**DOES TECHNOLOGY HELP OR HINDER LEARNING?**

**A TEACHER & STUDENT EXPERIENCE OF TECHNOLOGY**

**Part 1: The Teacher Part 2: The Students**

**Rosemary Sage**

**Overview**

This two-part article discusses both teacher & student experiences of using technology in education at all levels. The modern, global world depends on advanced technology for communication & progress, so it is important that students are adept at using tools for acquiring and applying knowledge in life and work. The information discussed shows the different reactions people have to technology & learning styles. A mix of face-to-face & online experiences, called *blended learning,* appears acceptable for both students & teachers.

**Part 1: Teacher Experience**

As a speech therapist, psychologist & teacher (*English & Maths*), I have often been called into school to observe struggling students. Once, I visited a class of 7 year-olds, using iPads in a Maths lesson. I bent over a lad screwing up his face as if in pain. The iPad asked him to ‘*Combine 6 & 4’.* He eventually pressed ‘*Listen*’, but remained puzzled and drew randomly on the screen instead. I asked if I could help, receiving a nod: ‘*Do you know what ‘****combine****’ means’*, I queried. He answered ‘*No*’, so I explained it meant ‘***add*’**. His problem was solved and the answer provided. Another time, a girl stared at a screen question: ‘*What number comes* ***after*** *35?’* She tried 34, then 33 & 32, with repeated error messages. The word ‘***after*’** was confused with *‘****before****’*. I have often muddled ***left*** & ***right*** as a cross-lateral processor. In my driving test I turned *left* when told to go *right,* so failed of course! Opposite words are often a problem for people, like me, having brain sides that are not differentiated for processing.

Thisimpelled me to look at other students, with screens displaying: *‘Find the* ***odd*** *numbers in the series’, ‘What is this* ***times*** *table?’, ‘How many* ***digits*** *are there before 20?’, ‘What* ***operations*** *are there in this multiplication?’*  ‘***Round*** *79 to the nearest ten*’. *‘Write a series with each number the sum of the two* ***preceding*** *ones, starting from 0 and 1’.* In maths, these are called ***Fibonacci*** numbers (eg.0 1 2 3 5 8 13 21), named after an Italian mathematician. His book, *Liber Abaci*, introduced the sequence to Europe although it was discussed in 200 BC by Pingala, in India, regarding patterns of Sanskrit poetry formed from syllables of 2 lengths. The journal, *Fibonacci Quarterly,* provides studies of these numbers, as seen in biology and building construction. In the question above, the word ***‘preceding’*** was unknown.

The point is that mathematical terms, learnt in other contexts, like *odd, after, times, digits, operations*, *round* & *preceding,* are often difficult for students with undeveloped English language (Sage, 2020). After all, the 500 common words have over 15,000 different meanings. This needs discussing with students. When considering Fibonacci sequences, we collected examples, like a pineapple fruit, fern plant and pine cone to provide relevance and purpose for studying them. Medical Research Council Studies on children testing as normal on psychological tests, but failing at school, showed higher level language problems not identified in commonly used assessments. Many subjects showed word confusions (Sage, 2000).

The UK has the most *Microsoft Showcase Schools* in Europe, announced this software firm in 2021. Head teachers drive schools through digital transformation, with Microsoft experts supporting them. Classes often use the *Teams* platform, with teachers sharing learning materials and homework. Use of digital technology is high-lighted in class with a ‘*bring your own device’* policy. Schools are encouraged by hard & software companies to introduce technology into daily teaching. However, reform strategies, like school choice and efforts to improve teacher quality, have not resulted in increased student performance across all development. The UK has climbed up the tables of the *2018 Programme for International Student Assessment* (PISA) for 15-year-olds, but at the expense of other progress.

* **Reading** - 14th, up from 22nd from tests three years ago
* **Science** -14th, up from 15th
* **Maths** -18th up from 27th

However, the Organisation for Economic Cooperation and Development (OECD) study found just 53% of UK students are satisfied with life, compared to 67% in member countries\*. They attribute this to the narrow academic Education approach, dominated by tests (Schleicher, 2020). This marginalises *personal* & *practical* development, which builds communication, resilience & adaptability. The Teaching unions say tests are tarnished by this wellbeing data.

Educators place confidence in instructional software to narrow the large test-score gap between students at the top & bottom of the socioeconomic scale. The OECD found that technology is limited in bridging the performance divide between these students, with a similar effect for ‘*flipped*’ classes (OECD.org: Science, Technology & Innovation, 2016 Report). Students watch lectures at home via technology and use class-time for discussion and problem-solving, but see Matteucci, (2019) for the effective use of this method, demonstrating that both teacher and student expertise is needed, such as effective communication abilities.

A 2019 report from the National Education Policy Center, University of Colorado, on *personalized learning*, a term corresponding with *education technology*, made robust comments. It found ‘*questionable educational assumptions embedded in influential programs, self-interested advocacy by the technology industry, serious threats to student privacy, and a lack of research support*.’ (p.24). Vulnerable students spend *more* time on digital devices than advantaged ones, with dangers of relying on technology in early literacy education. Much of the primary school day is spent on reading & maths if there are low test scores for these subjects, so other areas tend to be side-lined. Students tend to work alone on reading & maths with digital devices, while the teacher assists a small group.

**Why do devices hinder learning?**

When students read from screens, they absorb less information than from paper, because of a more restricted viewing angle & less haptic, three-dimensional, feeling experience (Sage, 2020). Another issue is the distraction that devices bring - the primary student doodling on the screen instead of doing maths or a senior one checking Instagram. However, there are serious reasons regarding learning progress (Nuffield Project, Sage, 2015)

1. **Motivation –** when intervening with the maths student, the language problem was spotted and a relationship formed to boost a correct response. Technology conveys information but cannot show social use. Teachers & class-mates help make knowledge meaningful, so technology may lessen motivation & depress group learning. Experts support students at screens that deliver lessons for ability, interests & choice. Learners must swap ideas to extend understanding. Allowing topic choice may lead to knowledge gaps (Nuffield lesson plans, Sage, 2015).
2. **Understanding** - as in student problems with maths instructions. Learners should take *pre-tests* to select software at appropriate cognitive-linguistic levels, but may find this makes false assumptions about understanding. It can supply instruction better than a human in some ways, but if content is faulty, inadequate or not presented to suit students, learning is ineffective.

In only a few cases are there defined concepts or standard learning sequences to chart progress. Secondary language literacy & numeracy have developmental stages, when brains are ready to think about *whole* (4-7 yr.) & *part*s (7-9 yr.) If teaching tables in maths or sound analysis for reading, learning will be difficult before maturation (Sage, 2020). Progress cannot happen unless students have acquired spoken *language narratives levels to* assemble sequences. Otherwise, we do not know *what* must be taught or the order for this.

Technology is often used for *reading comprehension*. Even in classes with no technology, learners are asked to find the main idea & make inferences before having acquired narrative thinking & language. Thus, content may lack meaning for them. Teachers choose texts to illuminate topics and students read them for reinforcement. When computers/tablets are used, the material takes the same approach, but subject background knowledge and vocabulary are more important than components. For reading comprehension, learners must examine the topic carefully and talk about it together in order to construct knowledge and vocabulary. This is crucial for those from less educated backgrounds, who are unlikely to pick this up at home—and may lack knowledge of basic terms, as in the student examples above.

Studies on the use of e-readers for students produces mixed messages, with researchers acknowledging their motivational aspects and the fact that people of all ages read continually from various screen devices today. However, the importance of teachers and others in interpreting and comprehending text is widely acknowledged. Also, the lack of haptic experience is crucial for some readers in making meaning (see Picton, 2014: Reid, 2016; Long & Szabo, 2016; Kaynar, Sadik & Boichuk, 2020; Sage, 2020).

Top of Form

**Bottom of FormCan technology help build knowledge?**

Software based on brain science can assist creative & critical thinking, retention & recall. If used for just support it may not work. ‘*What are the education aspects that a computer can do instead of a human*? ‘*How can technology assist learning aims?’* To answer questions teachers need understanding of learning that enables them to deal with problems effectively.

Classes have an ability range but instead of providing students with different content, it works to give them the same information. However, they must have different tasks that take account of narrative development (see Sage, 2020, for examples). Students might study the *History of Language*, but the more advanced compose a discursive essay, while others produce a poster, a set of comparisons/instructions/report on a key aspect, or other tasks at their narrative level. For teachers, this differentiation is challenging without psycho-linguistic understanding. Technology assists grouping students by ability, with appropriate tasks and means to assess performance. Video and audio recordings bring topics to life and give access to texts. Digitalised books are easily updated for those who struggle to read them, as the TOP HAT Company does well. Maths software facilitates student debates, when they give different answers to the same problem. Also, technology enables gifted students to study content not taught in their context & caters for learning problems with programmes designed by experts.

**Review**

Educators wanting educational equity must consider technology hindrances. Research highlights a *digital divide* - the lack of access that low-income citizens have to technology and the internet. Students, in the examples, must learn computer use to benefit from online information, but content language issues must be considered. Software developed in other cultures, may use different language expressions & vocabulary for instructions & information that users find unfamiliar. This possibility must be checked by teachers. There is a danger of creating a digital divide of the opposite kind by outsourcing learning to devices for building competencies, while advantaged students have the benefits of being taught by expert teachers, who can adjust learning to suit their individual needs.

\*The OECD’s 37 members are: Austria, Australia, Belgium, Canada, Chile, Colombia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States.

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**Part 1: The Teacher Part 2: The Students**

 **Rosemary Sage**

**Part 2: Student Experience**

We may think that all students are happy having technology as their learning companion. Britain, together with Chile, spends more time on screens compared to other nations (Sage & Matteucci, 2019). In a study of 100 students, at the University of Leicester, 3 spent 14 hours daily on their devices – watching sport in bed for half the night! (Sage, 2000). No wonder teachers complain about class yawners! However, parents are now more aware of negative issues and some provide rules about technology use, so students can learn the downsides of devices. This is necessary to regularly reinforce, as schools report that even primary students are on social media accessing questionable content (Sage & Matteucci, 2019).

An American study (Lepp et al, 2015) looked at mobile phone use for learning. Participating anonymously, students identified drawbacks:

|  |
| --- |
| ***Disruption, cheating, ringtone distractions, cyberbullying, inappropriate content, sexting and decline in writing competencies*** |

However, they recognised benefits that included:

|  |
| --- |
| ***Creativity, motivation, productivity, improved attendance, increased engagement*** |

Although there was a high level of support for phone use in classes/lectures, around 1/3 of students felt phones should be banned, but 90% said that they used them for course work.

A Swedish study (Olofsson et al, 2020) reported that cell phones were both useful tools but also annoying distractions. Therefore, the aim is to maximise benefits of classroom technology and minimise barriers to learning. Studies are useful for becoming aware of technology use for learning, as well as to reflect on and refine class experiences to improve performance.

Students from primary, secondary & tertiary education were asked how they best learnt & how technology helps studies. Answers are reported with names & some details changed.

**Ellie: age 9 years, at a village primary school in Middle England**

I learn best with mum and dad at home. At school I have to do things that are difficult for me. The teachers do not know my problems. I do badly and my friends do better than me. This makes me feel stupid! I do good things when they mean something and I understand the reason for knowing about them. Mum had me tested by a lady and my ability to work out things that I could see was really, really good. My problem is putting words together. I get in a muddle listening to teachers talking non-stop. My dad told me that brains grow at different rates and mine is slow like his at my age. He said that he had troubles at school but his mum fought to get help. He told me we have a *seeing brain* on the *right side* and a *hearing brain* on the *left side* and sometimes they don’t like talking with each other or take time to learn how to do so. He is a doctor, so there’s hope for me yet. My family always support and keep me going.

My worst things at school are spelling and maths. If we have to do exercises on the iPad I sometimes ask what the instructions mean. Others in the class are afraid to do this and muck about to avoid doing the work! I find videos good as they are moving and tell a story that I can see and then follow. I do not like screen tasks that are mostly words. I am not on *WhatsApp* yet, as my parents think it is not good for me. My brother, who is 13, uses a WhatsApp group to discuss homework and says it is a good way to swap ideas with friends. He is always texting his friends and my parents check this! They do not like us spending all our time on screens and make sure we do sport and other things. I play the violin and go to Beavers, so I can do real things, like cooking & forest tracking. I am a good dancer and often perform at concerts in our community.

**Comment:** Ellie is aware she has learning issues but seems adjusted to these and has home support. As 85% of what we learn is outside formal classrooms this is crucial for progress. As Ellie knows about her problem areas she is in a position to manage learning that works.

**Manish: age 15 years at a London secondary school**

I am afraid of new things, so was worried about using technology in lessons, when moving to secondary school. My parents are not tech savvy, but the school was good and provided iPads for those of us who did not own them. School has had a big technology drive, so I have learnt about apps that keep me interested. These make the lessons more fun. A favourite one of mine is Nearpod. This is a shared presentation and assessment tool and quite easy to use. You can create presentations like Power Point and include quizzes, polls, videos, images, drawing boards and web content. The presentation is interactive and shared with others in the class on their devices. The teachers like it because they can import material they already have or use one of the many lessons available on the website for a change. Slideshows are more fun with polls, quizzes, virtual reality trips (*such as to the Egyptian pyramids!*), drawing boards, fill-in the-blank-questions, web content and 3D objects - good for biology lessons.

We follow lessons on screens and answer questions, so take an active part. When we answer questions, the teachers can see them and help with things not understood. They sometimes share model answers on our devices, which help us with what to aim for.

My preferred learning is from seeing things and my friends are similar. One problem about lectures is that teachers talk for a long time, often too fast for some of us who do not speak English as a first language. Some teachers have strong accents, which make it a problem to understand and they use unfamiliar words. Technology improves visual presentations and gives me a clue on how to take notes or arrange information. Things like pictures, diagrams, and film are slotted into lesson text. This makes impact with visual examples of the topic. An advantage of things like Power Point is that drawings and diagrams, which are a big part of my science course, are better in colour & clearer than board sketches.

One big problem is that teachers go through things like PowerPoint presentations quickly, as they have to get through a lot in lessons, so slides vanish before points get noted. When recordings are available online, we can refer to them again in our own time. This takes off pressure, so I can concentrate on looking at slides and listening to the teacher and not bother about taking notes, which can be done later. We have a quiz after each lesson, which makes us think about what has been understood.

Problems do arise from using technology, as bugs are frequent. Sometimes, the pictures wobble or do not show up and the screen freezes. The picture and sound may not match. On the whole, the teachers are good at sorting out problems, so they do not hold up lessons.

I don’t think that *all* teachers should use technology in lessons, as we learn when information is clear and easily understood. It helps to repeat content differently, which teachers are good at doing. As we do not learn in the same way, new technologies have tools to help us all. Technology connects the teacher, lesson and students in ways that can suit everyone. Most of us do not cope well when having to listen to a teacher just talking for all of the lesson. Technology can motivate us, if we are aware of how best to use it and take the trouble to learn.

**Comment:** Manish has a good grasp of his learning preferences and takes his lessons seriously. He makes a strong point about repetition of material in different ways and the importance of interaction between teachers and learners.

**Luca: age 18 years and in the last year of a secondary school in a Northern English city**

I learn best by seeing things presented in different ways and then going over them again in my own time, as well as discussing issues with friends. I don’t think I would learn well if I had to listen to an audio of someone droning on and on about something in a boring voice. This is what gets me about normal lessons. Some teachers sweep in, deliver the topic, give the homework and then rush out to the next lesson. Visual information keeps me interested and helps to remember things better, as I can picture them in my head.

Technology is a cool learning aid. Not only does it help the teacher and students to communicate knowledge and ideas in new, interesting ways, but it allows us to access the information later when it suits us. For example, a group plans and presents a PowerPoint presentation and the teacher streams it from the subject web site, which we can access at home. (*My group recently did a presentation on river life from observations of the one running through our city*). This is a good way to reinforce lessons, without needing more teacher time and resources. Also, new technologies appeal to us younger ones, as we are into them in a big way. Look at the number of cell phones, iPads & laptops that students now have. This makes technology easy in class, because the teacher does not have to tell us how to use it. As many own devices (*phones/iPads*) less class ones are needed. School only has to provide devices if not available at home. This shows how learning is improved by new technology use.

As indicated earlier, learning is an exchange between everyone in a class. Teachers and students must interact to get the most out of an experience. Technology helps the move into the future digital world. The jobs we go into will demand tech skills. There are downsides, as technology can let you down, but we cope with this and know the infrastructure will get better.

**Comment:** Luca is sold on technology and appreciates the versatility and variety it brings to learning as he obviously does not warm to the traditional lecture-style approach. He understands the importance of becoming skilled in technology use for later working roles.

**Bella: A second year undergraduate psychology student from East Anglian**

I am a visual-haptic learner, which I found out about in course lectures on cognition. This means I learn best when seeing real things with tasks that apply new knowledge and understanding. In this way, I get the best from class experience. I have no problem reading books/articles for information, providing my house mates keep quiet! However, this does not make up for discussion with other students, who broaden and stimulate thinking from their different takes on topics. That is why I need active involvement of the lecturer and the rest of the group, in order to get my head around the subject. I do not wait for this to happen. I begin discussions or continue ones, which others have started. The reason that I am so keen about all this is because I know that learning is an exchange of ideas, beliefs and knowledge, as my studies of psychology illuminate. You only get what others want to give. The way to really learn is to facilitate talk in class. We have a Japanese student, who is brilliant at group talk. He says that in Japan the teachers focus on communication & relationships for effective team work in present and future working roles. He understands the rules of group talk and so knows how to apply them to teach us all! Most of us have not learnt these in British schools.

I do find technology useful and like the flipped classroom, where you have the material online to study, with questions and tasks to then bring to seminars with tutors. I have had boring lectures to put up with and the move to blended learning suits me fine! However, I do want chances to hear inspiring professors, who have done international research and can put us in touch with what the wider world is doing! This could be done with a short series of key lectures at the beginning or end of term. We have a great WhatsApp group going with psychology second years and this keeps us in contact, as many of us are scattered over the city now that we have left campus halls of residence. I think the flipped class has kept us going during the 2020 pandemic. Even the simulated lab work has been useful, although I must say the real is best, as I like to touch things and feel them in space (*haptic sense*). There are problems with technology, when the screen freezes and the audio disappears. Sometimes it is difficult to enter Zoom events and download materials, when the internet speed is low. Nothing is perfect and one has to get on with things and cope with difficulties.

However, one thing bothers me and that is the popularity of internet essay mills\*, where you buy your assignments and theses for a price. I know of students who do this and get away with it. Although my parents did not go to university, I have an uncle who did and is now a lecturer. He thinks standards have gone down, which is not surprising as many more are now entering higher education. Universities are big business and this mentality may affect quality. There are good staff, but we are also taught by those who lack the experience and research knowledge that my uncle has acquired and so do not have much to offer us.

**Comment:** Bella is a keen, active student who appreciates real experience to help her learn best. She sees the flexible benefits of online learning and is a fan of the flipped classroom, which seems to suit many students. Her ability to cope with technology let-downs means she is a good model to follow!

**Michael: A post-graduate student at a Southern English University**

My research subject is *andragogy* – the art and science of adult learning. My mother is a Further Education lecturer,teaching many foreign students learning in English, which is not their first language. I have heard about the challenges of their formal educational experiences. Therefore, it is interesting to work out how I learn, as no one has made me aware of this in my own education, even though I am a qualified mainstream science teacher! As a post-graduate student in my thirties, I value continual professional development opportunities. I have always been a seeker and achiever. I question. I investigate. I get on with things. I am inquisitive and questions inspire & motivate me to go on learning. The best teachers have pushed me to pursue my passions, while providing support when needed. I have found the higher education journey a huge test of independence, will-power and stamina!

Technology has been a blessing and a curse for me. Fortunately, I took a tech course last year, which has improved my confidence and skills. I found that I couldn’t ruin my computer, unless in a fit of temper I threw it out of the window! Now, I’m happy to try out things. A course *learning contract* kept us up to the mark. We all had to learn a new technology or improve a skill. People produced web sites, instructional programmes, video conferences and digital photography, as well as creating PowerPoints with sound and movement for presentations. Choice of these possibilities in the contract was good to suit our wide interests.

We have learned to create on-line curricula and use a chat room for discussions about articles and required readings. Group exchanges were paperless except for project handouts. It was a good experience for reluctant and eager tech learners alike! Technology gives many opportunities to explore, create and cooperate. I see an increase in communication and confidence amongst course mates on the tech course, which should be a must for everyone.

Tutors are often frustrated with technology, as the tools do not always work properly and the ongoing training received is erratic or non-existent. I was in tech hell when my research presentation went wrong and the screen continually froze! Luckily, it has not affected the assessment, as the tutor assured us that dealing with problems calmly is what matters. Machines fail just like humans! However, it puts one off stride, but others were willing to help. Technology is constantly changing & differs in each setting. Patience & willingness to learn allows technology to extend the world for students at every level.

However, technology has dangers for academics, as not all online information is correct and *fake news* is constantly bandied around. Also, some students are inclined to cheat, buying assignments and theses from web-site essay mills\*. There are academics willing to write these for large fees. The media reported this in March 2019. Professors were compiling theses for students, charging over £6,000, according to journalists. This service is easy to find on the web and should be stopped\*. Someone I heard about bought an essay for £60, saying he could earn more than that in an evening working at a city bar, so saving time for socialising!

I like the idea of research being more practice-based within the workplace, to broaden the knowledge of colleagues for real impact on progress. As I am investigating my own learning, recording this and then comparing my journey with other adult students, I feel that outcomes will be worthwhile for everyone. I understand Harvard University now focuses on PhD research degrees and practitioner doctorates, which are global developments. These are not as popular in the UK, because some think investigations within practice are not credible research. This is not my view as you have gathered! I think a personal record for assessment is more useful to take back into the workplace and share with colleagues. It is difficult to cheat with this method, so must be a favoured online assessment.

**Comment:** Michael is a ‘goer’ and determination has helped him succeed. He has a love-hate relationship with technology because of its unreliability but is able to cope with this. The learning contract is a sound idea to encourage the use of technology for creative purposes and is one that all courses should adopt as mandatory. Michael’s research topic has led him to support practice-based inquiries for impact on workplaces.

**Review**

Polarised views of classroom technology are common. Some think they distract and result in lower performance. Others suggest learning experience is improved and banning technology prevents student progress, especially for those with specific needs. Many views are based on anecdotes and not scientific data. Recommendations are based on research regarding how students process, retain and retrieve information.

When students use cell phones in class, their performance might be less. Psychologists explain this as *multitasking* and *divided experience.* Students believe they can attend to many things at once, but this can harm the user and other classmates (Lepp et al, 2015).

Students do better on tests when taking written notes rather than relying on laptop records (Mueller & Oppenheimer, 2014). It is not a question of distraction in these studies, but the *computer process* that harms learning. Taking hand notes is slower and has to keep up with the pace of speech. Students must interpret quickly and think actively about information received, which depends on retention and recall. Some students prefer laptop records and only reread these for exams, but unless followed by written notes to deepen thinking, this is less effective. Also, hand movements for writing help ideas to form & flow, seen in the COGS studies (Sage, 2020). However, students with writing problems benefit from processing and producing work on computer, so should be allowed to do so.

**Effective technology use**

Limits and strengths of classroom technology must be acknowledged. Studies show that multi-media-sensory learning increases retention-recall processes. This occurs when learners encode visual, auditory & haptic information into memory, as when they listen to a topic presentation (*auditory*), then watch a display (*visual*) before carrying out practical tasks (*haptic*) to implement understanding. Studies show efficiency of this mode (JISC, 2019).

There are cognitive benefits to using certain technological aids, especially quiz tools. Quizlet, an online app, can improve study strategies and retention-recall of material. It allows students to make flash cards, view those of other students & use gamification for courses. The app also enables self-testing, determining *how* & *what* to study through metacognition. (*167 – Students’ perspective and experience on higher education – YouTube*)

Technology enhances other goals as well. Students do not always check teacher emails! It may be possible to text them, although staff might not want to disclose phone numbers. However, I have found texting a helpful way of keeping in touch with tutees. Apps, lik*e* *Google Voice,* work without revealing personal codes. These tools are multi-purpose - enabling a dialogue on course content or notification of changes.

**Recommendations**

Technology can produce effective learning, but must fulfil ethical educational goals.

* Ensure devices in class minimize distraction using solutions that suit students & context
* Deliver multifaceted, multimodal learning, enabling students to use all sense modalities if possible (*hearing, sight, feeling, smell, taste*) & explain technology pros and cons.
* Invest in an **e-reader** (£50+) for texts if possible. This device reads e-books & is like a computer tablet, but without a screen. It uses electronic paper, reflecting light like the normal type, but is easier to read with a wider viewing angle. Electronic paper is a portable, reusable store & display medium, looking like paper but can be written on repeatedly. The e-reader downloads e-books from a computer or reads them from a memory card, to hear how they sound and assist changing the writing style for student needs. Thus, this technology is adaptable for many purposes & useful for those with specific needs.
* Use **captions** for showing videos, to help process information for inclusive learning. Captions help gain attention, with a longer viewing time for the message, vital for students with word processing problems. They make content perform better on search engines.

Although it might seem tedious to set up tech systems, they are easily updated for reuse. Tools are constantly changing so ongoing training for everyone is a priority, but not regularly available in many institutions (Chatterton, 2021).

The 5 students were brave to talk about learning and are impressive for awareness and acceptance of events. Their views are echoed in the 2020 student webinars of OECD, EDEN, TOP HAT & World Rankings. The overall opinion suggests that *blended learning* is the future, as people must be tech savvy for jobs, with its tools providing flexibility and choice. However, the downsides must be addressed, such as unreliable infrastructure, easy access to unsuitable materials and opportunities to cheat and pass courses without engagement. A strong view has been expressed that assessment must change to become a personal online record that can be updated for a job passport. Employers are aware of dubious practices and prioritize jobseekers from institutions with ethical practices and now offer positions to non-graduates showing high-level personal and practical competencies.

In 2012, the UK laws were relaxed, allowing non-qualified teachers to be employed in schools. Although bringing valuable life experience, it is vital that unqualified staff have understanding of psycho-linguistic learning processes. Education is a complex business in a diverse society. It is common for around 250 different languages & dialects to be spoken by students in UK city schools. Therefore, the linguistic content of computer programmes must be of concern to ensure learners can access the content successfully.

Finally, a quote from Bill Gates, the software billionaire, on Huffington Post: *Technology is just a tool In terms of getting the kids working together and motivating them,* ***the teacher is the most important***.’ If wisely implemented, technology improves engagement, knowledge retention, individual learning & collaboration, with innovation and inequality the defining global and educational issues of the 2020s.

**Note:**

\*Chris Skidmore brought the **Essay Mills Prohibition Bill** to the British Parliament on 10 February, 2020. An ex-university lecturer reported: ‘*My latter years of lecturing were blighted by constant attempts by students to hoodwink me into believing that the work they had submitted was a true reflection of their ability… year after year they purchased essays by companies that promised excellent grades’.* (Daily Telegraph: *No More Essay Mills,* p.19, 10.02.2021). The first reading of the bill is available on hansard.parliament.uk.

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