text or an action for people with physical impairments
- screen reader software, which converts text to speech for people with visual impairments
- automatic translation and caption content for people with hearing loss
- image-recognition software and ‘alt text’ for people who use screen readers
- summarizing articles for people with reading difficulties
- facial recognition software designed to help people who find it hard to manage passwords.

Website accessibility

Many content management systems are available to help build websites, and some have templates for creating accessible content and layouts. Features such as ‘alt text’ (alternative text that describes an image) can be provided for images so that people who use screen reader software can understand the message conveyed by the images on the page. This is especially important for informative images, such as infographics. When creating alt text, the text should contain the message you wish to convey through that image as well as any text included in the image.



Links

This content links to Sections 4.4B The human body and 4.7A Social components of identity.

Image auto-tagging using machine learning

This technology uses machine learning to recognize visual elements within images. It identifies patterns and checks them against a large database to make sense of what the image is. When the image is auto-tagged, screen reader software will be able to read ‘alt text’ to users.

Ways in which technology is making the world more accessible

Self-driving wheelchairs

With an ageing population worldwide – the number of people aged over 65 in the US is expected to increase from 48 million to 88 million by 2050, with many more people likely to face mobility challenges. One tech-enabled solution is self-driving wheelchairs, which use lidar sensors to build a map of the area where they are used and to avoid obstacles. They have been trialled at airports in Japan and in the US.

AI to help you 'see'

New apps are being developed to help people who are blind or visually impaired navigate the world around them. Google's Lookout app uses image recognition technology and machine learning to detect objects and people around it, and provides spoken cues to the user. It is only available on Pixel devices in the US currently but Google says it plans to roll it out more widely soon.

ATL ACTIVITY

Evaluate

Challenge: People with disabilities and elderly people are often discriminated against, both intentionally and unintentionally.

Intervention: A range of assistive digital technologies have been designed to help them to participate in society more fully.

Research, analyse and evaluate some of these assistive digital technologies, especially those that are present in your local area.



Tolerance for religions and cultural differences

Intolerance of different religions and cultures is present in all social media in every country in the world. Often this is expressed by internet ‘trolls’, individuals who intentionally antagonize and provoke others by posting offensive comments or other disruptive content online. These posts are often full of misinformation, distorted facts and stereotypes.

Laws are being proposed around the world to meet this challenge, and pressure is being put on digital communication and social media companies to take action themselves before being forced by governments.

ATL ACTIVITY

Research

Many studies have been made of the impact of trolls on individuals, businesses and organizations.

- Research detailed examples of the impact of trolls.
- Research different proposals from a range of countries to mitigate and reduce the impact of trolling.

ATL ACTIVITY

Thinking

Challenge: Some religious and cultural groups are not represented fully in popular culture, such as books, movies and digital games, or may only be included in a stereotypical way that perpetuates discrimination. The challenge is to design games and stories that do not rely on stereotypes, and that have storylines that do not discriminate or enhance discriminatory attitudes.

Evaluate the possibility of designing digital games to have a positive impact on this challenge.

ATL ACTIVITY

Thinking

Challenge: It can be difficult to find the true identity of individuals who post offensive material online, and even more so to take legal action against them. One intervention proposed is to force social media companies to ensure they know the authentic identity of each person using their platforms. Laws could then be enacted that allow people who have been targeted to access their identities.

Evaluate this intervention.

Activity: HL Extended Inquiry



Evaluate

Evaluate the impacts, implications and interventions.

- Have you evaluated the extent of the impacts and implications?
- Have you highlighted the most important impacts and implications that need to be addressed by the interventions?
- Have you evaluated the interventions using the six intervention criteria?

Recommend

Make recommendations.

- Have you recommended changes and additions to the interventions?
- Have you recommended other steps for future actions to address the challenge and its issues?

Below are possible challenges and interventions to show how an extended inquiry can be approached.

In each extended inquiry, several interventions should be considered.

- 1 Using the chart below, research and discuss at least one additional real-world intervention for each challenge.
- 2 Recommend steps for future actions.

■ Prescribed areas for inquiry: 5.2C Diversity and discrimination

Supporting topic	Possible challenges – inquiries	Possible interventions – extended inquiries
Gender equality	Fewer women are taking up ICT careers than men.	Policy of proactive hiring of women. Facilitating the study of ICT.
Racial and ethnic discrimination	Trolling of people from different racial and ethnic groups. Facial recognition technology is racially and ethnically biased, and can be used to control different groups.	Special apps and controlled areas in social media that are safe. Policies to control use of facial recognition technology. Improved facial recognition software.
Ability, access and inclusion	Help people with disabilities (focus on one disability only).	Use of assistive digital technologies for individuals. Use of digital technologies to work from home.
Tolerance for religions and cultural differences	Computer games are culturally and racially biased. The use of facial recognition software and other monitoring methods to control different groups.	Design games that are inclusive of different groups. Political action using social media to publicise the problems.

Activity: HL Extended Inquiry



Interventions address challenges through actions. In extended inquiries, you will work with interventions that involve digital technologies. To illustrate how an extended inquiry might be approached, review the following interventions and recommendations for the given real-world scenario.

After reviewing the interventions and recommendations below, investigate other possibilities.

- **Real-world example:** A top medical website is available in French only
- **Intervention:** Resolves
Automated translation is available for the website.
- **Possible recommendation for future action:** Acceptability
Evaluate translation software to see if it meets acceptable standards.

Activity: HL Extended Inquiry



Interventions address challenges through actions. In extended inquiries, you will work with interventions that involve digital technologies. To illustrate how an extended inquiry might be approached, review the following interventions and recommendations for the given real-world scenario.

After reviewing the interventions and recommendations below, investigate other possibilities.

- **Real-world example:** Representation of women in engineering programmes
- **Intervention:** Intercedes
Universities create policies for gender equity in admissions.
- **Possible recommendation for future action:** Equity
Monitor admission rates to ensure improvements in the representation of women.

Deeper thinking

Human rights in a digital age

The expansion of the digital communication infrastructure and the rapid adoption of digital technologies has resulted in a moment of profound societal transformation and disruption. Human rights protection in the twenty-first century will depend on our capacity to apply long-standing human rights principles to the digital realm.

Human rights are being exercised and violated in new ways all around the world because of digital technology. The internet has evolved into a critical tool for a variety of human rights and economic growth. On the other hand, new examples of how digital technologies are used to undermine human rights emerge every day, from governments banning Twitter and the electronic surveillance of citizens, to the right to be forgotten in Google searches in Europe, or forcing internet users to provide real names to service providers.

Our knowledge of how to defend and respect human rights is being severely challenged as our political, social and legal institutions have not kept up with this transformation. The human rights movement must adapt to the digital environment in which we now live. Data has become an inextricable aspect of our existence. Every encounter we have with technology, from using a debit card in a local store to liking a Facebook post, contributes to the near-infinite bank of data generated by and about us.

Digital technologies govern an entire process by which judgments about our lives are produced that can impact our freedom, our understanding of our place in society, and how others see us. They also have a significant impact on our human rights.

www.hrw.org/news/2014/12/23/human-rights-digital-age#
[www.cam.ac.uk/cammagazine/
humanrightsindigitalage](http://www.cam.ac.uk/cammagazine/humanrightsindigitalage)

ATL ACTIVITY

Social

The internet has become an indispensable tool for the realization of a range of human rights, but there are new examples of how digital technologies play a role in undermining human rights every day.

In small groups:

- Research the Universal Declaration of Human Rights.
- Select five 'rights' from the list.
- Each person in the group should choose a different technology, for example social media platforms, artificial intelligence and surveillance technologies.
- For your selected technology, research how the technology may have had a positive and/or negative impact on the 'rights' selected above at a global level.
- Share your findings with the group and discuss the short- and long-term implications on citizens.

Reflection

Now that you have read this chapter, reflect on these questions:

- Aside from facial recognition software, what other IT systems may have racial or gender biases?
- Aside from gender and racial inequalities, what other biases have evolved with the increase in the use of technology in our digital world?
- Should governments be allowed to create laws and policies surrounding new technologies that might impact our human rights?
- How has the digital divide impacted you locally, nationally and globally?



5.3

Sustainable development

UNDERSTANDINGS

By the end of this chapter, you will understand:

- ▶ the meaning of sustainable development in a digital society
- ▶ how sustainable development is a significant challenge in our digital society
- ▶ how digital technologies can impact the challenges faced by climate change and action
- ▶ how digital technologies can be leveraged for pollution and waste management
- ▶ how digital technology-related interventions are being used to respond to this challenge.

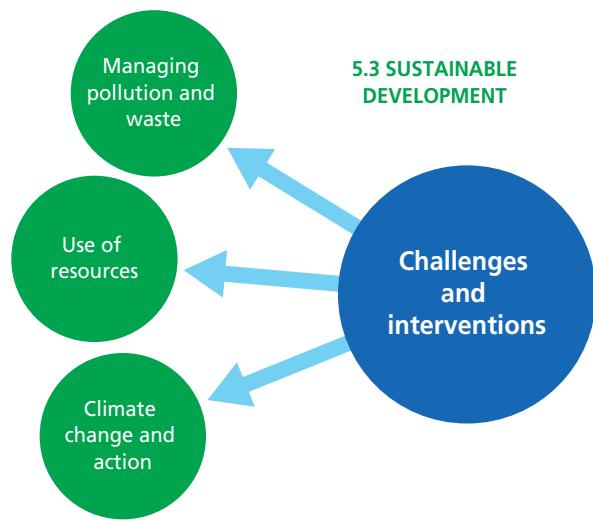
◆ **Sustainable development:** The ability to meet human development goals without depleting the natural resources that we depend on.

What is sustainable development?

Sustainable development refers to our ability to meet our goals for human development without depleting the natural resources that we depend on. It is a key focus of the UN, and it presents a significant challenge in a digital society.



5.3 SUSTAINABLE DEVELOPMENT



Digital technologies are critical to the advancement of human development and the creation of more inclusive societies. New technologies, such as the IoT, artificial intelligence and blockchain, are a powerful force for cultural and societal change, but they are also a means for achieving this in a sustainable way.

Historically, our essential individual and cultural needs – nutrition, mobility and buildings for shelter and survival – have been met at the expense of our planet. By harnessing new digital technologies, we can try to meet these requirements in a less destructive manner. We can also use them to avoid the overconsumption of natural resources, reduce pollution and increase equity between different stakeholders.

*Leveraging the digital age to drive transformative systems change
for a climate-safe, sustainable and equitable world.*

Éliane Ubalijoro, Sustainability in the Digital Age

Digitalization itself isn't innately sustainable, however. Although it can be used to improve unsustainable systems, it also tends to speed up unsustainable ways of life. While digital technologies can help with everything from sustainable farming to ending poverty, they can also threaten our privacy and security. The digital divide also reinforces existing inequalities found both within and between countries.

■ UN Sustainable Development Goals

The 17 Sustainable Development Goals of the UN are development strategies designed to address the global challenges we face – including climate change, responsible consumption and production, and environmental degradation – to achieve a better and more sustainable future.



■ The UN's Sustainable Development Goals

Many of the HL Extension topic areas connect to the Sustainable Development Goals as new technologies can be used to support and accelerate their achievement.

ATL ACTIVITY

Social

With another student, discuss how each of the UN's Sustainable Development Goals is impacted by digital technologies. Share your opinions with the rest of the class to see which line of argument is shared by the majority.

ATL ACTIVITY

Research

Research the following questions and document the process used.

- Are digitalization and sustainability opposites?
- Can new technologies such as artificial intelligence contribute to making our lives more sustainable?

ATL ACTIVITY

Thinking

Give one example of how big data could be used to help achieve each of the UN's Sustainable Development Goals.

ATL ACTIVITY

Research

In groups, create posters or a group collage for the 17 Sustainable Development Goals showing how digital technologies impact each goal. You should address both positive and negative impacts, for example, how digital technologies can:

- drive progress towards achieving the goals
- minimize inequality by providing access to basic services (for example, e-health or online education)
- better connect citizens and improve stakeholder engagement and information management
- increase productivity, efficiency and cost savings
- reduce product waste
- analyse and track progress
- help minimize the impact on the environment
- achieve technological change, such as recycling, waste minimization, substitution of materials, change production processes, control pollution and ensure efficient usage of resources
- negatively contribute to the depletion of resources
- create unequal access to information and contribute to the widening gap between the rich and poor.

In this chapter, we will look at three main areas of inquiry for sustainable development:

- climate change and action
 - global efforts to address climate change
 - national, regional and local efforts to address climate change
- responsible use of resources
 - responsible consumption, production and distribution of products and services
 - designing for responsible use of shared infrastructures and resources, for example, energy, transportation and built spaces
- managing pollution and waste
 - pollution and waste monitoring
 - pollution and waste prevention
 - pollution and waste reduction.

5.3A Climate change and action

Climate change is one of the biggest challenges faced by society today. International treaties such as the 2015 Paris Agreement on climate change and the 2030 Agenda for Sustainable Development have set out the ways that countries can lower their carbon emissions, increase their resilience to the impacts of climate change, and increase their overall sustainability.

Climate change has been accelerating since the Industrial Revolution. The increased use of fossil fuels such as oil and natural gas, combined with the destruction of ecosystems, has led to a net increase in greenhouse gases such as carbon dioxide in the atmosphere. This causes global warming and long-term changes in weather patterns. The effects include the melting of polar ice, rising sea levels and warming waters, and the resulting increase in extreme weather events such as droughts, flooding and hurricanes. It has also contributed to a rise in forest fires across the planet.

◆ Climate change:

Long-term shifts in the global or regional climate, such as temperature and weather patterns.

■ Global, national, regional and local efforts to address climate change

Dealing with climate change requires both the reduction of greenhouse gas emissions and interventions to deal with the unavoidable consequences. Advances in technology hold great promise for helping us to achieve these aims and we need to capitalize on these innovations to speed up climate action and ensure a secure future on our planet. Some examples of recent technologies that can be used to either combat climate change or reduce the impact of its effects include the following:

- Less expensive, cleaner energy from renewable resources such as solar, wind and tidal power – an ever-increasing number of organizations, including Google, Microsoft and Apple, and individuals, are transitioning to 100% clean energy.
- Consumers are moving to more sustainable transport methods such as electric vehicles, which are less expensive to operate, are more reliable, and produce less carbon dioxide.
- More data collection is improving our comprehension and models of climate change, giving us more substantial data to act upon.
- Researchers have better technology with which to investigate extreme weather events, make connections and future predictions and provide more direct support following a severe hurricane, for example.
- Social media can be used to encourage climate action and raise awareness of other sustainable development issues.

Some of these technologies have also contributed to environmental pollution, however, for example the mining of raw materials required for solar panels and batteries in electric vehicles. Other technologies have high energy demands, for example, data centres for cloud computing. The rapid development of new technologies has also contributed to an increase in the amount of electronic waste – currently in excess of 50 million tons every year.

ATL ACTIVITY

Research

Research how large amounts of data from monitoring the climate are being collected and processed by scientific and government organizations, both nationally and internationally by agencies such as the United Nations.

REAL-WORLD EXAMPLE

Data centres



Storing data in the cloud may seem simple and efficient but, in reality, this data is stored in enormous digital data centres that consume large amounts of energy. Now an indispensable part of modern computing infrastructures, the number of data centres are set to grow significantly as more and more organizations turn to them for cloud solutions and compliance assurances.

Even with the development of more sustainable energy solutions, the harsh reality is that both small and large data centres consume a lot of power – approximately 3% of all electricity used in the world.



Links

This content links to the discussion on carbon footprints in Sections 3.6E AI dilemmas and 4.3B Pollution and waste.

Blockchain is an effective tool for tracking, reporting and increasing accountability for greenhouse gas emissions in supply chains. It helps organizations by providing carbon emission data that is more reliable and easily accessible. Blockchain technology can be used to track and report on carbon footprint reductions across the entire chain as well as provide real-time data verification, instant authentication and clear data records.

Blockchain enabled platforms have the potential to transform corporate efforts into a collaborative endeavour. They can bring together all stakeholders, including governments and non-profits, and identify specific stakeholders that have reduced their carbon impact.

The European Union (EU) plans to:

- foster the development of blockchain technologies to incentivize stakeholders to decrease their carbon footprint and think about the societal impact of their actions
- establish technical support and investment initiatives to enable blockchain-based digital technologies that help mitigate and adapt to climate change
- develop blockchain-based solutions that create a network between suppliers and consumers, expanding beyond individuals to incorporate all stakeholders in society
- assist national government agencies in the development and adaptation of blockchain-based solutions that support climate action and greenhouse gas emissions reduction
- strengthen Europe's clean technology innovation ecosystem and boost clean technology start-ups with access to funding.

ATL ACTIVITY

Communication

Create an elevator pitch on how blockchain technologies can be used to reduce the impact of climate change by tracking and verifying emissions and other activities.

- Use effective research techniques to find information about how blockchain technologies are being used by different countries to reduce carbon emissions.
- Select one of these and summarize the information.
- Rephrase your findings so that they can be presented in less than a minute.
- Practice, and then record your oral presentation.

REAL-WORLD EXAMPLE

Drones used to help replant forests



Following intense forest fires in California, some companies are using drones to scatter seeds to help restore the damaged areas. Drones are useful as they can reach areas that might otherwise be inaccessible or dangerous, as burned areas are susceptible to erosion and mudslides. This intervention has not been completely successful, however, as one study found that less than 20% of the seeds actually took root and grew into trees. The majority of the seeds are wasted and forestry officials are concerned this will lead to a shortage of seeds.

www.wired.com/story/drones-replant-forests-seeds-take-root

EXAM PRACTICE QUESTIONS



Paper 1 (Section B)

- 1 Digital innovations are advancing the monitoring of climate throughout the world. Using a real-world example, discuss the impact of this type of digital innovation in helping to address climate change. [12 marks]

ATL ACTIVITY

Research

- **Challenge:** Optimize home energy use.
- **Intervention 1:** The use of home energy monitoring apps that display usage (time and amount); homeowners can use this data to change their energy usage.
- **Intervention 2:** The use of smart appliances and a smart controller that automates the control of energy, so that the least amount is used.

Using interviews, surveys or questionnaires, research the effectiveness of these two simple interventions in a range of households, offices and factories.

Weather forecasting to optimize renewable energy

The amount of renewable energy that can be generated by wind turbines and solar systems depends on the weather, and can be subject to wide variations. This is obviously a disadvantage in terms of being able to generate sufficient energy, especially for companies that are selling this energy to the network, where higher prices are paid for more predictable supplies.

Accurate weather forecasts are key to being able to predict the amount of energy that renewable systems are able to produce in advance. This is where machine learning comes in, as machine learning-based models are able to provide greater precision when predicting wind speeds compared to conventional models. It has helped to increase the competitiveness of the renewable energy sector, and can also be used when planning the location of new wind turbines or solar arrays.



Machine learning has enormous potential and can be applied to other areas to help slow down climate change and reduce the consumption of non-renewable resources.

Activity: HL Extended Inquiry

The diagram illustrates a process flow for an extended inquiry. It starts with a blue box labeled 'Evaluate' at the top, which contains a bulleted list of questions about impacts and interventions. A downward-pointing arrow leads to a blue box labeled 'Recommend' at the bottom, which also contains a bulleted list of questions about recommendations and future actions.

Below the diagram, the text states: "Below are possible challenges and interventions to show how an extended inquiry can be approached. In each extended inquiry, several interventions should be considered."

1 Using the chart below, research and discuss at least one additional real-world intervention for each challenge.

2 Recommend steps for future actions.

■ Prescribed areas for inquiry: 5.3A Climate change and action

Supporting topic	Possible challenges – inquiries	Possible interventions – extended inquiries
Global efforts to address climate change	The challenge of climate change, its impacts and implications are being recognised throughout the world.	A range of climate models have been developed and refined; they are being used to predict the future climate. The predictions are being used by governments, companies and institutions to make policies to lessen the impact of climate change, and to manage the effects of climate change.
National, regional and local efforts to address climate change	The challenge of climate change at the national level and below is a matter of local action. Before action can be taken, however, data and information are needed – data about the actual climate and its impact on the natural and human world.	The IoT and other digital technologies are being used to collect and process data so that action can be taken, especially for local challenges. A range of local and regional interventions can be applied, for example the distribution and use of energy and water in homes and offices, food production and supply chains.

5.3B Responsible use of resources

This section considers the responsible consumption, production and distribution of products and services, as well as designing for the responsible use of shared infrastructures and resources, for example, energy, transportation and built spaces.

Responsible consumption, production and distribution of products and services

The United Nations Sustainable Development Goal 12 focuses on the responsible consumption and production of goods and services. This includes the distribution as well. While consumption and production are one of the driving forces for the global economy, the use of resources is having a destructive impact on our planet. So much so, to improve sustainability, societies need to increase the efficiency of using resources and promote more sustainable lifestyles.

Consequently, focus has been placed on three main resources – water, energy, and food.

Water

Although water is a free commodity, only 3% of the world's water is drinkable, the infrastructure needed to deliver water is expensive and production often pollutes our rivers and lakes, while agriculture requires much water for successful crops and livestock. Chapter 4.3 Environmental and the next topic covers pollution and waste management in more detail, which is key to reducing pollution to water supplies as a result of manufacturing and human activities.

Energy

Households consume 29% of global energy while at the same time contributing 21% of CO₂ emissions, and further use of energy efficient technologies could make significant financial savings worldwide. Digital technologies are necessary to help reduce carbon emissions, yet, computer systems themselves have an immense energy requirement for their countless devices, data centres, applications and global networks. IoT devices and IoT smart city initiatives are examples of technologies aimed at reducing energy consumption.

Food

It is estimated that one-third of food produced is thrown away by consumers or retailers; or has been spoiled during transportation or at the time of harvesting. In addition to these figures, overfishing and degrading quality of soil has lessened the ability of our natural resources to provide enough food. Earlier on in this section, we addressed the access to safe and sufficient food. In addition to this, digital technologies such as the use of digital platforms to help connect suppliers with a surplus of food with manufacturers who can use it, can further reduce the amount of food wasted.

See <https://www.un.org/sustainabledevelopment/sustainable-consumption-production/>

Technology can help address many of these issues through looking across supply chains and what happens to products during and after consumption. Chapter 4.2 covered many technologies aimed at increasing efficiency during the production of goods and services as well as the use of smart technologies.

Sustainable transport

When evaluating the sustainability of different methods of transport, we need to consider its social, environmental and climate impacts. This includes the infrastructure that each method of transport requires, for example roads, water or air, and their sources of energy.

Fuel-efficient electric vehicles have become mainstream in recent years, but the next step may be driverless cars and trucks. They are more efficient than cars driven by humans as they are inherently 'smart'. However, they are expensive and resource hungry – more mining is needed for the raw materials required to make them, and the amount of data processing requires more energy hungry data centres.



ATL ACTIVITY

Research

The estimated carbon footprint of the average laptop computer is around 420 kg of greenhouse gases. This includes the carbon emissions during its production and transportation, and the first four years of its use.

- Research the carbon footprint of all of the components in a laptop, as well as their production process and distribution.
- Research ways that this could be reduced and create a proposal.
- Discuss your proposal with your peers and evaluate its effectiveness.

EXAM PRACTICE QUESTIONS



Paper 1 (Section B)

- 1 Discuss the claim that driverless cars will reduce our carbon footprint. In your response, refer to a real-world example. [12 marks]

EXAM PRACTICE QUESTIONS



Paper 1 (Section B)

- 1 Ride sharing apps can now be used to 'carpool' (share a vehicle between a number of individuals) to travel to work. This reduces the number of cars on the road and saves resources. Discuss the use of ride sharing apps for this purpose using a real-world example. [12 marks]

ATL ACTIVITY

Research

How are companies addressing environmental factors and sustainability when designing data centres?

ATL ACTIVITY

Research

Challenge: The world relies on the global distribution of oil and natural gas, which are delivered by sea and land. Digital technologies are used to determine the most efficient route to reduce the carbon emissions of the ships and trucks.

Research how this is done.

Activity: HL Extended Inquiry



Evaluate

Evaluate the impacts, implications and interventions.

- Have you evaluated the extent of the impacts and implications?
- Have you highlighted the most important impacts and implications that need to be addressed by the interventions?
- Have you evaluated the interventions using the six intervention criteria?

Recommend

Make recommendations.

- Have you recommended changes and additions to the interventions?
- Have you recommended other steps for future actions to address the challenge and its issues?

Below are possible challenges and interventions to show how an extended inquiry can be approached.

In each extended inquiry, several interventions should be considered.

- 1 Using the chart below, research and discuss at least one additional real-world intervention for each challenge.
- 2 Recommend steps for future actions.

■ **Prescribed areas for inquiry: 5.3B Responsible use of resources**

Supporting topic	Possible challenges – inquiries	Possible interventions – extended inquiries
Responsible consumption, production and distribution of products and services	<p>The challenge of connecting farmers to buyers, especially for small farmers, is complex. This challenge needs to be met to ensure the most effective and efficient use of farm products.</p> <p>The challenge of informing and educating people and communities about the responsible use of resources, especially through education about managing pollution and waste.</p>	<p>The use of virtual farmers markets and smartphone apps where farmers and suppliers add information about what they are selling and what they want to buy. Price and delivery negotiations are facilitated, and a payment system ensures the transactions are safe.</p> <p>Smaller-scale farmers, especially those selling special products such as organically certified produce, can join together to enable people to buy directly from the farms using a website. The fresh produce is delivered locally.</p> <p>A local education and information campaign that uses digital technologies, such as social media.</p> <p>An app that can provide instant information about how to dispose of waste at home responsibly.</p> <p>A game about managing waste for children to learn about how to handle waste responsibly.</p>
Designing for responsible use of shared infrastructures and resources, for example, energy, transportation and built spaces	<p>The challenge of managing water and electricity supplies is a complex task.</p> <p>Transportation in large cities is often slow and consumes a lot of resources.</p>	<p>The use of artificial intelligence to collect data about the water and electricity networks to predict where problems may arise and to manage repairs.</p> <p>Data scientists can use software to analyse the data from previous repairs and the current state of the networks.</p> <p>The creation of new smart cities.</p> <p>The modification of older cities with smart technologies.</p>

5.3C Managing pollution and waste

Environmental sustainability refers to the responsible use of natural resources so that future generations are not jeopardized. A big part of this involves the management of pollution and waste through monitoring, prevention and reduction.

The digital transformation of environmental sustainability, through technologies such as artificial intelligence, big data analytics, cloud computing, and the IoT, focuses on four key areas: pollution control, waste management, sustainable production, and urban sustainability.

Companies and organizations are using new digital products and platforms to reduce their carbon emissions, minimize waste and to ensure that their business practices are sustainable. Big data is also changing the way that we measure our impact on the environment. It can be used to enhance food traceability, improve production processes and to certify the environmental performance of goods (that is, their carbon footprint). Blockchain technology also has a lot of potential to reduce carbon emissions, maximize resource usage, extend product life cycles and increase sustainability.

Pollution and waste monitoring and prevention

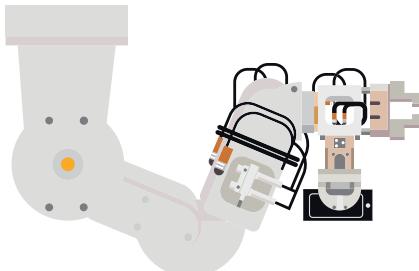
Waste management will be more efficient as a result of digital technology. The twenty-first century is being transformed by digitalization, which is impacting every aspect of society, including environmental technology. It will help us to recover more of the valuable minerals found in waste streams, lowering the amount of raw materials being mined and avoiding the environmental and climate consequences that arise.

The European Environment Agency made the following observations in 2021:

- Technology will be essential to move from a system of waste management towards the management of sustainable materials. Digital technologies make it easier for companies to employ recycled materials, improve purchasing and sorting decisions by consumers, and boost trash source possibilities.
- The majority of advanced digitalization in waste management and treatment is still in the early stages of development. New business models are emerging, including waste-specific software, waste e-trading platforms and business analytics.
- Some digital technologies are already in use in the waste management process but the current situation in Europe is varied, with numerous technologies being used at different scales.
- The waste management sector's digital transformation needs to be coordinated with efforts to make use of digital technology in the development of a circular economy.

Digital technologies in waste management

The rise of digitalization technologies is mainly due to advances in increased processing power, miniaturization and lower costs. Improved digital technologies assist in waste management as well. Robotics, the internet of things (IoT), cloud computing, artificial intelligence and data analytics are examples of specific digital technologies that are being used and that are predicted to have a significant impact on the waste industry's efficiency in the future.

					
PROCESS	Robotics	Artificial intelligence and neural networks	Internet of things	Cloud computing	
	Advancements in the pneumatic sorting process as a result of automation technology allow producing defined waste streams of high purity (over 90 %).	Machine learning — using neural networks based on the use of data or examples to solve problems without explicit programming — is used for classification and pattern recognition in the waste management context, improving the efficiency of sorting.	As more and more devices are connected to the internet or other networks, sensor-supported containers can collect data and transfer it to central units.	Storing and processing of sensor data and cloud based software solutions make it easy to optimise workflows and document failure to collect, failure in sorting or detect waste bins that are not paid for.	Processing and analysing data plays an important role in the recycling industry in order to identify patterns, extract information, discover trends or calibrate models. This knowledge is important in order to evaluate different options for the transition to a recycling economy.
EXAMPLES	- Robots that are able to identify and sort recyclables and critical materials through image recognition/IR scanning/AI vision systems when dismantling used phones/electronics	- Autonomous, self-driving street sweepers, refuse trucks	Smart waste bins with identification systems, weighing systems, level sensors, temperature sensors, software for optimising logistics	Cloud based software for: <ul style="list-style-type: none">Connection, standardising and optimising internal proceduresReal-time order management, route planning and optimisation, customer self-service, order-tracking and evaluation	<ul style="list-style-type: none">Electronically supported deposition of waste collection vehiclesEvaluation of sensor data for automated sorting plantsControl of waste incineration plantsDrone based data collection on landfills

Use of digital technologies in waste management

Links

This content links to Section 4.3B Pollution and waste.

Improving waste management logistics

Digital technology is being used increasingly in almost every aspect of waste collection and processing. Advances in digitalization have revolutionized certain parts of the logistics, which includes the process of planning, scheduling and dispatching tasks, employees and vehicles.

Algorithms can use optimization to identify the best solutions for allocating resources such as people and cars. Telematics, such as GPS systems that use navigation and vehicle tracking software, and enterprise resource planning (ERP) systems, are important examples.

The most obvious outcome of the enhancements is increased efficiency. Waste collection methods can also be better aligned with the objectives of a circular economy. For example, it must be able to respond to shifting waste trends and targets quickly, as well as make on-demand and customized services more accessible.

Incentivizing green behaviour

Digitalisation also allows for the creation of advanced waste management schemes that employ radio-frequency identification (RFID) to track household waste. The waste is tracked by a chip and, once the quantity and quality of separation have been assessed, the information is sent back to the person who generated the waste. Personalized messaging, combined with waste prevention programmes, can help guide customers toward better waste management practices.

ATL ACTIVITY

Inquiry

- **Challenge:** Informing and educating people and communities about the responsible use of resources, especially through education about managing pollution and waste, can use digital technology.
- **Intervention 1:** An app that can provide instant information about how to dispose of waste responsibly at home.
- **Intervention 2:** A game about managing waste for children to learn about how to handle the waste responsibly.

Research and evaluate both interventions used to manage pollution and waste using the HL extended inquiry framework.

Make a recommendation for steps for future action.

REAL-WORLD EXAMPLE

Water monitoring



A number of alarming headlines seem to suggest that the management of wastewater in the UK is deteriorating. In fact, it may simply be a reflection of improvements in wastewater monitoring techniques and accessibility of data since automated monitoring of storm overflows were introduced.

For example, the number of stormwater overflows resulting in sewage spills appeared to rise by 37% by 2020. However, as the monitoring of storm overflows increased by 46%, the Environment Agency believes that the actual number of events remained steady.

Automated monitoring of wastewater collecting networks and storm overflows is giving us a clearer indication of the extent of the problem.

www.kando.eco/recycling-water-has-to-become-the-norm-because-it-is-too-scarce-and-too-valuable-to-waste-3

Pollution and waste reduction

Air, water, soil and workplace pollution are all major concerns. The UN Sustainable Development Goals have a major emphasis on decreasing pollution, with the aim of substantially reducing the number of deaths and diseases caused by hazardous chemicals, air, water and soil pollution and contamination by 2030.

To achieve long-term global development, considerable action must be taken to limit pollution. Traditional pollutants such as residential air pollution and contaminated water supplies are steadily being reduced. For example, the use of more advanced home appliances and energy sources have reduced air contamination in the home, and access to more advanced sterilization facilities have reduced exposure to water-borne micro-organisms. However, there is still much to be done, as traditional pollutants continue to kill over 4 million people each year.

Further technological advancements will be required to develop inexpensive sensors for critical pollutants and innovative platforms for data gathering, validation and analysis.

EXAM PRACTICE QUESTIONS



Paper 1 (Section B)

- 1 Recycling facilities for old and/or broken digital devices, such as smartphones, games consoles, laptops and smart TVs, can now be found in most communities. The challenge is to recycle the components and materials effectively.

Using a real-life example, examine the effectiveness of the recycling of digital.

[12 marks]

ATL ACTIVITY

Thinking

Challenge: Too many cars on the roads creating pollution can be addressed by the use of ride-sharing apps or local social media, so that people can share their cars when commuting to and from work.

Discuss possible interventions and recommendations for future action.

Activity: HL Extended Inquiry



Evaluate

Evaluate the impacts, implications and interventions.

- Have you evaluated the extent of the impacts and implications?
- Have you highlighted the most important impacts and implications that need to be addressed by the interventions?
- Have you evaluated the interventions using the six intervention criteria?

Recommend

Make recommendations.

- Have you recommended changes and additions to the interventions?
- Have you recommended other steps for future actions to address the challenge and its issues?

Below are possible challenges and interventions to show how an extended inquiry can be approached.

In each extended inquiry, several interventions should be considered.

- 1 Using the chart below, research and discuss at least one additional real-world intervention for each challenge.

2 Recommend steps for future actions.

■ Prescribed areas for inquiry: 5.3C Managing pollution and waste

Supporting topic	Possible challenges – inquiries	Possible interventions – extended inquiries
Pollution and waste monitoring	Transportation in large cities often produces large amounts of pollution, chemicals, noise and visual impacts.	The IoT and other digital technologies are being used to collect and process data about chemical and noise pollution, leading to practical, social and political action.
Pollution and waste prevention	A large amount of food is wasted by homes, restaurants, farmers and other food suppliers.	Digital technology can be used to gauge the condition of fresh foods rather than rely on human monitoring. The system uses sensors that collect data on colour, odour, size, time, and so on, and uses food chemistry and artificial intelligence to create a digital picture of the food items being monitored. The data can accurately assess an item's freshness and condition. The intervention can use specialized monitoring equipment, hand-held devices and smartphone apps. The condition of the food can then be used to sell it faster, and customers can buy food approaching the end of its shelf-life at a discount.
Pollution and waste reduction	Managing e-waste is a major challenge with thousands of digital devices being discarded each year.	Three interventions are: <ul style="list-style-type: none">• re-sale or gifting devices to needy people• processing the discarded digital devices to retrieve valuable components• requiring manufacturers to reprocess digital products when they are discarded.

Activity: HL Extended Inquiry

Interventions address challenges through actions. In extended inquiries, you will identify and evaluate interventions that relate to digital technologies. To illustrate how an extended inquiry might be approached, review the following interventions and recommendations for the given real-world scenario.

Goal 11 of the UN Sustainable Development Goals is to make cities and human settlements inclusive, safe, resilient and sustainable. Its targets include the promotion of resilience to disasters such as earthquakes.

After reviewing the outline for an intervention below, investigate and evaluate specific real-world examples of how digital technologies have been used as interventions for the challenge of detecting of earthquakes.

■ **Real-world example:** Earthquake detection

■ **Intervention:** Mitigates

Specific digital technologies can be used to detect hidden microquakes.

■ **Possible recommendation for future action:** Innovation

Algorithms can be used to detect hidden microquakes within seismic data.

■ **Possible recommendation for future action:** Feasibility

Determine the accuracy of the data and to what extent it effectively detects earthquakes.



Reflection



Now that you have read this chapter, reflect on these questions:

- To what extent can artificial intelligence help to monitor waste management?
- What digital technologies can be used to improve environmental sustainability?
- How can machine learning be used to forecast the energy production of solar power arrays?
- How can you lower your carbon footprint?



Section 6

HL extended inquiry

6.0

Overview of HL extended inquiry for interventions

UNDERSTANDINGS

By the end of this chapter, you should be able to:

- ▶ learn about a range of interventions associated with a variety of challenges and how you can select appropriate ones to evaluate
- ▶ know how to conduct HL extended inquiries into interventions that address specific challenges
- ▶ know how to evaluate interventions using the criteria in the study guide
- ▶ know how to formulate and recommend steps for future action that will be assessed in HL Paper 3.

The focus of this section is the interventions that address specific challenges in the HL extension topics. As part of the HL course, you will be required to evaluate interventions and recommend steps for future action that will be assessed on HL Paper 3.

This section directly follows from Section 5 HL extension: Challenges and interventions, which focuses on the following topics for inquiry, and a range of interventions that will address the impacts and implications of the challenges in the topics:

5.1 Global well-being

- local and global inequalities
- changing populations
- the future of work

5.2 Governance and human rights

- conflict, peace and security
- participation and representation
- diversity and discrimination

5.3 Sustainable development

- climate change and action
- responsible use of resources
- managing pollution and waste.

HL interventions and extended inquiry

You are expected to evaluate at least one intervention for each challenge sub-topic as practice before the HL pre-release is published, and also to prepare for HL Paper 1 Section B, where you will be asked to use knowledge of interventions that you have studied in your response.

An important part of each inquiry is to recommend steps for future action based on the outcome of your evaluation. This section will show you how to select and evaluate the nine required interventions.

When the pre-release for HL Paper 3 is published, you will be able to focus on the specified challenge sub-topic and the specified interventions.

The interventions may not completely solve the challenge(s) in the topics. They may need to be a combination of four main purposes

- to **mitigate** (reduce) the negative impacts
- to **intercede** (intervene) in an existing process to reduce negative impacts
- to **enhance** (improve) the positive impacts
- to **resolve** (eliminate) any negative impacts.

Outline of challenge topics and types of interventions for HL

Some specific digital interventions are outlined in Section 5 that you can use to conduct an extended inquiry. However, you are encouraged to identify additional ones to investigate that are local and relevant.

The suggestions that follow show you the types of interventions you can look for in your local community, or regionally or globally, that you can use as a starting point for your investigation.

■ Topic 1: Global well-being



Inequalities between people and in communities from a local to a global level, focusing on:

- economic differences that are being created and managed using digital interventions
- access to, and production of, sufficient nutritious food that is being enhanced using digital interventions
- access to medical care, including medicines, which is increasingly making use of many types of digital interventions.

The impact of changing populations on the well-being of people and communities:

- Population growth is putting pressure on well-being in many ways, and the impact of sustainable growth is being managed using digital interventions.
- Populations are aging in many places while others have a large proportion of young people, which can be managed using digital interventions.

The changing nature of work for people and communities:

- Employment is being impacted by automation and other uses of digital technology.
- Secure work that is significant and rewarding is being both enhanced and negatively impacted through the use of digital interventions.
- Suitable work for all in the community is being both enhanced and negatively impacted through the use of digital interventions.

■ Topic 2: Governance and human rights



There is the constant challenge for peace and security in the midst of many conflicts:

- The challenge of wars and conflicts in and between nations is being impacted by the use of digital interventions both positively and negatively.
- The desire for, and maintenance of, security is being enhanced by the use of digital interventions, but often with issues.

People and communities want to participate in and be represented by their local government:

- Communication of political ideas and activism of all types is being impacted by digital interventions, with a range of issues emerging as well.
- Governments at all levels are using digital interventions to communicate with people and communities, mostly positively.

People and communities want their human rights to be respected, an end to discrimination and an acceptance of diversity:

- Gender equality is being enhanced with the use of digital interventions.
- Digital interventions have sometimes increased the impact of racial and ethnic discrimination.
- Access and inclusion, especially with regard to people with disabilities, is being enhanced with the use of digital interventions.
- Tolerance for cultural and religious differences is being enhanced with digital interventions, but intolerance is also increasing.

■ Topic 3: Sustainable development



Climate change is having a significant impact on the sustainability of our current lifestyles and requires action:

- Global efforts to address climate change and increase awareness and action often use digital interventions.
- National, regional and local efforts to address climate change are also doing the same.

The sustainable and responsible uses of resources in many areas of the world are being challenged:

- Innovative production and distribution of products and services are being developed that impact the sustainability of resources positively.
- Innovative uses of resources in manufacturing are being developed.

Managing pollution and waste is an increasing challenge all over the globe:

- The monitoring of pollution and waste is being enhanced through the use of digital interventions.
- Improved waste management and reductions in the amount of waste being created have been made possible by the use of digital interventions.

6.1

Conducting an extended inquiry

How to approach the selection of an intervention

Once you have selected a challenge topic and an area of inquiry based on the list above, you need to research the specific contexts and interventions, then assess the interventions to see if they are suitable.

An important part of this selection process is narrowing down the specific challenge by looking at the technology that is addressing the challenge. You can then investigate the intervention in detail using the approach given in the example below.

Before you select an intervention, however, you need to consider the specific context, the digital technologies involved and the real impacts.

Possible types of digital technologies in the interventions

A major source of interventions is the development of new digital technologies. Many are associated with this list of technologies, which are often interconnected

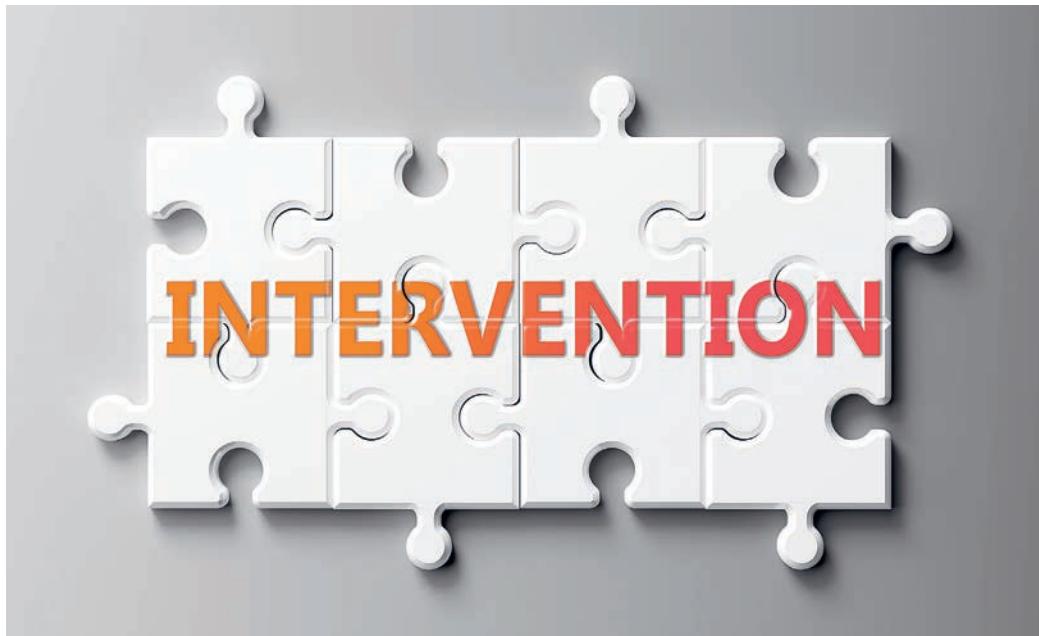
- internet of things (IoT)
- artificial intelligence (AI)
- robotics
- distributed and cloud computing
- augmented/virtual/mixed/extended reality (AR, VR, MR, XR)
- networks and devices for accessing networks (for example, smartphones).

How to assess an intervention

Intervention proposals usually start out as general ideas that need to be researched to narrow them down into real-world examples, which address a real challenge, and specific digital technologies, which leads to a specific inquiry focus.

- The specific interventions could be digital technologies that are used by people and communities. A good idea is to find at least two digital technologies that can be compared and evaluated, as you may be required to do this in the HL Paper 3 examination.
- You can also look for different intervention policies about digital technologies and their uses in specific contexts that can be evaluated.
- The inquiry focus needs to be on a specific context with real people and actual communities.
- The positive and negative impacts of the interventions that arise as they address the challenge topic need to be fairly obvious at the start.
- The interventions do not need to be perfect, but they should clearly lead to recommendations and future actions to improve their effectiveness in addressing the specific inquiry focus.
- Make sure that you select an intervention that has a different purpose from the others you have investigated, to ensure the full range is covered.

The final consideration is to match the intervention evaluation criteria in the ‘Evaluating interventions’ table at the end of this section to your intervention to evaluate it.



How to conduct a HL extended inquiry

The HL extended inquiry model builds on the inquiry process in Section 1. You need to use this model to conduct your inquiry into the interventions. During the course you will select a challenge topic, area of inquiry and interventions to investigate under the guidance of your teacher. When the pre-release is published, you will apply this model to the specified challenge.

■ The HL extended inquiry model



Most of this inquiry model will be familiar to you from your study of the core sections and the HL challenges, but there are two additional items that need to be studied in this model that are specific to extended inquiries into interventions:

- 1** The **four categories of intervention** (mitigate, intercede, enhance and resolve) identify what the intervention is trying to achieve and have been explained previously.
- 2** The **six intervention criteria** (equity, acceptability, cost, feasibility, innovation and ethics) are used to evaluate the interventions:

- the evaluations need to focus on **both the positive and negative impacts** and implications of the intervention, as many people's first reaction is to focus on the negative impacts and implications
- the evaluations, especially the negative ones, lead to **future steps and recommendations**; these must address the features of each criterion specifically in the context of the digital intervention
- many of these criteria overlap with each other and need to be considered at the same time.

■ Evaluating interventions: The six intervention criteria

Intervention criteria	Explanation of the criterion and examples
Equity	<p>Does the digital intervention fairly and equally address the concerns, needs and requirements of specific people and communities impacted by the specific challenge?</p> <ul style="list-style-type: none"> Supplying laptops to disadvantaged students with restrictions on their use has impacts on them that are both positive and negative – students get the advantage of using the machines, but they may not be as good as those of other wealthier students. The use of satellite-based internet connections by remote communities is increasing the ability of all people to participate in a digital society, but they can be expensive and not as effective as mobile or land connections. The use of generic and universal social media platforms may not satisfy the needs and requirements of minority groups, forcing them to develop their own, at some expense and inconvenience.
Acceptability	<p>Do people and communities impacted by the challenge find the digital intervention acceptable in terms of clearly specifying transparent responsibility and accountability?</p> <ul style="list-style-type: none"> The use of electronic voting machines and voting apps may not be acceptable to some due to accountability issues for problems that may arise, such as interference with the voting by hackers or a lack of transparency in the counting. Electronic voting machines and voting apps can be acceptable to others who value the convenience of using them, such as quick results, no need to travel, and can vote any time. The use of drones as a recreation toy may not be acceptable to people living near places where they are used due to privacy concerns.
Cost	<p>What are the financial, social, cultural and environmental costs for people and communities associated with the digital intervention?</p> <p>Overall, do these costs outweigh the benefits of the intervention to the people and communities?</p> <ul style="list-style-type: none"> The use of facial-recognition software in shops, streets and communities has minor financial costs but can have significant social and cultural implications. The environmental impacts of mobile phone towers can be too high for some people. What are the hidden costs and benefits of the growth in online shopping for the various stakeholders – shop owners, shoppers and transportation workers?
Feasibility	<p>Is the digital intervention technically, socially and politically able to be designed, implemented and used? What are the barriers to each of these?</p> <ul style="list-style-type: none"> Are laws and policies to enforce social media companies to control trolls and misinformation technically and politically feasible? Can robotic soldiers be controlled effectively by their artificial intelligence software? Is it feasible to have an effective digital technologies recycling programme?
Innovation	<p>Is the digital intervention innovative in its approach? Is it some other type of changed intervention, for example, evolutionary or adaptive, transformational, or an extension or combination of earlier interventions?</p> <ul style="list-style-type: none"> The development of assistive technologies for people with disabilities and elderly people can be innovative, such as the use of robots, or evolutionary, such as voice-controlled wheelchairs. The use of e-health is another version of the usual face-to-face consultation between doctor and patient. Working from home using digital technologies is an adaptation of the office workplace to the home.
Ethics	<p>Does the intervention produce any type of harm for people and communities? What is the nature and type of harm? How and who determines the importance of the digital intervention, especially compared to others' judgements about it?</p> <ul style="list-style-type: none"> The rights and wrongs of using smartphone apps installed on children's smartphones to track their movements. Is the increasing use of digital communications to contact elderly people instead of physically visiting them ethical? Does the gig economy, which facilitates flexible working hours, have hidden ethical issues associated with it?

6.2

Example of an extended inquiry for an intervention

- An intervention in global well-being: COVID-19 pandemic QR track and tracing app
- Area for inquiry: Local and global inequalities
- Inquiry area focus: Access to health care and medicine (supporting detail item)
- Issue and context: Meeting the challenge of the COVID-19 global pandemic



- Negative and positive aspects of issue: Every person and community, from small towns to nations, has needed to respond to the pandemic. Many people have been infected and some are dying; medical and hospital facilities have been swamped and cannot cope. Actions have been taken in the hope they can control and eventually stop the pandemic.
- Interventions: Some digital technology initiatives have been developed by government agencies to deal with the impact of the global pandemic, such as smartphone apps. Two types of apps have been designed and each has been partially successful:
 - Track and trace apps: Intended to track where people have been; if the virus was in that area, they can be contacted to be tested and then isolate so that they do not infect others.
 - Vaccine passport apps: Designed to show that a person has been fully vaccinated, or has had the virus, or has recently tested negative. They can be used as a form of entry ticket to participate in community activities, such as entertainment events, shopping and education, and to travel locally and internationally. They are intended to prevent people who could have the virus from spreading it to others present.



Top tips

The two interventions are similar and allow for direct comparison. This allows for depth in the responses to Paper 3, Question 4.

Detailed inquiry into a track and trace app that uses QR codes

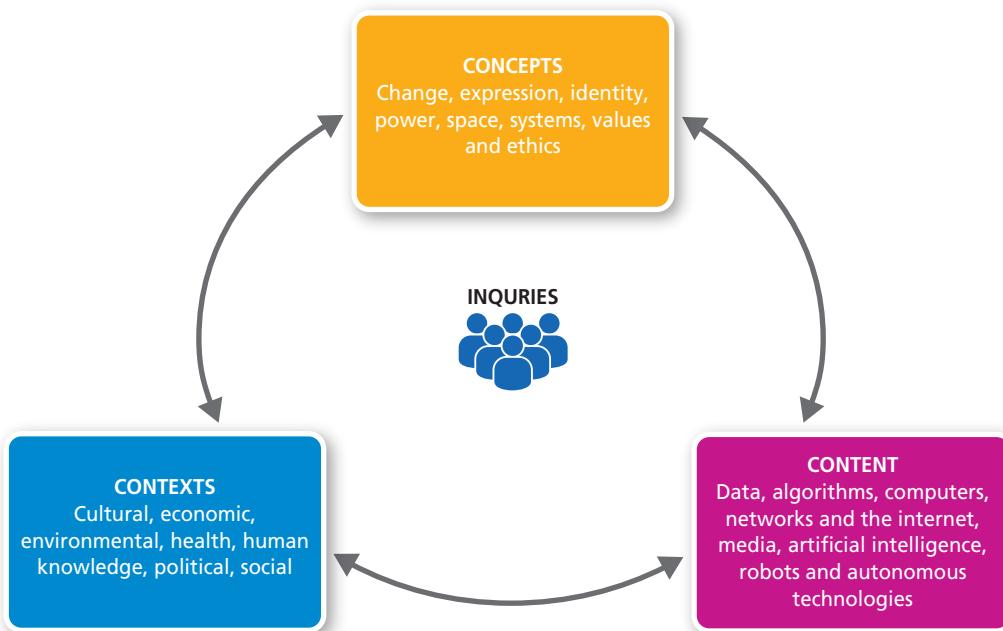
■ Overview of the intervention

When you enter a building or location, you are required to scan a QR code with your smartphone camera, which opens up a link to a government website. The website is linked to a database that records the name of the premises or location, time of entry, and records your name and phone number. More than one person can be added to the list.

If a COVID-19 case is found to have been in the premises or location, the government can use the database to locate all people present at approximately the same time and contact them with details for further action, such as quarantine or isolation instructions.



■ Details of intervention – connecting the 3Cs



Concepts – application to the intervention

This part highlights the issues that can be found when the concepts are applied to the intervention. All of the concepts have been used in this example, but other interventions may leave some of them out because they are not relevant. The issues raised here can be used for evaluating the intervention with the specific evaluation criteria in the study guide.

- **Identity:** The issue is that a person's identity and private movement data is recorded – this needs to be investigated.
- **Power:** The issue is that this information can be used by people in power, such as police and health authorities, which can be beneficial but also has potential negative impacts as our privacy can be infringed – this needs to be investigated.
- **Values and ethics:** To what extent is the data protected by laws, regulations and policies? Why do people use, or not use, the app? Apply the three ethical frameworks:
 - Virtue: 'I want to be a good citizen and participate in society meaningfully as it combats the virus.'
 - Consequences: 'I want to ensure good consequences for myself and others once the virus is controlled.'
 - Principles: 'The app infringes my personal rights so I will not use it; everyone should look after themselves.'
 - Rules-based: 'I will use the app as I have a duty to be a responsible member of the community.'
- **Systems:** There are links between several systems, for example personal smartphones and government systems – this needs to be investigated.
- **Space:** Our experience of space is now different – it is linked to the possibility of surveillance, which needs to be investigated.
- **Change:** The app is an innovation that has been created for this purpose; it adapts current digital technology, which needs to be investigated.
- **Expression:** The data from the places checked into using the QR code can be put together as a record of your activities and displayed in a map; this is not a major concept for this intervention.

Content – digital technologies used

The content should be connected to the content topics specified in the *Digital Society Guide*; for example, this content is in Chapter 3.4. It is advisable to refer back to the content topics for help in understanding the digital technologies used in the intervention.

- Smartphone and camera – to scan an image of the QR code.
- App software – app to convert the image of the QR code to the identification number and location of the business, and to display them on a screen along with your name, phone number and the time of scanning. Once the information is checked (and modified, if necessary), the screen confirm button can be pressed and the information is sent to a government website where the data is stored in a database.
- Government database software – if the government contact tracers learn that a person infected with COVID-19 visited the same place, the software will retrieve the contact details of all the people who visited around that time. These people will be contacted automatically by text message with instructions to isolate and take a COVID-19 test. During the next days, and weeks, there would be further contact between the government and the people affected, for example, to learn the names of others who were with them or the names of people living with them, so that they can also be contacted if the person contacted using the QR information is found to be infected.

Contexts – in the real world

People and communities, stakeholders, local/regional/national level scope:

- At local community level, connected to the regional level.
- Individuals who visit a premises or location, other people present, the owners/managers of the business/site and people working at the location.
- Other stakeholders: government, health authorities, developers of the app.

■ Analysis of the intervention

The use of the intervention has impacts and implications for people and communities.

Positive impacts and implications

- The app facilitates the tracking and tracing of potential COVID-19 infections to enable the isolation of potential and actual infected persons.
- The use of the data is quick and easy. Modern database software can process the individual data, and also look for patterns in the data that are useful to medical and government authorities to prevent and control COVID-19 infections.
- The data includes information that can be linked and used with other software, especially communications/messaging software, to facilitate the control and prevention of COVID-19 infections.
- The data includes phone numbers, which can be used to access movement and contact information from telecommunications companies to highlight areas where the infected person has been and to warn others of this danger.
- The purpose of the data is restricted to a single use, so monitoring of the use of the data is not hard to do.
- Track and trace enables restrictions due to the presence of infections to be localised and controlled, which lessens their impact on people and the economy.
- Timely information through quick contact of potentially infected people will facilitate decision-making by health and government authorities.

Negative impacts and implications

- Possible access to private movement information by police and other authorities.
- The use of the data by government/medical authorities without their knowledge has an impact on people's privacy.
- Time and place data can allow authorities to target the movements of people in a location, for example making the use of local CCTV recordings easier, which has implications for the privacy of a person's activities.
- The laws and regulations regarding the use of the data are not clear as the situation is new.
- Permission to use the data is implicit in the download of the app and the use of the QR code – explicit permission is not usually sought from the person using the QR code.
- It is not clear exactly how the data will be used, who will be using it, when it will be deleted and how secure the storage is.
- People will be wary of using the app at certain locations, which impacts the quality of the data and means that infection tracing is compromised.
- People can be made to download the app, and penalised if they do not, which is an invasion of our freedom.
- People may feel that their privacy and personal rights are being infringed and will not use the app, which means that COVID-19 infections will be harder to control.

Connections between impacts and implications

- The main connection is that the benefits of the app will enable tracking of people who may have come into contact with a person carrying the virus (who may not be visibly sick). This benefit comes at a potential cost, however, as the same data can be used for other purposes around which there are issues.
- Another type of connection that needs to be analysed is which of the impacts are the worst and which are the most important. This can be done by ranking the impacts.
- Another type of connection that needs to be analysed is the extent of the impacts, for example the length of time the impacts have effect, the severity of the impacts on people and communities, the number and range of people impacted, and the location of the impact (local, regional, national, global).

Conclusion

The in-depth analysis above forms part of the ideas that need to be considered when making an overall evaluation of the impacts and implications of the intervention, and the extent to which it is effective in addressing the challenge. It also forms the basis for the recommendations for future steps that are needed.

ATL ACTIVITY

Thinking

Use the bullet points above to write a conclusion. It should consider the positive and negative impacts to come to an overall conclusion about the impact of the intervention on people and communities. Overall, were the impacts positive or negative?

Provide a justification that specifically highlights one or more impacts as being the best and worst, and explain why the overall impact is negative or positive. You can also highlight what needs to be improved. This provides ideas for the recommendations.

Type of intervention

These categories can be used to identify and explain what the intervention is trying to achieve and how it will impact the challenge in various ways. In this case, all of them can be considered to develop a deeper understanding of the intervention.

- **Mitigate:** The use of the data from the app mitigates the challenge of the spread of the virus and its impact on communities. It enables infections to be tracked and controlled, lessening the spread of infections.
- **Intercede:** This app intercedes in the processes to control the spread of the virus by adding an extra method for tracking and tracing infected people, which has positive and negative implications and impacts.
- **Enhance:** This app enhances the tracking of potentially infected people so they can be instructed to isolate and get tested. It makes tracking more efficient as it is fast, cheap and requires little effort by users and trackers. It makes tracking more effective as information about the movements of infected people is timely, specific to the task, detailed and accurate. However, these benefits also enhance some of the negative impacts, especially around privacy and the improper use of the data.
- **Resolve:** This app resolves the issue of tracking of people with the virus or who may potentially have it, which was very difficult due to the lack of data that was timely, specific to the task, detailed and accurate.

Evaluation criteria

The following criteria are used to evaluate the intervention (some will be more useful than others).

Equity

The app is not equitable:

- It can be seen as being an invasion of privacy, so there may be power and ethical issues.
- It requires the use of a smartphone, which some may not have or may have difficulty using.

The app is equitable:

- It is the same for everyone and is easy to use, which all contributes to the fight against the virus.



Acceptability

The app is not acceptable:

- The inconvenience of using the app at each location means that some people will not use it.
- It is not clear who is accountable for issues with the privacy of the data.
- It is not clear how the privacy issues are being handled.
- Fears over the use of the data mean that some people will not use it.
- The transparency of the use of the data is not clear.
- Some minority groups are sensitive to being monitored and will react against the app.
- There is some fear over the future use of the app, especially if it becomes spyware by being hacked or modified without people knowing.

The app is acceptable:

- It is a small inconvenience for people to use to help stop the spread of the virus.

Cost

The app is costly:

- It forces people to buy a smartphone if they do not have one.
- Learning how to use the app may be an issue for certain people.
- Some individuals will have less trust in the authorities due to privacy and cultural considerations.

The app is not costly:

- The financial cost is low for the individual as the app is free.
- It builds a sense of community responsibility and participation, which is valuable.
- The environmental costs are very small as it is a digital resource.

Feasibility

The app is feasible:

- It is technically easy to develop and distribute.
- It is generally socially acceptable, given the need to stop the virus.
- It is generally politically acceptable, as the small political cost is limited to minorities.
- The barriers to use are limited to minorities.

Innovation

The app is innovative:

- It is innovative as this amount of tracking has not been attempted before.
- It is innovative as it is asking people permission to be tracked, whereas systems such as CCTV and facial recognition software do not ask permission.
- The app has potential for incremental change: it can evolve for a different use, such as tracking people's activities.
- Adaptive change of the technology to new circumstances is also possible.
- The app has potential for radical change as it opens up the tracking of movement in a more extended and public way. It is potentially transformational as people become used to being tracked and having less privacy.
- The app also has potential for radical change if the use of tracking is extended to other crises and uses, for example tracking who leaves and enters apartment buildings (normally a private matter) could now be linked to public safety.

Ethics

Considerations about the use and implications of being right or wrong include:

- consequential ethical considerations
 - it is good for overall public health as it combats the impacts of the virus
 - it has potential negative impacts on our privacy
- rule-based ethical considerations
 - impacts on the right to privacy
 - impacts on the right to free decision-making
 - it is a rule from the health authorities and the app must be used
- virtue-based ethical considerations
 - being a good citizen to help society, which means it should be used
 - people who do not use the app might be labelled as not being 'good citizens' and could be reported to authorities.

■ Reflection on the overall success and effectiveness of the intervention

Overall, the app has been successful in helping to combat the spread and impact of COVID-19.

There are concerns and issues that need to be addressed, however, especially those held by various minority groups in society, about privacy and human rights. The long-term implications also need to be addressed, as the app opens up new ways of tracking people, and the accountability and responsibility for the app, especially for the future, is not clear. The practical success of the app and the future development and use of such apps needs to be considered.

Recommended step(s) for future action based on the evaluation criteria

Overall, most of the negative evaluations can be partially mitigated and the positives enhanced using the following steps. They will intercede in the current use of the app and hopefully resolve the main privacy issues.

- The first is to work with community leaders and other important and influential people, asking them to talk to people in the community with concerns and to attempt to mitigate or even resolve the issues. These leaders can also be used in advertising campaigns using news and social media.
- The second is the improvement of the rules and regulations concerning the storage and use of the data collected. These need to be reviewed by a government-appointed privacy commissioner, who will make recommendations. Ideally this would be an independent commissioner with the power to implement regulations and to hold people accountable if privacy issues are found.
- The third recommendation is to have other track and trace methods available, such as paper-and-pen registration at shops and venues, for those without smartphones.
- The long-term impacts of apps such as this one are connected to the larger issues around privacy in a digital society and need a high-level governmental and political response.

Top tips

The recommended steps for future action should be realistic and avoid being speculative. The needs of the specified stakeholders must be considered, and the recommended steps need to be connected to the operation and use of the app.

Activity: HL Extended Inquiry

Carry out a similar intervention inquiry for a vaccine passport app – the other intervention mentioned as a response to the challenge of COVID-19 – that is used in your community or elsewhere.

Reflection



Now that you have read this chapter, reflect on these questions:

- Each digital device you use, and the software it has installed, is an intervention to a challenge that someone encountered. Reflect on the reasons why and how you use your digital devices. What challenges do each device and app help you to meet?
- Reflect on the type of interventions associated with each digital device. To what extent do the devices and apps mitigate, intercede, enhance and/or resolve the challenges?
- To what extent are the devices and apps you use successful and effective in meeting your challenges?
- What are some recommendations for improving each device and app?
- Remember that policies, regulations and laws – even though they are not digital technologies – can also be considered to be interventions. Select an app: are there any policies, regulations or laws that should be implemented when using the app? Be inventive and creative! Einstein said: 'Imagination is more important than knowledge.'
- Can you use the six intervention criteria to evaluate your possible intervention(s) for the digital device and app selected?

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Section 7

How to approach external assessments

7.0

Overview of external assessments

Introduction

At the end of the course there are two examinations for SL students and three examinations for HL students.

The subsequent chapters in this section will visit each of these exam papers.

■ Overview of digital society examinations for SL students

	Weighting	Duration	Total marks
SL Paper 1	40%	1 hour 30 minutes	40
SL/HL Paper 2	30%	1 hour 15 minutes	24

■ Overview of digital society examinations for HL students

	Weighting	Duration	Total marks
HL Paper 1	35%	2 hours 15 minutes	52
SL/HL Paper 2	HL 20%	1 hour 15 minutes	24
HL Paper 3	25%	1 hour 15 minutes	30

The information below applies to all examinations.

Before the examinations you must have:

- **Discussed** appropriate scenarios relating to digital society in class on a regular basis.
- **Understood** the meaning of the command terms found at the end of the *Digital Society Guide* and what kind of response is expected for each of them.
- **Planned** answers in class for questions that require extended responses, especially those that use the following command terms: ‘discuss’, ‘evaluate’ and ‘to what extent’.
- **Practised** writing responses on SL/HL Paper 1 Section A for all parts (a, b and c) and the common SL/HL Paper 2 questions and received feedback from your teacher and other students. HL students should also practise answering HL Paper 1 Section B and HL Paper 3 questions.
- **Used** digital society terminology in responses (and avoided using words such as ‘something’, ‘thing’, ‘stuff’, and so on).

When reading a question in the examinations, it is important that you identify the

- **command term** used (and the kind of response and the depth required)
- **stakeholders** (and how they are involved in the scenario)
- **digital systems** and **digital society terminology** used in the specified scenario
- relevant **concepts** in the specified scenario.

ATL ACTIVITY

Thinking

A list of the command terms for this course is given below. You need to become familiar with these so that you can use them effectively in the examination.

Complete one of the following activities:

- Create a game to help you link these different terms to their definitions, for example a sorting and matching game.
- Create online flashcards for each of these terms.

Command terms for each assessment objective level

AO1	
Define	Give the precise meaning of a word, phrase, concept or physical quantity
Identify	Provide an answer from a number of possibilities
Describe	Give a detailed account
Outline	Give a brief account or summary
State	Give a specific name, value or other brief answer without explanation or calculation
AO2	
Analyse	Break down in order to bring out the essential elements or structure
Distinguish	Make clear the differences between two or more concepts or items
Explain	Give a detailed account including reasons or causes
Suggest	Propose a solution, hypothesis or other possible answer
AO3	
Compare	Give an account of the similarities between two (or more) items or situations, referring to both (all) of them throughout
Compare and contrast	Give an account of similarities and differences between two (or more) items or situations, referring to both (all) of them throughout
Contrast	Give an account of the differences between two (or more) items or situations, referring to both (all) of them throughout
Discuss	Offer a considered and balanced review that includes a range of arguments, factors or hypotheses; opinions or conclusions should be presented clearly and supported by appropriate evidence
Examine	Consider an argument or concept in a way that uncovers the assumptions and interrelationships of the issue
Evaluate	Make an appraisal by weighing up the strengths and limitations
Justify	Give valid reasons or evidence to support an answer or conclusion
Recommend	Present an advisable course of action with appropriate supporting evidence/reason in relation to a given situation, problem or issue
To what extent	Consider the merits or otherwise of an argument or concept; opinions and conclusions should be presented clearly and supported with appropriate evidence and sound argument

Applying command terms

ATL ACTIVITY

Thinking

In this activity, we will use the example of cookies to demonstrate the different ways to answer questions using a variety of command terms.

- On your own, try to complete the same activity but with a different topic of your choice, for example, computer games.
- Compare your answers with other students' and your teacher's answers.



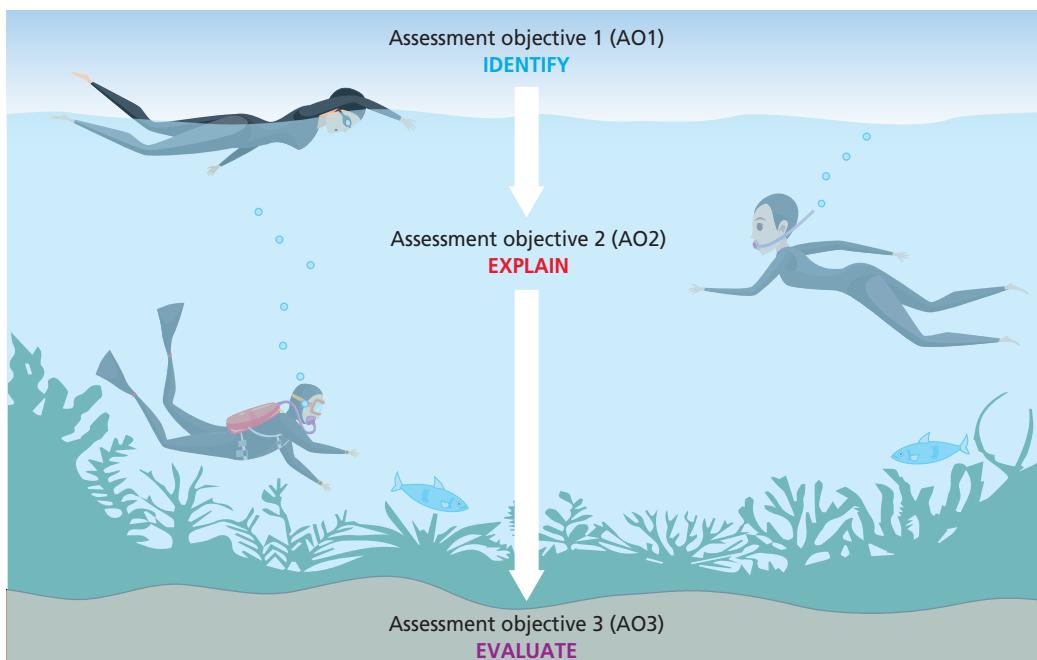
Command term	Sample question	Possible marks	Possible answers
Identify	Identify two types of cookies.	1–2 marks	Oatmeal, chocolate, chocolate chip, peanut butter, macadamia
Outline	Outline the reasons for baking cookies.	2 marks	Quick, therefore easy to bake. Small treat, therefore cheap to make.
Describe	Describe a chocolate chip cookie.	2–4 marks	A small cake, typically round and flat and with a crisp or chewy texture. Made from dough. Includes chocolate chips inside or on top of the cookie. Chocolate chips can range in size and amount of cocoa.
Explain	Explain one reason for eating cookies.	2–6 marks	Cookies have a sweet flavour and a texture that is soft but crunchy at the same time, making them a pleasure to eat.
Distinguish	Distinguish between chocolate chip cookies and oatmeal cookies.	2–4 marks	Chocolate chip cookies are sweeter than oatmeal cookies as they are made with chocolate chips instead of oats.
Analyse	Analyse the decision to bake chocolate chip cookies for a bake sale.	6 marks	Reasons for: <ul style="list-style-type: none">they are already in portion sizesthey keep fresh for longer compared to cakesthey are popular with students. Reasons against: <ul style="list-style-type: none">not everyone eats chocolatesome people have gluten allergiesindividual wrappers add to the cost.
Compare	Compare how cookies are made by the top brands to those that are home-baked.	6 marks	An extended response could be based on the following points: <ul style="list-style-type: none">They both use the same base ingredients.They both use machinery to make cookies, but on different scales.They will both be packaged in an airtight container.
Contrast	Contrast how cookies are made by the top brands to those that are home-baked.	6 marks	An extended response could be based on the following points: <ul style="list-style-type: none">Cookies made by top brands may include more preservatives and will last longer, whereas home-baked cookies will not.Home-baked cookies may be made by hand, whereas top-brand cookies will be mass produced.
Compare and contrast	Compare and contrast the role of cookies in Western and Asian diets.	6 marks	An extended response could be based on the following points: <ul style="list-style-type: none">Both could be considered part of a snack.Both could be consumed with a hot drink.The flour used may be different – Western brands tend to be wheat-based, whereas Asian brands may be rice or tapioca based.Snacking on cookies at any time is acceptable in Western diets, but it may not be in Asian cultures.

Command term	Sample question	Possible marks	Possible answers
Discuss	Discuss the nutritional value of cookies as a snack.	8–12 marks	Include an opening paragraph in this response (see the PEEL template later in this chapter), followed by a paragraph that talks about the ingredients and their nutritional value. A third paragraph would discuss the ingredients that are negative for good nutrition. End with a paragraph that concludes what the overall nutritional value of the cookie is with your opinion.
Evaluate	A student purchased cookies for their recess break. Evaluate this decision.	8 marks	In the response, include an introductory paragraph about the choices available to a student at break. Follow this with a paragraph on the benefits/pros of buying a cookie at recess break. The third paragraph would be the drawbacks/cons of buying the cookie. The final paragraph should weigh up the pros and cons of the decision.
To what extent	Peanut butter cookies are one of the most-liked cookies at the ABC school cafeteria; however, many students have peanut allergies. To what extent should the ABC school ban peanut butter cookies?	8 marks	In this response, include a short introductory scene-setting paragraph. It should be followed by a paragraph of reasons to ban peanut butter cookies, then a paragraph to support peanut butter cookies. The final closing paragraph should then weigh up the decision to ban the cookies, supported by the arguments made.
Recommend	Recommend a solution, based on student, parent and school impacts, to address the issue of peanut and other allergies.	12 marks	Banning of foods that contain nuts and other allergens is not effective – as so many foods contain them, it would severely restrict the foods that are still allowed at the school. So, instead students and teachers need to be trained about the dangers and how to treat allergies. In this response, the recommendation would follow the student response to the 'to what extent' command term in the box above. The 'recommend' question is 12 marks as it combines two responses.

Extended-response questions: Deep dive

Students often identify great ideas but then merely list them rather than providing the depth required in extended responses. It is important that you understand each of the command terms and the depth that is required for each response.

IB mark schemes provide examples of valid points or arguments, but each of these ideas require the answers to be developed fully, according to the command term specified.

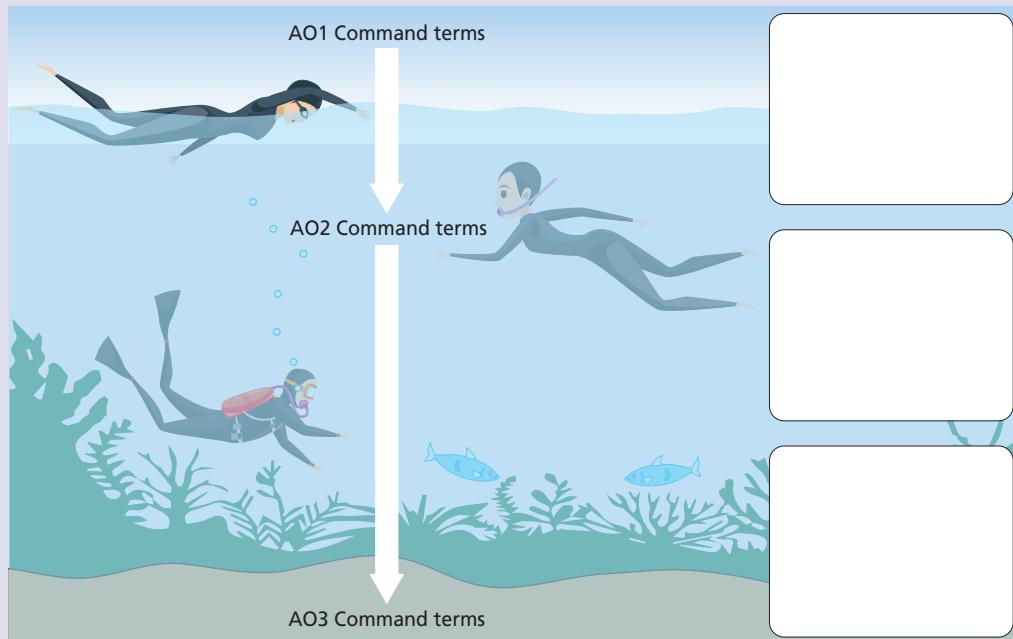


ATL ACTIVITY

Thinking

Look at the command terms given below and sort them into the different assessment objective levels on the diagram.

analyse compare compare and contrast contrast describe discuss distinguish
evaluate explain identify justify outline recommend to what extent



Now, look closely at the command terms for AO1, AO2, and AO3 to see how they build upon each other.

AO1

These terms focus on knowledge and understanding. For example, you may need to *describe* how the digital system functions, or *define* digital society terminology.

These questions use mark schemes with short answers that can be marked as correct or incorrect.

AO2

These questions require you to develop initial statements, either in the form of an analysis or an explanation. They either use mark schemes, with answers that can be marked as correct or incorrect, or markbands that describe the level of performance across the whole extended response answer. These are applied using a 'best-fit' approach, choosing the level that is most appropriate for the response even if it is not a perfect fit.

AO3

These questions require you to synthesise the comments made in the analysis so that conclusions can be drawn, opinions expressed and recommendations made. They use markbands only as they are extended-response questions.

Developing your response: Arguments and conclusions

Print and laminate this PEEL page and use it when practising examination-style questions as you work through the next chapters. The PEEL chart is very useful for constructing and developing paragraphs that include conclusions and your point of view.



P POINT	E EVIDENCE	E EXPLORATION	L LINK
Increasingly complex answer			
Start with a clear topic sentence. Your point should support your argument.	Add evidence or an example to reaffirm your initial point and develop the argument.	Explain <i>how</i> your evidence/example supports your point. Give further information to support relevance.	Link the point to your topic sentence or to the point in the next paragraph.
First of all ... We can argue that ... On one hand ... We can see that ... Furthermore/Moreover ...	For example ... This is demonstrated by ... Source A shows ... This is supported by ...	This means that ... It can be argued that ... This suggests that ... This shows that ...	Therefore, we can see ... It is clear that ... It is essential that ...
Example: Facial recognition use in high schools to check attendance <i>We can argue that facial recognition has improved its reliability over recent years, reducing the false identification of individuals.</i>	Example: Facial recognition use in high schools to check attendance <i>As of April 2020, one of the best facial-identification algorithms has an error rate of just 0.08%.</i>	Example: Facial recognition use in high schools to check attendance <i>This means that matching subjects to clear images, such as school ID photos, can achieve almost perfect accuracy.</i>	Example: Facial recognition use in high schools to check attendance <i>Therefore, because of the high accuracy rates, we can see that the use of facial-recognition algorithms can play a larger role in identifying students' daily attendance in schools.</i>

ATL ACTIVITY

Communication

Practice using PEEL in your responses

- Revisit the cookie command term exercise on page 374–375. Use the PEEL worksheet to modify your responses to questions that require complex answers.
- Restructure your answers so that they follow PEEL. Include each letter in your response to clearly identify the different elements, for example: '*One reason for eating a cookie is that it is convenient (P) because cookies are already pre-cooked and packaged (E). At home, the cookie jar is always full and within reach on the table (E), which is why a cookie will always be the snack I go to first when I come home from school (L).*'

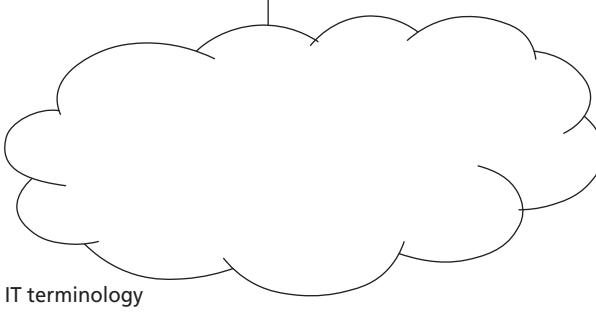
In the following chapters you will have further opportunities to use the command terms and develop your writing using PEEL as you practise the different types of examination papers.

Preparing for extended responses (AO3) in Papers 1, 2 and 3

Significant planning for an extended response is needed, so make use of additional paper provided to plan using a simple tool like this planning worksheet.

The 'cloud' question planning sheet

	+	-
Discuss	*	*
Examine		
Evaluate	*	*
Justify		
Recommend	*	*
To what extent		



IT terminology

Examples, Opinions/Conclusion:

Extended responses require you to consider multiple perspectives. You can use this planning worksheet to specify the following:

- the stakeholders
- the digital systems involved
- the advantages and disadvantages, associated costs and benefits or associated claims and counter-claims.

Remember:

- to increase the depth of your response, you need to provide reasons why each point is a positive or negative
- your analysis should be balanced
- your conclusion/recommendation must refer back to the comments in the analysis.

Digital society command terms – more information

Each exam paper uses command terms that indicate the kind of response and the depth required. It may be a short answer question (AO1) or an extended response question (AO3).

Digital society command terms (2024 onwards) Digital society terminology is the terminology associated with the development, use and impact of digital technologies on individuals and societies.	Answer question Use digital society terminology Description Detail for command term	
	Answer question Use digital society terminology Description Detail for command term	AO3 Compare: Give an account of the similarities between two (or more) items or situations, referring to both (all) of them throughout. Contrast: Give an account of the differences between two (or more) items or situations, referring to both (all) of them throughout. Evaluate: Make an appraisal by weighing up the strengths and limitations. Examine: Consider an argument or concept in a way that uncovers the assumptions and interrelationships of the issue. Justify: Give valid reasons or evidence to support an answer or conclusion. Recommend: Present an advisable course of action with appropriate supporting evidence/reason in relation to a given situation, problem or issue. To what extent: Consider the merits or otherwise of an argument or concept; opinions and conclusions should be presented clearly and supported with appropriate evidence and sound argument.
Answer question Use digital society terminology Description Detail for command term	Answer question Use digital society terminology Description Detail for command term	AO2 Distinguish: Make clear the differences between two or more concepts or items. Analyse: Break down in order to bring out the essential elements or structure. Compare and contrast: Give an account of similarities and differences between two (or more) items or situations, referring to both (all) of them throughout. Suggest: Propose a solution, hypothesis or other possible answer. Explain: Give a detailed account including reasons or causes.
Answer question Use digital society terminology Description Detail for command term	AO1 Identify: Provide an answer from a number of possibilities. State: Give a specific name, value or other brief answer without explanation or calculation. Define: Give the precise meaning of a word, phrase, concept or physical quantity.	Describe: Give a detailed account. Outline: Give a brief account or summary.
		1–2 marks
	2–6 marks	4–6 marks
	6–8 marks	8–12 marks

Reflection

Now that you have read this chapter, reflect on these questions:

- Do you know how to approach the different command terms in examination questions?
- Can you match the command terms with the different assessment objectives (AOs)?
- Do you know how to use PEEL in extended responses?



7.1

Approaches to Paper 1

UNDERSTANDINGS

By the end of the chapter, you will have:

- ▶ gained an understanding of how to prepare for Paper 1
- ▶ looked at sample Paper 1-style questions for both SL and HL, and how to approach them
- ▶ seen how the mark scheme is applied to a sample Paper 1-style question for both SL and HL.

Introduction

The main purpose of Paper 1 is to assess your ability to identify, analyse and discuss various scenarios using the concepts, content and contexts you have learned in the course.

- **SL Paper 1** questions will address common SL and HL syllabus and real-world examples.
- **HL Paper 1** questions will address common SL and HL syllabus and real-world examples, as well as the HL extension in Section B.
- Overview of SL and HL Paper 1

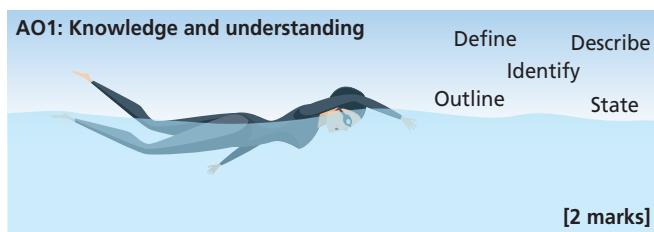
	SL Paper 1	HL Paper 1
Weighting	40%	35%
Duration	1 hour 30 minutes	2 hours 15 minutes
Total marks	40	52
Paper details	Answer two of four questions Each question has three parts: a 6 marks b 6 marks c 8 marks	Two sections on the paper: <ul style="list-style-type: none">● Section A: Answer two of four questions (these are the same questions as SL Paper 1), 40 marks● Section B: Answer one of two questions, 12 marks (not subdivided)

SL Paper 1 and HL Paper 1 Section A

You can practise Paper 1-style questions at any point in the course. When learning about the content of the course, you should explore new articles for possible scenarios. When you are studying a specific context, try more extended-response questions and make links to different concepts.

In both SL and HL, you will choose two of four questions. Each question has three parts: a, b and c. The style of these questions, sample responses and mark schemes are discussed here.

■ Part a: Knowledge and understanding questions (AO1)



These questions use command terms that require you to demonstrate knowledge and understanding.

Define

Identify

Describe

Outline

State

Top tips

Take a minute or two to brainstorm the keywords, then write two or three clear sentences, or one combined sentence.

EXAM PRACTICE QUESTIONS

Paper 1 (Section A)

- a **Identify** two characteristics of a key field in a database. [2 marks]

Sample student response

It is unique. It identifies one record in a database.

Mark scheme

- Unique identifier.
- Identifies a record in a database.
- A field that holds unique data.

The student has gained both marks, although a better answer might be: 'A key field is the unique identifier for each record in a database.' This response states the word being defined, then gives the correct definition.

Part b: Application and analysis questions (AO2)



These questions use command terms that require you to demonstrate application and analysis.

Analyse

Distinguish

Explain

Suggest

EXAM PRACTICE QUESTIONS

Paper 1 (Section A)

- b **Explain** the difference between data matching and data mining. [4 marks]

OR

- b **Distinguish** between data matching and data mining. [4 marks]

Top tips

- Take a few minutes to organize your ideas, then write a description with examples.
- Use the PEEL method to plan your paragraph responses.
- Be sure to address both data matching and data mining, highlighting the points of difference.



Sample student response

Data matching describes the effort to compare two sets of collected data. It compares records in different databases to find individuals who appear in more than one database. For example, a person in the genetic profile database may also appear in a database of diseases. Data matching may link databases on key fields, for example, to build up information about a person. The genetic database could be linked to other databases to identify the citizens.

Data mining is the process of analysing a large batch of information to discern trends and patterns. Data mining looks for hidden relationships and patterns in data. For example, data between genetic profiles and various diseases. It does not identify individuals rather it identifies patterns in the data, i.e. it uses a number instead of a citizen's name.

Mark scheme

Points that can be used in the response:

- Data matching
 - compares two sets of data
 - compares records (usually using key field matching) in different databases to find the data about the item that appears in more than one database, usually to combine the data into a more complete record
 - data in one database aligns with data in the other databases about the same item.
- Data mining
 - analysing hidden patterns of data
 - look for patterns to make better decisions.

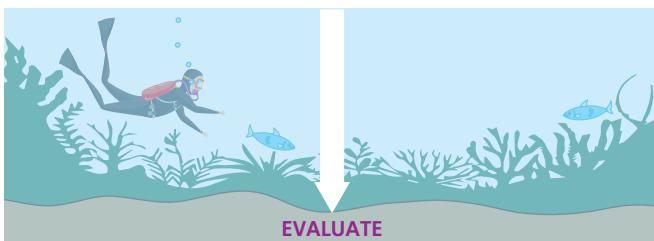
Markband

In addition to the paper-specific analytic mark scheme points listed here, marks for part b can be allocated using markbands. While level descriptors are written in the form of individual bullet points, markbands are applied holistically using a best-fit approach.

1 mark	Limited response about each item, shows little understanding of the topic.
2–3 marks	Reasonable description of each term, but the answer may be unbalanced and not clearly show the difference.
4 marks	Response is a clear, detailed and balanced explanation of the difference between data matching and data mining.

The sample student response above has the qualities of the top markband (4 marks).

Part c: Evaluation and synthesis questions (AO3)



These questions use command terms that require you to demonstrate evaluation and synthesis.

Discuss

Examine

Evaluate

Justify

Recommend

To what extent

Other AO3 command terms – compare, compare and contrast, and contrast – are primarily used in Paper 2.

EXAM PRACTICE QUESTIONS



Paper 1 (Section A)

- c **Discuss** reasons why students may be uncomfortable with the use of facial recognition in high schools to take attendance. [8 marks]

Sample student response

The student listed the following advantages and disadvantages in their planning notes and then explained them in the first part of their response.

Advantages of facial recognition:

- can decrease time – faster than manual attendance
- strengthens security measures – increases safety and security of students
- helps find missing students – can quickly scan and record who is present and scan for those missing
- makes attendance more efficient – eliminates human error.

Disadvantages of facial recognition:

- threatens privacy – personal data is stored in the school database
- imposes on personal freedom – violates personal rights
- technology is still new – may not be reliable
- errors can implicate innocent people – gender bias, racial bias, etc.
- technology can be manipulated – may not accurately record student attendance data.

Note that your response is expected to include terminology related to the social and ethical impacts, as well as references to the facial recognition scenario.

ATL ACTIVITY

Thinking

Rewrite the advantages and disadvantages given in the sample student response in an extended format, explaining how they are advantages and disadvantages.

Top tips

Remember to use the worksheets from Chapter 7.0 to organize your response in order to provide the depth and analysis required in extended-response questions. It is important that you address the specific command term for each response.

- Take 5 to 10 minutes to organize your ideas using the ‘cloud’ worksheet.
- Use the PEEL method to plan your paragraph responses.
- Write a balanced, descriptive response with depth and analysis, appropriate terminology, opinion and a conclusion.
- Take specific note of the command term used and what the question is asking. Make sure that you are answering the question asked, not the question that you wanted. Is it referring to one of the concepts?
- To show in-depth, accurate knowledge, you must use what you have learned during the course about the information in the sources and apply it to the question.
- Throughout your response, use information and examples from sources, so that there is explicit reference to support your narrative.



After explaining the advantages and disadvantages, the student writes an overall conclusion:

Students may be uncomfortable with the use of facial recognition to take attendance because it raises a variety of privacy issues. Facial-recognition software will rely on a database of student photos and indicators that could make them uncomfortable. If their photos are stored and not secure, this information could be leaked, and their photos could be reposted over the internet or used by bullies. However, these concerns can be addressed by using a local database that is secured and encrypted. This will prevent remote access to the information as well as limit the availability of stored content. Using a third-party platform or online software creates a risk that students' personal identification data could be shared/accessed publicly.

Additionally, automation of attendance may make students concerned about the accuracy and reliability of the program. The AI system may misidentify students, particularly if they make any significant changes to their physical appearance.

Mark scheme

The top markband for this question is 7–8 marks.

7–8 marks

- The response is focused and demonstrates an in-depth understanding of the demands of the question.
- Response demonstrates evaluation and synthesis that is effectively and consistently supported with relevant and accurate knowledge.
- The response is well-structured and effectively organized.

The sample student response above has all of the qualities given in the top markband, so it scores a perfect 8.



HL Paper 1 Section B

This section only appears in the HL Paper 1. HL students are expected to answer one of two 12-mark extended-response questions based on the HL extension. Your responses require evaluation and synthesis, as well as an analysis of claims and counter-claims related to the HL extension. Additional stimuli may be provided in the question.

EXAM PRACTICE QUESTIONS



Paper 1 (Section B)

HL topic: Global well-being

Area of inquiry: The changing population

Challenge: The use of digital technologies is increasing in the care of elderly people, either in care homes or their own homes, who have limited movement and other disabilities due to age and medical conditions.

Discuss the use of these digital technologies, as their overall impact has been questioned by some people. In your response, you need to refer to a real-world example.

1 Context-based response: In your response, refer to a real-world example within one of the following contexts: social, health or cultural. [12 marks]

OR

2 Concept-based response: In your response, refer to a real-world example and one of the following concepts: identity, values and ethics, or power. [12 marks]

Top tips

'Discuss' is a command term that requires a considered and balanced review that includes a range of arguments, factors or hypotheses. Opinions or conclusions should be presented clearly and supported by appropriate evidence. A balanced review usually includes recommendations for the future to resolve, mitigate and/or intercede in negative issues, and to enhance positive impacts.

Top tips

Consider the following tips when approaching this HL Paper 1 Section B question:

- Only one example is needed to support your arguments.
- Only one concept or context needs to be addressed, depending on which is referenced.
- Select a real-world example that you have studied within the prescribed area of inquiry.
 - If **contexts** are specified in the question, ensure that the context of the use of the digital technology is one of those specified – in your planning notes describe how the example has impacts and implications in that context.
 - If **concepts** are specified in the question, ensure that the example is connected to one of the concepts – in your planning notes include a range of points to show how it is connected.
- Use the ‘cloud’ planning worksheet to analyse and list a range of positive and negative impacts and implications, organized to support the claims and counterclaims relevant to the question. Counter-claims *must* be provided for Section B responses.
- Prepare a balanced overall conclusion to the question, including links to the impacts and implications to support your conclusion.
- Include recommendations in your conclusion as well.
- Use the PEEL method to plan your conclusion and recommendations.

■ Writing your response

- Write your response ensuring that all your points are explained with supporting evidence from the real-world example.
- The first part of your response needs to be a justification of your choice of real-world example referring to the context or concept you have chosen. Provide a specific real-world context by describing who, where, when, what, why and how.
- The second part of your response should be an analysis and explanation of the positive and negative impacts and implications in the context of the real-world example. Ensure that you have linked and evaluated them where possible, for example, some uses of the digital technology are both negative and positive at the same time in different ways and for different reasons, and some are better or worse than others for a variety of reasons that need to be specified and justified.
- The last part of your response needs to state your conclusion clearly, with references back to the positive and negative impacts and implications to justify it. This will involve evaluating the impacts and implications, and synthesizing them into an overall answer to the question.

Step 1: Choose a response starting focus – introduction

This is a list of possible starting points you could use to construct a response based on the contexts and concepts the question asks you to refer to. Some suggestions about the digital technologies you could include, and a brief scenario, are also provided.

Context-based question:

- **Social:** Keeping in touch with family and friends, and having companionship.
Scenario and digital technologies: Easy to use a tablet-style computer with teleconferencing, email and messaging software OR use of robots and robotic creatures they can communicate with.
- **Health:** Monitoring the activities of the elderly person living by themselves in case of accidents and medical events.
Scenario and digital technologies: Using cameras, motion detectors and voice-detection devices to passively and actively monitor the activities of the elderly person.

- Cultural: Being part of groups and having access to other activities.

Scenario and digital technologies: Easy to use a tablet-style computer so the elderly person can join groups of people with similar interests, and have access to entertainment and streaming services.

Concept-based question:

- Identity: To have an identity is closely connected to having relationships with others, singularly or in groups, with some common characteristics such as ethnicity, nationality, culture.

Example and digital technologies: Elderly people often find keeping in contact with others difficult as movement and abilities are impacted by age and health issues.

Access to an easy-to-use tablet-style computer will enable them to keep in contact with others and groups that they identify with.

- Values and ethics: Elderly people with limited movement and other disabilities may not be treated well by their families as they may be seen as a burden.

Scenario and digital technologies: Using digital communication devices instead of visiting elderly people in person may be ethically questionable.

- Power: Power imbalances usually arise when there is a difference in circumstances, in this case due to limited movement and health issues, which gives the carers power over elderly people.

Scenario and digital technologies: Some members of families, and also friends, may use their power to move elderly people into care homes, or to make them stay in their own homes for financial and other reasons. In this situation, the digital technologies listed in other focus suggestions above can be used to lessen the impacts and implications of the power imbalance.

Step 2: Explaining your starting point

The first part of your response needs to be a justification of your choice of real-world example, explaining the connection to the context or concept you have chosen in detail. Provide details of the specific real-world context by describing who, where, when, what, why and how.

The response requires accurate and relevant knowledge that the starting points above do not include. Personal examples of situations and people you know about are very useful.

ATL ACTIVITY

Thinking

For each of the starting points suggested above, write an introductory justification of the approach to the question.

Step 3: Analysis of relevant and accurate knowledge

Relevant and accurate knowledge is required, so the next step is to make a list of a range of impacts of the digital technology, as the question states that ‘the overall impact has been questioned by some people.’

You need to show an analysis by structuring your list and making connection points between them wherever possible. You need to show that the points are relevant and accurate by explaining how and why the impacts and implications come about from the use of digital technologies.

The following sample student analysis focuses on the social context: keeping in touch with family and friends, and having companionship.

Positive impacts (claims/advantages/benefits):

- Voice calls are easier than with normal phones because mobile phones are not locked in one location, and the use of a speakerphone feature means the device does not need to be held, which helps people with disabilities.