Literature Review

The impact of modern technology on student learning experiences in higher education

Introduction

Modern technology has had a profound impact on the delivery of and engagement with higher education over recent decades. It has informed changes relating to the delivery of courses, the way students engage with these and the resources available for students to aid them with their studies. While the majority of these changes have occurred due to general developments in technology, some have emerged as a byproduct of changing demands from institutions and students alike, or responses to urgent needs such as the Covid-19 Pandemic (Liasidou, 2023).

Whilst it can be difficult to predict what future developments may look like within the realm of modern technology and higher education, there is a notable portfolio of pre-existing research within the field that aims to identify best practice and areas for development. This research is worthy of examination, with an aim to identify arguments and hypotheses that provide a strong foundation for moving further into the field. The aim of this literature review is to provide information about the research that has previously taken place in this area, including the background information relating to this, along with insight regarding some of the technologies that are currently being used, and some that may be beneficial in the future. The important aspect of the student experience and outcomes will also be noted, which allows for the direct correlation between research and real world implications.

Background Information

Digital technology has been affecting higher education institutions for some time (Kopp et al., 2019), with trends in this becoming more prevalent over the last decade. Whilst many would assume that these changes had only begun to occur

during the Covid Pandemic of the early 2020's, this is not the case. Advances in technology, and the internet in particular, helped spark a "revolution" in distance learning during the late 20th and early 21st century (Moore & Benson, 2012). The role that "e-learning" has played in this cannot be understated or neglected, with it becoming one of the most relevant and in demand learning modes over the last decade (Leontyeva, 2018). These observations highlight the notion that the advances in modern technology as it pertains to higher education are profound enough to have a deep impact on the general public consciousness.

Some institutions have provided pushback in the past as it related to the embracing of modern technology within higher education. There is a general assumption within society that the further embrace of modern technology is impacting the mental wellbeing of students in a negative way, with the introduction of this into higher education potentially contributing to this (Power, 2022). Whilst this research may highlight this, there is little supporting evidence to indicate that the emergence of technologies such as virtual learning environments are directly correlated with this, as most studies indicate that the concerns regarding mental wellbeing and students relate to social media (Braghieri et al., 2022).

Virtual Learning Environments and Virtual Reality

One of the most significant trends relating to modern technology and it's impact on the student learning experience within higher education is the utilisation of virtual learning environments (Weiss et al, 2006). These tools allow course facilitators and providers to provide course related audio and video materials, allow for computer based assessments and gather statistical information regarding course engagement (Limniou & Smith, 2010). Whilst students need to actively log into the system and go through the materials, much like the process of attending on-campus for an in person course, many of the potential barriers are removed by doing this.

The potential impact of virtual reality machines and tools is something that is emerging as an important research area for many sectors, including higher education. These tools are already being utilised within such diverse fields as

medicine, architecture and tourism (Stecula, 2023), so it would seem both reasonable and beneficial for these to be brought into the education of these topics. Virtual laboratories, for example, can assist educational institutions in not only providing accurate representations of applied fields, but can also assist with the financial and physical burden of creating real world environments (Vergara et al., 2022).

These aforementioned tools offer an interesting area of study as they pertain to higher education. As more careers and employers offer roles that involve some form of hybrid working, with aspects such as virtual meetings and digital telephony, it may prove beneficial for academia to prepare students for this. Providing the ability to experience modern technology in this way not only increases digital literacy, but allows for a more dynamic workforce as these students graduate and begin their careers.

Artificial Intelligence and "Chatbots"

Research presently exists that explores the potential developments that could be made in relation to modern technology and higher education, with notable research being conducted into the uses and benefits of Artificial Intelligence (Urmaneta & Romero, 2024), believing that the adoption of this will provide benefit to students and their learning. Contrasting sentiments to this have been raised in both general research and academia specifically (Chan & Hu, 2023) which highlight prevalent concerns regarding the ethical implication of AI tools such as generative text. They remark about the usage of AI within digital game based learning, acknowledging the ability of AI to adapt in real time to enhance the way students are able to engage with the narratives and rules of these games. This level of adaptability could potentially lead to future developments in more adaptive higher education courses, much like is being seen at a secondary level (Tosheva & Martinovska, 2011).

Whilst educational institutions are right to urge caution with students in relation to generative AI, it appears that there is a general misunderstanding with academia (or specifically, those outside of computing based academic) regarding exactly what AI is and how this can be used. There is space within the higher education market for

AI to aid not only students but also faculty, in a way that does not compromise the academic integrity of the courses. Having noted concerns relating to engagement with faculty staff as one of the negatives of modern technology in higher education, this may potentially alleviate some of the tasks that faculty find themselves doing, which could lead to further time for interactions with students.

Many institutions are also currently using some variety of a “chat-bot” to help aid faculty staff and students with the educational experience (Haman, 2021). While some of the products are still in their infancy and there is still considerable research that is required to realise how these can best benefit students, with the Large Language Models used to train them still being constantly developed (Kim et al., 2023), there are examples of instances where this has provided benefit. Evidence suggests that the use of chatbots and generative AI can provide a holistic overview of materials (Daneshvar Kakhki et al., 2024) for student’s to build from, thus allowing them to focus on the details required to succeed.

Student satisfaction

Studies have been conducted that analyse the impact that modern technologies, specifically e-learning, have on student satisfaction, with a notable survey questioning 1238 students on their thoughts and feelings regarding these distance e-courses, with the students providing both positive and negative feedback (Leontyeva, 2018). 85.14% of students highlighted the availability of these courses via distance learning as an advantage and 80.9% noted positives in relation to them having more free time, which is contrasted by 55.3% of students noting concerns regarding communication with staff as a disadvantage. Similar sentiments regarding engagement with faculty have been identified elsewhere, with research indicating that students who had in-person classes at least once a week during the Covid-19 Pandemic were more satisfied with the level of engagement with their faculty and academic staff when compared to those who had no level of in person engagement (Wright et al., 2023).

While students appear to appreciate the easier access and availability to learning materials that modern technology allows with regards to higher education, a notable issue of the engagement from faculty is identified. It is possible, potentially, that the level of “buy-in” from these academic institutions may not be at the same level as that of the students engaging with the courses. It is known that students appreciate the flexibility and convenience of online learning (Jaggars, 2014), however evidence suggests that academic institutions may either be unwilling to or unable to facilitate the same level of engagement as students (Hamlaoui, 2021).

With regards to student academic outcomes in relation to online learning, there is mixed data regarding the efficacy of this when compared to in-person study. While some studies (Akpen et al., 2024) have identified that students themselves report receiving better outcomes from online study when compared to in-person methods, other results did not provide this level of clarity. It has been identified that characteristics such as age and ethnicity had more of an impact on higher education outcomes than whether someone studied online or not (Hachey, 2022). What this shows is this while there might be no objective benefit to online based study, there isn’t a particular hindrance to outcomes. This, paired with the flexibility that people require in the modern age shows that it does remain a good choice for students to utilise should their needs require. It is also reassuring to see that those students who are not able to choose the kind of institution they attend, such as those with disabilities that would make in person study impossible, are not placed at a disadvantage due to online study.

Conclusion

The developments in modern technology that exist to enhance the student experience within higher education have developed considerably in recent years, however the foundations and research to aid this have been around considerably longer. It is clear that many institutions remain skeptical of these kinds of developments, naively believing that tools such as online learning, virtual relation and artificial intelligence will compromise the rigour of higher education and lead to graduates who do not possess the skills of those who came before them. Despite

this, however, there does appear to be slight changes being made pertaining to the perception of these tools and their place in higher education. Students appear to find these tools to be beneficial to them and their studies. In the case of e-learning platforms, many students find these to be crucial to them being able to access the education at all, thus enfranchising more people to access higher education, many of whom may not have been able to do this previously.

The future of modern technology within higher education is exciting, with high levels of research taking place currently to help push this forward. In particular, the possibilities for both artificial intelligence and virtual reality to help move academia forward is something that is worthy of more attention and resources. Much like in general day to day life, people rely on modern technology to help assist them with tasks, help them gather knowledge and improve interactions with others. Whilst some of this has already found itself being appreciated by higher education institutions, the full adoption of this will allow for the benefits that technology has on society as a whole to become benefits within the worlds of higher education and academia.

Word Count: 1879

Reference List

Akpen, C.N., Asaolu, S., Atobatele, S. et al. (2024) 'Impact of online learning on student's performance and engagement: a systematic review', *Discovery Education*, 3, p. 205. Available from: https://doi.org/10.1007/s44217-024-00253-0 [Accessed 9 September 2024].

Braghieri, L. et al. (2022) 'Social Media and Mental Health', *The American Economic Review*, 112(11), pp. 3660–3693.

Chan, C.K.Y. and Hu, W. (2023) 'Students' voices on generative AI: perceptions, benefits, and challenges in higher education', *International Journal of Educational Technology in Higher Education*, 20, p. 43. Available from: https://doi.org/10.1186/s41239-023-00411-8 [Accessed 9 September 2024].

Daneshvar Kakhki, M., Oguz, A. and Gendron, M. (2024) 'Exploring the Affordances of Chatbots in Higher Education: A Framework for Understanding and Utilizing ChatGPT', *Journal of Information Systems Education*, 35(3), pp. 284–302. Available from: https://doi-org.uniessexlib.idm.oclc.org/10.1007/978-3-030-78645-8_8 [Accessed 9 September 2024].

Hamam, D. (2021) 'The New Teacher Assistant: A Review of Chatbots' Use in Higher Education', in Stephanidis, C., Antona, M. and Ntoa, S. (eds.) *HCI International 2021 - Posters*. HCII 2021. Communications in Computer and Information Science, vol 1421. Cham: Springer. Available from: https://doi-org.uniessexlib.idm.oclc.org/10.1007/978-3-030-78645-8_8 [Accessed 9 September 2024].

Hamlaoui, S. (2021) 'Teachers' Resistance to Educational Change and Innovations in the Middle East and North Africa: A Case Study of Tunisian Universities', in Ouaissa, R., Pannewick, F. and Strohmaier, A. (eds.) *Re-Configurations. Politik und Gesellschaft des Nahen Ostens*. Wiesbaden: Springer VS. Available from: https://doi.org/10.1007/978-3-658-31160-5_11 [Accessed 9 September 2024].

Hachey, A.C., Conway, K.M., Wladis, C. et al. (2022) 'Post-secondary online learning in the U.S.: an integrative review of the literature on undergraduate student characteristics', *Journal of Computing in Higher Education*, 34, pp. 708–768. Available from: https://doi.org/10.1007/s12528-022-09319-0 [Accessed 9 September 2024].

Jaggars, S.S. (2014) 'Choosing Between Online and Face-to-Face Courses: Community College Student Voices', *American Journal of Distance Education*, 28(1), pp. 27–38. doi: 10.1080/08923647.2014.867697.

Kim, J.K., Chua, M., Rickard, M. and Lorenzo, A. (2023) 'ChatGPT and large language model (LLM) chatbots: The current state of acceptability and a proposal for guidelines on utilization in academic medicine', *Journal of Pediatric Urology*, 19(5), pp. 598–604. Available from: https://doi-org.uniessexlib.idm.oclc.org/10.1007/978-3-030-78645-8_8 [Accessed 9 September 2024].

Kopp, M., Gröblinger, O. and Adams, S. (2019) 'Five common assumptions that prevent digital transformation at higher education institutions', *INTED2019 Proceedings*, pp. 1448–1457. Available from: https://doi.org/10.21125/inted.2019 [Accessed 9 September 2024].

Leontyeva, I.A. (2018) 'Modern Distance Learning Technologies in Higher Education: Introduction Problems', *Eurasia Journal of Mathematics, Science and Technology Education*, 14(10).

Liasidou, A. (2023) 'Inclusive pedagogies in digital post‐Covid‐19 higher education', *British Journal of Special Education*, 50(1), pp. 6–27. Available from: https://doi.org/10.1111/1467-8578.12436 [Accessed 9 September 2024].

Limniou, M. and Smith, M. (2010) 'Teachers' and students' perspectives on teaching and learning through virtual learning environments', *European Journal of Engineering Education*, 35(6), pp. 645–653. doi: 10.1080/03043797.2010.505279.

Moore, J.L. (2012) *International perspectives of distance learning in higher education*. Benson, A.D. and Moore, J.L. (eds.). Rijeka, Croatia: IntechOpen.

Power, R. (ed.) (2022) *Technology and the Curriculum: Summer 2022*. Ontario Tech University. Available from: https://pressbooks.pub/techcurr20221 [Accessed 9 September 2024].

Stecuła, K. (2023) 'Identifying diverse uses of virtual reality in higher education and exploring perceptions of VR in the chosen field', *Scientific Papers of Silesian University of Technology. Organization and Management Series*, 2023(181), pp. 549–565.

Tosheva, S. and Martinovska, C. (2011) 'Adaptive E-learning System in Secondary Education', *International Journal of Emerging Technologies in Learning (Online)*, 7, pp. 36-41.

Urmeneta, A. and Romero, M. (eds.) (2024) *Creative Applications of Artificial Intelligence in Education*. Cham: Springer Nature. Available from: https://directory.doabooks.org/handle/20.500.12854/138889 [Accessed 9 September 2024].

Vergara, D. et al. (2022) 'Educational trends post COVID-19 in engineering: Virtual laboratories', *Materials Today: Proceedings*, 49, pp. 155-160.

Weiss, J., Nolan, J., Hunsinger, J. and Trifonas, P. (eds.) (2006) *International Handbook of Virtual Learning Environments*. Dordrecht: Springer. Available from: https://link-springer-com.uniessexlib.idm.oclc.org/book/10.1007/978-1-4020-3803-7#bibliographic-information [Accessed 9 September 2024].

Wright, G., Volodarsky, S., Hecht, S. and Saxe, L. (2023) 'Student satisfaction and the future of online learning in higher education: Lessons from a natural experiment', *Online Learning*, 27(1), pp. 336-355. doi: 10.24059/olj.v27i1.3224.