

YES – NO – NOT GIVEN

Do the following statements agree with the claims of the writer in Reading Passage 3?

In boxes 27–30 on your answer sheet, write

YES if the statement agrees with the claims of the writer
NO if the statement contradicts the claims of the writer
NOT GIVEN if it is impossible to say what the writer thinks about this

27 Wegener's ideas about continental drift were widely disputed while he was alive. True

28 The idea that the continents remained fixed in place was defended in a number of respected scientific publications. Not Given

29 Wegener relied on a limited range of scientific fields to support his theory of continental drift. False

30 The similarities between Wegener's theory of continental drift and modern-day plate tectonics are enormous. False

Alfred Wegener: science exploration and the theory of continental drift
by Matt T Greene

P1 Introduction

This is a book about the life and scientific work of Alfred Wegener, whose reputation today rests with his theory of continental displacements, better known as 'continental drift'. Wegener proposed this theory in 1912 and developed it extensively for nearly 20 years. His book on the subject, *The Origin of Continents and Oceans*, went through four editions and was the focus of an international controversy in his lifetime and for some years after his death.

P2 Wegener's basic idea was that many mysteries about the Earth's history could be solved if one supposed that the continents moved laterally, rather than supposing that they remained fixed in place. Wegener showed in great detail how such continental movements were plausible and how they worked, using evidence from a larger number of sciences including geology, geophysics, paleontology, and climatology. Wegener's idea – that the continents move – is at the heart of the theory that guides Earth sciences today: namely plate tectonics. Plate tectonics is in many respects quite different from Wegener's. However, in the same way that modern evolutionary theory is very different from the ideas Charles Darwin proposed in the 1850s about biological evolution, yet plate tectonics is a descendant of Alfred Wegener's theory of continental drift, in quite the same way that modern evolutionary theory is a descendant of Darwin's theory of natural selection.

Test 2

Questions 20–23

Do the following statements agree with the claims of the writer in Reading Passage 2?

In boxes 20–23 on your answer sheet, write

YES if the statement agrees with the claims of the writer
NO if the statement contradicts the claims of the writer
NOT GIVEN if it is impossible to say what the writer thinks about this

- 20 Machines with the ability to make moral decisions may prevent us from promoting the interests of our communities. True
- 21 Silicon police would need to exist in large numbers in order to be effective. Not Given
- 22 Many people are comfortable with the prospect of their independence being restricted by machines. False
- 23 If we want to ensure that machines act in our best interests, we all need to work together. True

You should spend about 20 minutes on Questions 14–26, which are based on Reading Passage 2 below.

Living with artificial intelligence

Powerful artificial intelligence (AI) needs to be reliably aligned with human values, but does this mean AI will eventually have to police those values?

This has been the decade of AI, with one astonishing feat after another. A chess-playing AI that can defeat not only all human chess players, but also all previous human-programmed chess machines, after learning the game in just four hours? That's yesterday's news, what's next? True, these prodigious accomplishments are all in so-called narrow AI, where machines perform highly specialised tasks. But many experts believe this restriction is very temporary. By mid-century, we may have artificial general intelligence (AGI) – machines that can achieve human-level performance on the full range of tasks that we ourselves can tackle.

If so, there's little reason to think it will stop there. Machines will be free of many of the physical constraints on human intelligence. Our brains run at slow biochemical processing speeds on the power of a light bulb, and their size is restricted by the dimensions of the human birth canal. It is remarkable what they accomplish, given these handicaps. But they may be as far from the physical limits of thought as our eyes are from the incredibly powerful Webb Space Telescope.

Once machines are better than us at designing even smarter machines, progress towards these limits could accelerate. What would this mean for us? Could we ensure a safe and worthwhile coexistence with such machines? On the plus side, AI is already useful and profitable for many things, and super AI might be expected to be super useful, and super profitable. But the more powerful AI becomes, the more important it will be to specify its goals with great care. Folklore is full of tales of people who ask for the wrong thing, with disastrous consequences – King Midas, for example, might have wished that everything he touched turned to gold, but didn't really intend this to apply to his breakfast.

So we need to create powerful AI machines that are 'human-friendly' – that have goals reliably aligned with our own values. One thing that makes this task difficult is that we are far from reliably human-friendly ourselves. We do many terrible things to each other and to many other creatures with whom we share the planet. If superintelligent machines don't do a lot better than us, we'll be in deep trouble. We'll have powerful new intelligence amplifying the dark sides of our own fallible natures.

Test 2

For safety's sake, then, we want the machines to be ethically as well as cognitively superhuman. We want them to aim for the moral high ground, not for the troughs in which many of us spend some of our time. Inevitably, as we become more powerful, if there are routes to the moral high ground, they'll be better than us at finding them, and steering us in the right direction.

However, there are two big problems with this utopian vision. One is how we get the machines started on the journey, the other is what it would mean to reach this destination. The 'getting started' problem is that we need to tell the machines what they're looking for with sufficient clarity that we can be confident they will find it – however it actually turns out to be. This won't be easy, given that we are miscreatures and conflicted about the ideals ourselves. We often ignore the suffering of strangers, and even contribute to it, at least indirectly. How then, do we point machines in the direction of something better?

As for the 'destination' problem, we might, by putting ourselves in the hands of these moral guides and gatekeepers, be sacrificing our own autonomy – an important part of what makes us human. Machines who are better than us at sticking to the moral high ground may be expected to discourage people who believe in free will, self-determination. We might lose our freedom to discriminate in favour of our own communities, for example.

Loss of freedom to behave badly isn't always a bad thing, of course: giving ourselves the freedom to put children to work in factories, or to smoke in restaurants are signs of progress. But are we ready for ethical silicon police limiting our options? They might be so good at doing it that we won't notice them; but few of us are likely to welcome such a future.

These issues might seem far-fetched, but they are to some extent already here. AI already has some input into how resources are used in our National Health Service (NHS); here in the UK, for example. If it was given a greater role, it might do so much more efficiently than humans can manage, and act in the interests of taxpayers and those who use the health system. However, we'd be depriving some humans (e.g. senior doctors) of the control they presently enjoy. Since we'd want to ensure that people are treated equally and that policies are fair, the goals of AI would need to be specified carefully.

We have a new powerful technology to deal with – itself, literally, a new way of thinking. For our own safety, we need to point these new thinkers in the right direction, and get them to act well for us. It is not yet clear whether this is possible, but if it is, it will require a cooperative spirit, and a willingness to set aside self-interest.

Both general intelligence and moral reasoning are often thought to be uniquely human capacities. But safety seems to require that we think of them as a package: if we are to give general intelligence to machines, we'll need to give them moral authority, too. And where exactly would that leave human beings? All the more reason to think about the destination now, and to be careful about what we wish for.

Test 3

Questions 36–40

Do the following statements agree with the views of the writer in Reading Passage 3?

In boxes 36–40 on your answer sheet, write

YES if the statement agrees with the views of the writer
NO if the statement contradicts the views of the writer
NOT GIVEN if it is impossible to say what the writer thinks about this

- 36 The Vygotsky model of education supports the concept of a mixed-ability class. True
- 37 Some teachers are uncertain about allowing students to take on MKO roles in the classroom. Not Given
- 38 It can be rewarding to teach knowledge which you have only recently acquired. Yes
- 39 The priority should be to ensure that the highest-achieving students attain their goals. Not Given
- 40 Taking part in collaborative outdoor activities with teachers and classmates can improve student outcomes in the classroom. Yes

The case for mixed-ability classes

Picture this scene. It's an English literature lesson in a UK school, and the teacher has just read an extract from Shakespeare's *Romeo and Juliet* with a class of 15-year-olds. He's given some of the students copies of *No Fear Shakespeare*, a kid-friendly translation of the original. For three students, even these literacy demands are beyond them. Another girl simply can't focus and he gives her pens and paper to draw with. The teacher can ask the *No Fear* group to identify the key characters and maybe provide a tentative plot summary. He can ask most of the class about character development, and five of them might be able to support their statements with textual evidence. Now two curious students are wondering whether Shakespeare advocates living a life of moderation or one of passionate engagement.

As a teacher myself, I'd think my lesson would be going rather well if the discussion went as described above. But wouldn't this kind of class work better if there weren't such a huge gap between the top and the bottom? If we put all the kids who needed literacy support into one class, and all the students who want to discuss the virtue of moderation into another?

The practice of 'streaming', or 'tracking', involves separating students into classes depending on their diagnosed levels of attainment. At a macro level, it requires the establishment of academically selective schools for the brightest students, and comprehensive schools for the rest. Within schools, it means selecting students into a 'stream' of general ability, or 'sets' of subject-specific ability. The practice is intuitively appealing to almost every stakeholder.

I have heard the mixed-ability model attacked by way of analogy: a group hike. The fittest in the group take the lead and set a brisk pace, only to have to stop and wait every 20 minutes. This is frustrating, and their enthusiasm wanes. Meanwhile, the slowest ones are not only embarrassed but physically struggling to keep up. What's worse, they never get a long enough break. They honestly just want to quit. Hiking, they feel, is not for them.

Mixed-ability classes bore students, frustrate parents and burn out teachers. The brightest ones will never summit Mount Qomolangma, and the stragglers won't enjoy the lovely stroll in the park they are perhaps more suited to. Individuals suffer at the demands of the collective, mediocrity prevails. So: is learning like hiking?

The current pedagogical paradigm is arguably that of constructivism, which emerged out of the work of psychologist Lev Vygotsky. In the 1930s, Vygotsky emphasised the importance of targeting a student's specific 'zone of proximal development' (ZPD). This is the gap between what they can achieve only with support – teachers, textbooks, worked examples, parents and so on – and what they can achieve independently. The purpose of teaching is to provide and then gradually remove this 'scaffolding' until they are autonomous. If we accept this model, it follows that streaming students with similar ZPDs would be an efficient and effective solution. And that forcing everyone on the same hike – regardless of aptitude – would be madness.

Despite all this, there is limited empirical evidence to suggest that streaming results in

better outcomes for students. Professor John Hattie, director of the Melbourne Education Research Institute, notes that 'tracking has minimal effects on learning outcomes'. What is more, streaming appears to significantly – and negatively – affect those students assigned to the lowest sets. These students tend to have much higher representation of low socioeconomic class. Less significant is the small benefit for those lucky clever students in the higher sets. The overall result is that the smart stay smart and the dumb get dumber, further entrenching the social divide.

In the latest update of Hattie's influential meta-analysis of factors influencing student achievement, one of the most significant factors is the teachers' estimate of achievement. Streaming students by diagnosed achievement automatically limits what the teacher feels the student is capable of. Meanwhile, in a mixed environment, teachers' estimates need to be more diverse and flexible.

While streaming might seem to help teachers effectively target a student's ZPD, it can underestimate the importance of peer-to-peer learning. A crucial aspect of constructivist theory is the role of the MKO – 'more-knowledgeable other' – in knowledge construction. While teachers are traditionally

the MKOs in classrooms, the value of knowledgeable student peers must not go unrecognised either.

I find it amazing to watch students get over an idea to their peers in ways that I would never think of. They operate with different language tools and different social tools from teachers and, having just learnt it themselves, they possess similar cognitive structures to their struggling classmates. There is also something exciting about passing on skills and knowledge that you yourself have just mastered – a certain pride and zeal, a certain freshness to the interaction between 'teacher' and 'learner' that is often lost by the expert for whom the steps are obvious and the joy of discovery forgotten.

Having a variety of different abilities in a collaborative learning environment provides valuable resources for helping students meet their learning needs, not to mention improving their communication and social skills. And today, more than ever, we need the many to flourish – not suffer at the expense of a few bright stars. Once a year, I go on a hike with my class, a mixed bunch of students. It is challenging. The fittest students realise they need to encourage the reluctant. There are lookouts who report back, and extra items to carry for others. We make it – together.