Unintended Consequences of E-Learning: Reflections on the Digital Transformation of Learning in Higher Education

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Introduction

The use of digital technologies in Higher Education has grown dramatically during the COVID-19 pandemic with many courses moved to online teaching, a trend which is likely to continue post-pandemic. However, the rise of such E-Learning is likely to have a number of unintended consequences for students, teachers, higher education institutions, employers and society more generally (Webb et al. 2021)[1]. These have important implications for regional and local labour markets, skills development and observatories.

E-Learning can generate innovative approaches to learning and can enhance efficiently and convenience, particularly for those wishing to work or study remotely or 'at a distance'. Some students favour the use of digital technologies and enjoy having on-demand access to lecture content and other materials, particularly for revision and assessment. However, there are a number of associated issues that can lead to unintended consequences for those involved and for wider society.

After the introduction, this chapter starts with a brief description of digitalisation in Higher Education to offer context for the digital transformation of university learning. Section 3 considers who might be particularly affected by barriers around the move to large-scale E-Learning in terms of digital access and the digital divide. This is followed by exploration of three key issues around the

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unintended consequences related to the rapid uptake of digitised teaching and learning due to the COVID-19 pandemic. These issues are: (1) the impact of E-Learning on assessment, particularly where and how learning is delivered due to remote learning and assessment; (2) the use of learning analytics, and how data is gathered and used particularly with the growing use of learning analytics which can undermine privacy and increase the surveillance of people's activities?; (3) the implications of machine learning/Artificial Intelligence (AI) in learning and teaching, and what ways students are supported by digitalisation through the increased use of Machine Learning/Artificial Intelligence (AI) assistants for students? Finally, conclusions are presented.

Digitalisation in Higher Education

Increasingly education is becoming more digitised and digitalised. Digitisation is the conversion of information from an analogue to a digital format (De Mauro et al. 2016). While digitalised concerns technology becoming more embedded and changing processes, such as marking student assignments online, rather than on paper and the use of different technologies becoming embedded in the education process. A report by the University and College Union (UCU 2020a), points to increasing quantification, heightened commercial and market aspects of higher education, and an increasing use of automation in higher education. Increased metrification in universities has seen automation and the use of technology, such as data analytics, as the solution for measuring outputs and performance and dealing with the increased use of the world wide web by students. The increase of automation has led to the outsourcing of much technology, with commercial entities seeing universities and other Higher Education Institutions (HEIs) as prime customers, changing the higher education landscape to become more and more like a market.

In education, digitalisation includes the use of technologies that analyse digital information to help make decisions, such as data analytics, AI and machine learning and the algorithms that these run on. For example, algorithms help to process information and data, and machine learning can process and adapt to information they are being fed (UCU 2020a). The use of AI, or more specifically machine learning in this paper, in teaching includes chatbots and learning analytics. AI used in teaching can provide tailored support by processing information

about students, analysing their behaviours, assessing their engagement with classes and personalising learning support (Houser 2017).

Making information processes machine-readable – datafication – has led to many tasks once carried out by humans now being carried out by machines. This automation includes automated testing such as the use of software to proctor exams, AI grading, and plagiarism detection software. The use of automation in education represents a growing industry, with a focus on improving efficiency for tasks such as assessments (UCU 2020a). Furthermore, automation in libraries can increase their performance and the quality of work for librarians, as well as being more convenient for those accessing such resources (Olagoke and Kolawole 2019).

There are considerable implications for HEI staff working online (some are discussed below). The greater use of online meetings to discuss courses and teaching among staff may be subject to various behavioural biases (Bouckley et al. 2020). These may indirectly affect online teaching and its organisation. There is also a need to understand and operate these processes and interpret their outcomes. However, such digitalisation has a number of potential unintended consequences for those involved and for links with local or regional labour market observatories, including issues associated with: the digital divide, remote learning and assessment, learning analytics and AI.

The Digital Divide

The digital divide can be considered as the 'gap' between different groups and individuals, in relation to accessing adequate Internet and information and communications technology (ICT) facilities and the information, services, or uses gained through them (Venezky 2000, Nishijima et al. 2017). This becomes a barrier to access online learning, which results in severe disadvantages. An example for this can be seen in difficulties accessing employment support services that are increasingly being offered online, for students and young people that are looking for employment (EEF 2020, Quinn 2020) or access to employment support services, for instance for students or young people looking for work (McQuaid et al. 2003, 2004). Digital divides can be influenced by the human and physical capital and skills required for using ICT (and other digital hardware and software), as well as availability and use of technical and social support. Remote

learning can make access easier for those with different schedules, unable to attend campuses physically, and to reach a wider audience. However, different groups of staff and students have varying attitudes towards the use of open educational resources (Ochieng and Gyasi 2021). Importantly, the use of online and remote learning can discourage access to learning for some, highlighting aspects of the digital divide. These disadvantages may arise from a lack of physical access to equipment (e.g. laptops) or adequate internet connections (especially if learning material is presented in forms, such as videos, requiring fast internet connections that may not be available to all students due to physical limitations (e.g. many rural areas) or cost constraints for the students etc. Additionally, the experience of students, and their local support networks, in using ICT-based learning may vary due to factors such as their primary and secondary schooling opportunities and their family income etc. This is particularly apparent where access to the Internet outside of HEIs campuses is uneven: a study in South Africa for example, found that the uneven distribution of Internet served to heighten social inequalities amongst university students (Oyedemi 2012).

Although online education may help expand access, the impact of COVID-19 pandemic has highlighted the lack of digital access for certain groups in society, such as sharing computers or Internet access, or having suitable places to study (Holmes and Burgess 2020). There are similar patterns across the EU, as indicated in the Digital Economy and Society Index (DESI 2020) which measures the progress made by EU member states towards a Digital Economy. The Open University noted that 88% of organisations state that they have a shortage of digital skills, which can be wide ranging (The Open University 2019). Some students have very limited practical support either remotely (e.g., via helplines) or in-person, the latter especially affected those living alone during the COVID-19 pandemic with no face-to-face learning or in-person support on campus. Not all people are skilled Internet users with relevant study or research skills. In 2018, adults in the UK who have never used the Internet, or not used it within the last three months, still numbered 5.3 million (10 per cent of the population), although this has been declining over the years (ONS 2019). Of these non-users, 56 per cent are disabled (compared to around 22 per cent of the population being disabled), 58 per cent are women and around three-quarters are over 65 years, while the economically inactive also have high rates of non-users. However, non-users have consistently been falling in all of these groups over recent years. Solutions

may vary but might include expanded formal teaching or learning and also less formal or even volunteer-based intensive, one-to-one support.

The digital divide raises issues around the extent of access:

- what ICT infrastructure do both students and educators have effective access to when carrying out E-Learning and teaching remotely (including hardware such as computers, laptops, as well as Internet access and support);
- are the necessary digital skills in place for students and staff when learning and teaching online;
- how do these differentially affect groups in terms of access to learning, employment opportunities and local labour market information and intelligence;
- how do HEIs and teachers support students who have skills gaps and cannot make full use of E-Learning or who are particularly affected by issues such as COVID-19 pandemic?

E-Learning and Assessment

E-Learning (also known as online or virtual learning) allows learning at distance (remote learning) or in a blended (combining online and classroom-based learning) format. It allows students to learn outside of the physical university campus. Blended (or hybrid) learning may have online components that complement face-to-face interactions and/or elements designed to replace face-to-face interactions (Crosslin et al. 2018, Siegelman 2019). The COVID-19 pandemic has impacted types of online learning, with many HEIs globally choosing to move most or all teaching online, and by the end of August 2020, 49 per cent of HEIs in the US intended to use some form of online learning (Quinn 2020).

Lecture capture technology enables recording lectures, which can be accessed, for instance for students unable to attend a class, or those who attended but wish to review the class, although this may lead to students replacing attendance with online viewing, with possible different levels of attention being by them. Learning Management Systems (LMS) or Virtual Learning Environments (VLEs) such as Blackboard, Canvas, and Moodle are used to manage these as well as oversee data relating to digital aspects of courses (UCU 2020a). These platforms have proven to be especially important as HEIs moved to online learning during the COVID-19 pandemic.

Some universities have moved further providing additional Massive Open Online Courses (MOOCs) on platforms such as Coursera, edX, Udacity, offer online learning on a large, global scale to both registered students and other interested people. An assessment of 76 MOOCs found that although presentation of course materials scored high, a majority scored poorly on the instructional design quality (Margaryan et al. 2015), although this varies between MOOCs and over time some may make considerable changes. Such use may also encourage the use of completely automated assessment. The use of such assessments can also mean limited individually tailored feedback for students (de Freitas et al. 2015).

As E-Learning can be synchronist or non-synchronist, space and time can be changed in the online environment, and thus educators need to be flexible (Boudreau 2020). Online learning such as computer assisted instruction generally does not have the individualised advantages of one-to-one learning, and will not be adapted to particular learning styles (Surjono 2015).

In terms of assessment, many standard forms of assessments have been replicated using LMS and VLEs for online submission of assignments. However, class tests, exams and presentations performed remotely are not subject to the same types of monitoring as they would in person. Remote proctoring has seen a rise in numbers since the impact of COVID-19 pandemic caused HEIs to increase the use of remote learning. Software for remote monitoring of assessments such as Proctorio uses artificial intelligence to watch body language of learners and scan the surrounding environment. It includes the use of human proctors via video calling software as well as the use of adapted web browsers that stops users moving between tabs during an exam (Hubler 2020). There are significant issues of surveillance concerning exam monitoring (see: Webb et al. 2021, Schwauger 2020).

There are technological challenges of remote and online learning, including access to and skills in using the equipment for both staff and students, as well as taking learning or administration material designed for face-to-face use and adapting it to a digital platform. The VLE can aid teaching, if used ~~in~~ effectively, as many face-to-face teaching principles also apply to virtual learning.

A review of different approaches to remote learning by the Education Endowment Foundation (EEF) found that quality of teaching, ensuring equitable access to technology, peer interaction, student support, and having different approaches to different types of assignment were key to remote and blended

teaching through schools (EEF 2020: 22). They also found that pupils are able to learn by remote teaching, as long as the teaching is delivered appropriately and uses effective teaching components such as clear explanations, frameworks, and feedback (EEF 2020: 22). Additionally, teacher involvement has been found to be crucial in aiding student ~~perception~~ views and perceptions of the usefulness of remote laboratories (Viegas et al. 2018).

The onset of the COVID-19 pandemic led to a swift relocation of classes from face-to-face to online, which in the longer term may lead to a shift in learning modes and approaches, including the opportunity for innovative education methods such as game-based learning to become a standard part of the curriculum (Sutton and Jorge 2020). It is useful to set out potential advantages and possible challenges with remote learning and assessment.

There are a number of potential *advantages* of remote learning and assessment such as:

- VLEs can allow for a deeper engagement with students, as teaching staff are given more information on how students engage with course content and students can learn in flexible ways that may suit them more (Minsky 2020).
- A virtual classroom can offer a sense of community (Ogbunu 2020).
- The use of remote and virtual learning for laboratory work, such as Virtual and Remote Labs (VLRs), allows for a safer learning environment (Gravier et al. 2008, Heradio et al. 2016).
- They allow students with differing abilities and from different time zones to participate in learning at times that suit them, and repeatedly (Gravier et al. 2008, Viegas et al. 2018).
- Lecture capture ~~is~~ can be used regularly to view content which is useful for students unable to attend classes (Jisc 2018, Morris et al. 2019), but may deter some students from full participation in other aspects of the course.
- It allows near unlimited and flexible sharing of digital resources with students (which are accessible at all times) (Jisc 2016, 2018).
- Remote learning can complement face-to-face teaching as well as being time-saving for staff (Joseph-Richard et al. 2018)
- It can prompt professional reflection (Morris et al. 2019), and when combined with analytics can help staff tailor their teaching styles, methods and content (Joseph-Richard et al. 2018).

However, there are challenges and *issues* that may lead to unintended consequences such as:

- The outsourcing of technology – such as plagiarism analysis, or remote assessment software – can lead to students manipulating software, such as 'gaming' the system with little to no engagement with the learning material (Chin 2020).
- The use of plagiarism software~~, such as~~ like Turnitin, can make writing essays into an algorithm-pleasing exercise, rather than an engagement with the material students are writing about (Williamson 2019). Concerns arise also over its accuracy and its exploitation of student writing for its software; and issues such as buying assignments from 'ghost writers' (people paid to write an assignment for students) or writing text in a way to subvert the software etc. (Straumscheim 2015, Williamson 2019, UCU 2020a).
- Most software, VLEs, and Artifical Integggligence applications are developed in countries such as the USA, China, Russia or India, and in the EU, and may not fully reflect the needs of users in other countries or among different groups in each society.
- There are concerns that the use of MOOCs, which encourage an open access, off-campus mode of learning, could be threatening to existing HE models (UCU 2020a).
- The use of monitoring practices for assessments have been described as invasive and discriminatory. There is a danger of violation of privacy, particularly when student scanning practices are in use. This may also lead to questioning the legitimacy of the test results, if it makes students feel self-conscious.
- Lecture capture is more negatively viewed by staff than students because of issues related to control of the content and quality of recordings captured (Taplin et al. 2014, Morris et al. 2019), authenticity, spontaneity, self-censorship and lack of real-time interactions potentially reducing student active engagement.
- There can be a feeling of staff being constrained in lecture capture: staff are more careful of what they are saying, there is a reduction in spontaneity, restricted movement due to microphone issues, with lectures becoming more didactic as a result, as well as a lack of interaction with students (Bond and Grussendorf 2013, Joseph-Richard et al. 2018;). The lack of physical interaction for some subjects such as healthcare is a concern (Butina et al. 2013, Quinn 2020).
- Adapting lessons to go online and responding to individual e-mails or other communications by students (when issues could have been resolved during lectures) can significantly increase workload for staff. (Taplin et al. 2014).
- Workloads are also affected by staff spending time helping students navigate IT resources. The role of staff can then turn into facilitator, rather

than educator: “While the intention is to equip faculty with relevant teaching tools, the unintended outcome is that it reshapes their traditional roles.” (Nworie and Houghton 2008: 55). Anecdotally, the number of teaching and administration related meetings appears to have increased (even if meetings may often be shorter, overall, more time appears to be taken up by them).

- The 24-hrs flexibility that the online learning offers blurs work-life boundaries and can impact health and wellbeing of staff (Taberner 2018, DeFilippis et al. 2020).
- Particularly during the COVID-19 pandemic, the transition to online learning has been very sudden and stressful for many staff and students. A quick adaptation to online learning teaching is work- and time-intensive and requires an investment in infrastructure, skills development and support (Wild et al. 2020).
- E-Learning can reduce attendance in face-to-face lectures (in the blended learning model) and diminish live interaction and discussion (Chang 2007, Bond and Grussendorf 2013, Morris et al. 2019) as the new technologies tend to replace the live experience rather than complement and enhance it (Nworie and Houghton 2008). Additionally, having the lecture available to access at any time could lead to reliance upon it as the sole means of topic revision, rather than exploring other materials.
- Online learning can lead to “e-escaping”: the lack of physical interaction can make students feel like it is easier to disengage and ultimately drop out of a course (Nworie and Houghton 2008).
- There may be pressure to focus more on making material attractive (e.g., visually), which may in practice (with limited time for preparation) reduce the depth of appropriate content, possibly reducing deep learning suitable for higher education, so presentation and content need to be complementary.
- Various ‘soft’ skills (such as team-working, leadership, etc.) and social skills may be developed differently, and in different ways, compared to classroom-based teaching; and those developed more intuitively in face-to-face classes may be hard to replicate online.

E-Learning has advantages, particularly for those students who have access to necessary ICT resources, social and academic support and whose style of learning is suitable for E-Learning. However, it raises many issues for staff, students and institutions with potential unintended consequences and other implications for skills development and labour supply in local labour markets that must be considered. It is important that labour market observatories do not focus just on

the potential advantages, but that they identify significant issues for different student and labour market groups and develop suitable solutions.

Learning Analytics

Learning analytics uses digital data collection to help inform decisions and make improvements in an educational setting (Buckingham 2012, Corrin et al. 2019, Jones 2019). This data can be obtained through data recorded about students (administrative records, surveys), as well as data from online learning platforms, VLEs, LMS, and social networking sites (Zilvinskis et al. 2017). These can help individual students by relaying data and information about them to create personalised learning and support students.

There is currently limited research on the impact of learning analytics on students and its use by educators, with work being more focused on technological developments rather than on application to learning –(Ferguson et al. 2016, Knight et al. 2020) and integration with local and regional labour market information systems that seek to consider both labour market demand and supply characteristics.

There are a number of potential *advantages* of using learning analytics such as:

- Learning analytics can help students to identify areas of strength and weakness, providing a tailored experience for the student (UCU 2020a).
- They can provide data on student engagement, as well as predictive information on student performance (Wong 2017), thus assisting academic decision-making.
- If provided to the student, they can allow for a reflective standard of learning, one in which they may be able to engage deeper with the learning process (Rivera-Pelayo, et al. 2012, Eynon 2015).
- They can give a unique, user-centric, up-to-date service in libraries (Mannheimer et al. 2016), and therefore enhance learning-.
- They can be used with data analytic systems, such as Integrated Planning and Advising Services (IPAS) to give personalised and developmental feedback (Educause 2014).
- The data can provide information for algorithms to facilitate university admissions and student support departments to considerably shorten the administrative labour related to advice giving to current students and applications processing from prospective students (UCU 2020a).

- They potentially provide new information in a timely way that might efficiently be included in information on, and analysis of, local labour market supply and demand factors.

However, there are *issues* that may lead to potential unintended consequences such as:

- The outsourcing of technology has led to concerns over data usage without acknowledgement of pedagogical approaches and frameworks. Its usage can be vague and rely on private companies using the data for commercial purposes in a non-transparent way (Zeide 2019, UCU 2020a).
- Decisions about student attainment or development can be influenced, or even fully made, by algorithms rather than academic staff with associated concerns (Zeide 2019).
- Learning analytics can be used to predetermine student success and failure (Educause 2014) and can lead to datafication of student learning and behaviours (NUS 2015), for example, by 'game playing' to fit with expectations set by the analytics system.
- The use of AI in learning analytics may be also subject to bias especially as they are often based on data that is itself biased (e.g. AI used to help choose software engineers for recruitment used data on existing engineers, but these engineers were relatively homogenous and mainly male, so the AI determined an 'ideal' engineer to be male and rejected female candidates). Hence AI are usually based on, and can reinforce, existing situations and power relations and so favour or be biased against certain groups (O'Neil 2016, UCU 2020a, EC 2019).
- A reliance on metrics, coupled with the marketisation of the university, has led to a push on improving the "student experience", which often falls onto the work of academics increasing workloads, and consequently their declining mental health (Morrish 2019).
- The processing of information about students, against parameters they may be unaware of, can impact self-identity and undermine privacy (Drachsler and Greller 2016), and question institutional transparency (Zimmer 2013).
- HEIs need to make increased efforts to ensure that they have strong protection of data against misuse and loss (Educasue 2014).
- There is a risk of Learning Analytics leading to technology- rather than education-led learning (Price and Kirkwood 2014). This form of technological determinism might also lead to questionable decisions, especially when analytics fail to consider a complex context of education and learning, and needs for discretion (Zilvinskis et al. 2017).

- Despite potentially using algorithms every day, most staff are unaware of how learning analytics work, and thus it becomes difficult for them to question the decisions that the algorithm makes (O'Neil 2016, Rainie and Anderson 2017, Prinsloo 2020).

The greater use of E-Learning entails changes to where and how learning is done. It also may shift power relations towards third-parties and away from qualified staff and individual students, and even teaching institutions. Opportunities for labour market observatories may include better integration of information but they must be aware of the many issues raised in this discussion.

AI assistants

Artificial Intelligence (AI) assistants are being used more often to help students, both with academic subjects, as well as more general guidance, such as university life. Commercial companies are increasingly being used to provide some of these assistants, such as Microsoft's Cortana, Amazon's Alexa, and Apple's Siri. It is suggested that people may share more personal details with an AI assistant than a human (Centre for Data Ethics and Innovation 2019). One such assistant, named Jill Watson, was built at Georgia Tech's School of Interactive Computing in 2016, and was designed to help increase student social interaction and working together quickly and to answer basic questions about studied content so that educators could focus on more complex teaching problems (Georgia Tech 2020).

There are a number of potential *advantages* of using AI assistants such as:

- AI assistants can learn from and adapt to students' needs.
- They can provide tailored support to students (UCU 2020a).
- They can be available at all times, and its ability to answer basic questions can free up time for educators to focus on deeper teaching issues, particularly if staff find they are being inundated with similar and repetitive questions (Georgia Tech 2020).

However, *issues* that may lead to unintended consequences include:

- It may not be clear to the student that they are conversing with a machine, particularly if it is given a name or personality traits (Georgia Tech 2020).
- There are potential privacy implications of third parties providing these assistants, and danger over commercial providers becoming a powerful

player~~s~~ in education (Centre for Data Ethics and Innovation 2019, Williamson and Hogan 2020).
- Such software could affect pedagogic guidance and the teaching methods of educators, as they adapt their teaching styles to fit with AI tutors (UCU 2020b).
- The push to use such assistants could leave students with a lack of social interactions between staff and peers, and could limit depth of discussions.

Again, while opportunities are presented for observatories to gather new information almost in 'real time', it is crucial that they consider the potential unintended consequences of extensive use of AI and their effects on education labour, new labour market demands, and a wider local and regional skills development.

Conclusions

This chapter explored some of the unintended consequences of digitalisation in Higher Education and the move to large-scale and wide-spread E-Learning during the COVID-19 pandemic. These mainly reflect overlapping behavioural, pedagogical, technological, ownership issues and digital exclusion.

Some areas of potential unintended consequences discussed include engagement of some students, staff skills and workloads, privacy and surveillance, and the non-transparent 'nudging' of staff and student behaviour by the software systems used. The growth in E-Learning offers many opportunities for innovation, especially when blended with other face-to-face, peer-to-peer learning and social support activities. However, there is a danger that the E-Learning model has become technology-led (hardware and software), rather than pedagogically-led. Although digital learning can provide a tailored and self-reflective means of learning, there are issues regarding student engagement, the potentially higher workloads for staff, the possible biases in AI, and compromised decision-making processes that can lose sight of pedagogical priorities in the face of technological appeal. Further issues relate to limitations and potential biases in the development and availability of software and VLEs and effects of their ownership. Finally, the issues regarding access to both infrastructure and digital skills highlights the need to ensure advancements in technology do not leave some individuals excluded.

There remain many further issues that are crucial for local and regional labour markets. The requirements for more relevant labour market information and intelligence can also help create an agenda for future research, but have not been explored in this paper. For instance, the effects of: 1) various uses of surveillance based on the compulsory use of E-Learning software (such as monitoring student attendance and participation); 2) the generation and analysis of digital footprints of staff and students, with information generated online being used by employers and influencing university recruitment; 3) the implications of outsourcing technology to private companies with high levels of monopoly power; 4) cyber security which is a major threat to universities; 5) copyright of materials used in learning and their wider use; 6) data protection and legislation such as GDPR which are particularly important as higher education institutions deal with huge amounts of information; and 7) the complex ethical issues related to the use of digital technologies and datafication, (such as who has access to data, who is making decisions, what is data being used for, what value does online learning have compared to face-to-face, ensuring informed consent, protection of vulnerable groups, etc) (Williamson et al. 2020).

Finally, additional major issues related to potential unintended consequences include the monitoring and use of AI, which raise further issues for staff, as well as students. The use of specialist software to monitor staff and student activities, for instance through advising them on replies to e-mails or deadlines that they should meet, may mean that they need to accept the analysis by third-parties (private companies) of their e-mails and other communications (such as 'Teams' or other online meetings) and the possible use of this analysis for wider third-party use (even if anonymously) such as the development of AI or machine learning for the third-party. In addition, they may also seek to influence staff behaviour (e.g., by 'nudging' -or suggesting that staff block certain time for different activities). Finally, the use of third-party software may tie both institutional users and staff or students, who wish to operate compatible software on their personal equipment, into ongoing annual charges rather than one-off purchases.

Currently, there is a lack of research, and a coherent framework of analysis, on the medium- and long-term impacts of the move to greater E-Learning, using learning analytics on student performance and engagement and using AI to assist staff, students and institutions. During and following the pandemic, research should focus on the effects of remote learning and assessment on different types

of students, the commercialisation of infrastructure and data, surveillance and the treatment of staff and student digital footprints, as well as the increased work demands related to the rollout of E-Learning. Further research is also required into how local and regional labour market information and intelligence can be integrated with the rise of digital information on students, courses and employers. How to avoid unintended consequences of such digitalisation of learning, and dangers related to implicitly influenced (nudged) or changed behaviours of those involved in higher education, is an important concern.

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