POST-COVID-19 UNIVERSITIES: OPPORTUNITIES AND CHALLENGES FOR TECHNOLOGY-ASSISTED EDUCATION

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ABSTRACT

The study is aimed at better understanding responsiveness of contact universities to technology-assisted education Post-Covid-19 pandemic. The suggestion is that a strong relationship exists between positive technology application in teaching and disciplines acceptance of technology. Without disciplines acceptance of technology, its application in teaching poses a challenge. When compelled, *force majeure*, to rely on technology to save an academic year, contact universities showed resilience. Students' laptops were hastily organised and synchronous online learning ensued. The application of technology in a particular context and this way is called a factor set 1. Two such factors appear in literature as the first factor set which entails synchronous technology-as-utility factor set 1 (FS-1) and asynchronous technology-as-essence factor set 2 (FS-2). There was, however, a need to develop a framework to better understand how technology is applied within the education context. Furthermore, we employed Peer Conversational Interviews with five teachers with less than five years of teaching experience and those possessing more than fifteen years teaching experience. These data were supplemented with data drawn from exploratory descriptive analysis of literature. These data collection efforts were intended to find out whether contact universities applied technology using FS-1 or FS-2 and implications of such decisions in reimagining contact universities beyond Covid-19 pandemic. Results show a strong relationship between disciplines such as IT and Engineering and the positive application of technology in terms of FS-2. They also show that post-pandemic, students are gradually warming to online teaching

offerings. There is a need to provide more support to disciplines that show a lackadaisical attitude towards technology application in their areas.

Keywords: remote learning, technology-assisted education, Covid-19 pandemic, technology-as-utility, technology-as-essence

INTRODUCTION

During the COVID-19 pandemic, contact universities across the globe were faced with a hasty implementation of emergency remote learning. Technological gadgets that enable remote learning were hastily organised and the synchronous, technology-as-utility factor set was implemented *force majeure*. This meant that students and lecturers met online at a specific time to allow for teaching to take place (synchronous) and technology use was reduced to what could be achieved within the operational efficiency of contact universities. This means that contact universities had little interest in innovating themselves in light of these new developments (Ali 2022; Czerniewicz 2020; World Bank 2020). We look closely on opportunities proffered to universities post-pandemic in respect of technology-assisted education. Our interest is also on the challenges such opportunities pose to entrenched university cultures and operational efficiencies and even whether these cultures and operational efficiencies should matter when technology is used in higher education or whether the disruptive nature of technology application in education should be allowed to thrive. The focus of study is on physical contact universities and their post-pandemic conditions and how these universities' environments leverage remote learning and attempt to meaningfully theorise and reimagine it beyond its pandemic conceptions. We begin our analysis of these institutional conditions during and post-pandemic using an exploratory descriptive design and a qualitative research approach.

This approach to research has historically been used when concepts under investigation are vague such as remote learning, factor sets of technology application and universities' environmental conditions post-pandemic. These concepts require clarity to enable theorisation and re-imagination of technology-assisted university education post-pandemic. Polit and Beck (2012) argue that exploratory descriptive design in a qualitative research approach is particularly significant in uncovering the full nature of a poorly understood phenomenon. In the next sub-sections, we provide a fuller description of this qualitative research approach to make a case for its use in this article. We further make use of what Jansen (2023) calls Peer Conversational Interviews (PCI) to refer to invitational but powerful conversations in which participants are experts and highly experienced individuals in their areas of academic specialty. In our case, the conversations involve higher education teachers with masters and terminal degrees qualifications and less than five years and more than fifteen years' experience. PCI is

also discussed under the research methodology to follow in the next sub-sections. Variations in teaching experience are intended to determine whether this factor plays a role in technology acceptance and application. We focus first on the basics of technology application in environments such as universities through the use of a new model first introduced in the book written by Pitso (2023a). The model looks into issues of technological access as a necessity that enables technology acceptance and application in various contexts. Without access to these basics then technology-assisted education is impossible to implement. Hence, availability of technology infrastructural capacity is the prerequisite for technology-assisted education. The second factor in technology-assisted education is acceptance. In environments where technology is applied, acceptance is key to proper application of technology in these contexts. Third, we look at how technology is applied in a particular context such as a university involving either synchronous, technology-as-utility factor set (FS-1) or asynchronous, technology-as-essence factor set (FS-2). Figure 1 under the Conceptual Framework further elucidates these concepts. We argue that universities Environmental Forceful Factor (EFF) is critical in determining whether a university would apply technology moderately, optimally or addictively hence, these application variables are at the centre of our investigation. The questions that drive the study are:

> What opportunities are there for contact-based universities to leverage capabilities of technology in education in order to optimise its potential to enhance education and what challenges do these opportunities pose to universities?

This question involves the Environmental Forceful Factor as enabler or hindrance to technology application in teaching and learning, factor sets synchronous, technology-as-utility and asynchronous, technology-as-essence as well as use of Chat-GPT and AI capabilities to support students learning.

CONCEPTUAL FRAMEWORK

Technology use in contact sessions is not necessarily a new thing as these institutions across the globe had already implemented blended learning in various levels of quality (Tshabalala 2014; Van Rensburg and Uguttu 2022). In order to develop a better understanding of technology use in higher education, we have adopted a model developed by Pitso (2023a) called Technology Access, Acceptance and Application (TAAA) Model (see Figure 1). The first aspect of the model entails access at two levels. Firstly, Access to technology relate to availability of technological infrastructure to enable staff and students to use and apply technology. Universities, at the time of the Covid-19 outbreak, were underprepared to implement remote learning in terms of technological infrastructural readiness (Torres and De la Cruz 2022; Li and

Lalani 2020; Pohkrel and Chhetri 2021; Pitso 2023b; Pitso 2023c). Without a proper readiness to implement remote learning, universities had to hastily organise laptops and, in some cases, even use smart mobile devices in cases where students and staff possessed such gadgets. There was also a total closure of universities so that students and staff had to learn and work from their homes. This home study was a major blow for effective delivery of remote learning as it imposed other challenges. Firstly, the home conditions were mostly not conducive for remote learning. Data had to be made available and this was sometimes quite sporadic. There was also lack of consistent supply of electricity, a necessity in technology use, because of load-shedding in South Africa. Rural and peri-urban students were particularly vulnerable given that access to electricity in South Africa remains a challenge (Pitso 2023a). Universities' use and application of remote learning became a microcosm of the South African society with high levels of inequality in terms of access to electricity, varying living conditions and data access. Access to technological infrastructure is particularly important to break even so that all citizens can leverage benefits of technology and eliminate the digital divide. Another major challenge on access to technology relates to how it was applied during the pandemic. Given that most universities in South Africa were using blended learning, that is, applied technology-based instruction in a synchronous and technology-as-utility factor set. This means that teachers and students met online in terms of a strict time schedule and in a manner that is not disruptive, so the operational efficiency of universities remained intact.

Technology was accepted in universities on the basis that it supplemented in-person contact sessions and technology application was moderately implemented so that universities adapted to technology application in lieu of optimising its use in learning and teaching. This limited access to technology-assisted education. There is also institutional culture that Hayes (2017) describes as obsessed with efficiency and hierarchy which earlier around 2011 was described as the *Rise of an All-administrative University* by Ginsberg who observed a power shift from faculty professors to HR as a practical means of compromising academic freedom for bureaucratic management. The nature of research is that it thrives under academic freedom and cannot thus be managed as a practice with tools of efficiency, control, calculability and predictability. Research is impossible to outline in advance and anticipate its outcomes or outputs. This is not its primary purpose. Its *raison d'etre* is to generate knowledge by confronting big unknowns in a qualitative descriptive form (Du Plooy-Cilliers, Davis and Bezuidenhout 2021). Research can thus not function within efficiency mode that seeks achievement of clear outcomes within specified time-frames using known strategies. This strategic approach would definitely ensure institutional operational efficiency but quite inimical to ideals of science and research which are essentially epiphanic and not possible to outline in

advance. Drawing its origins from Leiden University around 1575, academic freedom is intended to keep power, choice, decisions about research and teaching in the hands of academics and be exercised without any sort of administrative rigmarole that tends to stifle and compromise research work. There is significant research that needs to be conducted as society migrates into deep cyberspaces and into the cognitive age. This digital society is still a human-centred society with new demands that humanity develops its intelligence and ingenuity as conditions of benefiting from this new society set to intensify around 2025 (Fukuyama 2018). It is the true quest of society 5.0 to pursue a better life for all of humanity that imposes new demands on universities to eliminate relics of racialism, inequality, neo-liberal economic ideology including its business nomenclature such as strategy, branding and bigotry that were allowed to encroach in universities during apartheid (Taylor and Taylor 2010).

These narrow ideas made their presence in universities because academic freedom was compromised during apartheid and cannot be allowed to continue under guises of instruments such as institutional efficiency that facilitate neo-liberalism in higher education. Further encroachment of these neo-liberal ideas in universities precincts are not only inimical to universities conceptions thoroughly thought out in the 18th century. This business and bureaucratic culture in higher education compromises the ideals of these hallowed spaces. It boggles the mind as to how university professors become technocrats. Once they become incorporated into university administration, they become bureaucratic instruments that compromise ideals of a university and then serve narrow business interests. The ideals of Taylorism scientific management are inimical to academic freedom hence universities acceptance of technology is moderate to protect Taylorism operational efficiency. Technology has to be allowed to be disruptive in universities as leader of society and function in an asynchronous way where students gain full control of their own learning. Pitso (2023a; 2023b) raises the following critical elements of disruptive technologies in universities:

- University education will stream online similar to Netflix beyond 2030. The de-distancing of universities would soon become ubiquitous as access to universities enabled by students' easy access to technologies would soon be available at a touchscreen level of laptops and smart mobile-phones such as folder Z3 and its variants.
- Students would be able to curate their own personal curriculum drawing educational courses from universities across the globe. The days of students registering at one university under a strictly designed curriculum would soon be over. The idea of a universal and unproblematic knowledge is over as knowledge status would constantly change as research takes precedence under academic freedom and new knowledge emerges that

contests extant knowledge and its saliences. After all, the days of absolute knowledge are over as knowledge is now considered as informed conjecture (Creswell 2013). This is a very fluid and dynamic space of research where notions of efficiency, control, predictability and calculability become entirely quaint. It is a space of uncertainty and unpredictability, a space of disruption where new technologies become integral to that disruption. New technologies develop constantly. Take the case of chat-GPT with its variants meaning in which, when research its earlier version, a new variant is already in existence, making the research space fluid and disrupted, both of which are a good thing. There is already chat-GPT-4 Turbo that can extract information from as early as April 2023 (Davies 2023). Research has to go beyond adapting to optimally using and applying technology as integral part of research life. Big research analytics have to be normal part of research now. This is application of technology-as-essence because under these circumstances, research and education apply latest variants of technologies such as chat-GPT-4 Turbo or metaverse immersive technologies. Universities across the globe would have to develop a universal accreditation system and university teachers would have to assume new responsibilities including helping students to curate new pathways for learning. Teaching, research and community engagement in this study is understood as learning. Teaching is individual level learning because an individual learns about knowledge unknown to the individual but known by others in the discipline. Research is collective learning as we learn about something new in the real sense and community engagement is learning at a local level (Bowden and Marton 1998) with a strong recognition of regional ontologies in education.

- Students would take online assessments as and when they are ready and such assessments would focus mainly on productive thinking and eliminate the mimetic epistemology that replicate extant knowledge which chat-GPT and its variants make available to students at the touch of a laptop or mobile screen. The overreliance of undergraduate studies on known, existing knowledge is increasingly becoming a relic of the past as terabytes of knowledge are easily accessible via advanced technologies such as chat-GPT and its variants.

It is clear that the access factor in the model goes beyond infrastructural readiness to allow use of technology in education. It is also about access to new opportunities to learn differently and in an empowering way while new challenges also emerge. These new opportunities and challenges around technology-assisted education post-pandemic have to be better understood so universities could earnestly seek their higher designs beyond physical buildings. We

elaborate on some of these issues in later sub-sections of this article. However, we suggest that Factor set 2 (FS-2) would lead universities to their next higher design beyond operational efficiency into a disruptive learning and teaching environment where academic freedom and students learning is essentially heutagogic (self-determined), paragogic (peer learning) where peers could, in the near future, involve intelligent robots and telagogic online, streaming like Netflix where students curate personal curricula and a universal accreditation system exists (Pitso 2023a).

Technology acceptance is the first step towards complete adoption of technology in a particular environment and, for our purpose, in education in particular universities. Conditional to technology acceptance and later adoption is the idea of how a university environment is essentially organised. Universities that mimic Macdonald's Food Outlets in terms of operational efficiency (Hayes 2017) and measurability of outcomes under strict control and predictability conditions would tend to accept technology in what is termed conditional pragmatism. The first part of conditional pragmatism on technology acceptance occurred during the Covid-19 pandemic but was mostly driven by *force majeure*, that is, it occurred under emergency conditions. The second part of conditional pragmatism occurs post-pandemic where the propensity to revert to in-person contact sessions is strong and technology use is mostly moderate meaning universities seek to adapt technology to its operational efficiency. This approach to technology acceptance in universities is viewed as counterproductive because the issue is not only about technology-assisted education but also about the huge societal move towards a society that would be regulated via cyberspaces and universities have a responsibility to ready our societies for optimal application of technology in their lives, learning and work or risk irrelevance. The macro-level acceptance of technology, the society level, has to guide technology acceptance at a meso level of a university, then that would occur at a micro level of an individual.

This analysis of technology acceptance is useful because it is clear that the meso-level of technology acceptance is the most crucial for both society and individuals. Universities post-pandemic approach to technology acceptance is dependent on two factors. Environmental Forceful Factor 1, as characterised by a dominant, rigid bureaucratic culture, abbreviated as EFF-1. It involves university management attitudes toward honouring neo-Taylorism operational efficiency (Hayes 2017) in which case technology acceptance is moderate and regulated within this business operational efficiency. This business efficiency-driven management model has a negative impact on the basic functionalities of a university which are research and teaching. It impacts research negatively in the sense that calculability and research control become ubiquitous and compromise academic freedom and result in the following:

- The existential risk to research which is when research is reduced to impactful outcomes. Upstream and blue-sky research, which are almost impossible to evaluate on their impact on reality and practices in the short to medium term, are often marginalised as research succumbs to neo-Taylorism all-administrative university ambience. Every effort made to ensure dominance of neo-Taylorism operational efficiency in universities entrenches a counterproductive culture of narrow pragmatic perspective of research impact and even the evaluation of slow burning research impact has negative consequences.
- Measuring research output to reward research excellence is equally negative in that it pursues narrow neo-Taylorism operational efficiency (Pitso 2021).
- Short to medium term research productivity indicators that include the number of published articles and books, citations, h-index and direct impact are measures that do not serve the ideals of research well.
- Boggling down research administration to universities administrative rigmarole and frustrating researchers' timelines and adding unnecessary stress to an already high-level stressful research endeavour does not serve the interests of research and would have a negative consequence to research work in the long run.

This EFF-1 also has a negative impact on universities teaching endeavours:

- The continued use and insistence on a child of the west teaching model called pedagogy remains one of the egregious anomalies of 21st century universities. Pedagogy ought to have been restricted to basic education at a primary level. It has no place in higher education as only young adults access such a level of education. It is thus *infra dignitatem* to young adults at universities.
- The incentive-based teaching and assessment approaches defined in terms of accreditation, promotions and graduations deify the application of classical, operant and ratomorphised human behavioural model that reduce students to levels of extrapolated animal behaviour. It is not clear how universities allowed such constructs to shape its operations given that this behavioural research traces its origins to after the second world war research endeavours of Behavioural Psychologists such as B.F Skinner. Prior to the war, Skinner was reluctant to extrapolate his animal experimentation results to human behaviour understanding that attempting to regulate human behaviour at this level was an *infra dignitatem*, way below human dignity. Post-war, Skinner succumbed to the dictates

and contingencies of war and insisted that behavioural principles applicable to animals now have wider applicability even to human levels and organisation of society as well as its constituent organisations such as educational institutions (Capshew 1993).

The continued insistence on EFF-1 in universities not only vitiates the universities project and its research as well as teaching but now has a direct effect on the application of technology in education. This often involves application of synchronous and technology-as-utility factor set 1 (FS-1) with moderate and adaptability of technology to operational efficiency of universities (Pitso 2023a) as suggested earlier. Adapting universities have no interest to transform or experience fundamental change on their DNA. They seek cosmetic and superficial changes that sustain their traditions as influenced by business and Behavioural Psychology principles suggesting a serious cognitive warfare between purist universities' ideals in research and teaching that thrive on EFF-2 conditions as well as the efficiency-driven universities' ambiences as shaped by EFF-1 conditions.

Environmental Forceful Factor 2 (EFF-2) (adhocratic culture) entails university management attitudes and upholding of academic freedom which functions optimally under environments that leverage individual initiatives and self-organisation in lieu of defined rules and hierarchies as in Environmental Factor 1. EFF-2 tends to have a high tolerance of and open to highly disruptive newness hence it provides increased support to initiatives that empower individuals to be innovative, learn independently and declare the university progressively unnecessary in the learning, research and work of individual experts. These are spaces of asynchronous, technology-as-essence factor set 2 (FS-2).

The third stage of technology adoption after access and acceptance is technology application that can occur at three levels – adaptive, optimal and addictive. As already stated, moderate adoption of technology application in education seeks to adapt technology to operational efficiency of a university (Pitso 2023a). It tends to prefer synchronous application of technology in education and reduces it to utility meaning use versions of technology with least disruptive tendencies, factor set 1 (FS-1). Those institutions that prefer optimal application of technology and allow latest versions of advanced technologies in line with factor set 2 (FS-2), tend to have a high tolerance of disruptiveness and tend to create and sustain EFF-2 where staff and students are empowered to take initiative, self-govern as administration's role is limited to technocratic work and professors regain faculty power on matters of research and teaching. Addictive adoption is the extreme version of technology application which is an issue worthy of being investigated but not relevant in this article. In the study intended to determine the effects of optimal application of technology on university students learning and whether

they result in greater well-being, intelligence and ingenuity, Pearce (2021) and Pitso (2023a) studies show that such learning:

- Enables highly inclusive, student-centred learning environments similar to EFF-2 university conditions. This means that active agency of students in their own learning becomes crucial and critical when technology is optimally utilised in students learning. This is because optimal technology application in education enhances collaborative opportunities across disciplines and fosters global networks as well as global multi-disciplinary e-collaborations as enabled by cloud computing. Pitso (2023a) study confirms the transition of students learning from lecturers to students with increasing physical distance but closer collaborative cyberspaces. There is also evidence from Pearce (2021) and Pitso's (2023a) studies that with increased optical application of technology in education, students' motivational levels, as well as their emotional well-being, increase as they take greater control of their learning, and their dignity as young adults is restored. One of the critical findings in Pitso's (2023a) study is that the perennial use of pedagogy in universities, a profound infra dignitatem, represented an egregious impugnment of university students' dignity as young adults.
- Transcends geographic limitations as pixels mobility allows students to collaborate across continents and set goals with other students, they would not be able to reach in in-person contact sessions. The opportunities to network across worlds and develop powerful relationships with students one has never met physically become so ubiquitous that it becomes disruptive of traditional modes of learning. There are indeed great opportunities that technology application proffer to students and universities but there has to be equal access to technological infrastructure and resources, reliable supply of electricity, use of factor set 2 (FS-2) in universities application of technology in education and a conducive university environment along the lines of EFF-2 as stated earlier. Figure 1 provides a summary of these ideas about technology-assisted education.

RESEARCH METHODS

Peer Conversational interviews (PCI)

These experts' interviews are designed to promote powerful, dedicated interactions between the experts on the field or topic under investigation and the interviewer who is equally an expert in the same area (Jansen 2023). Critical in this type of interviews is that the interviewer becomes

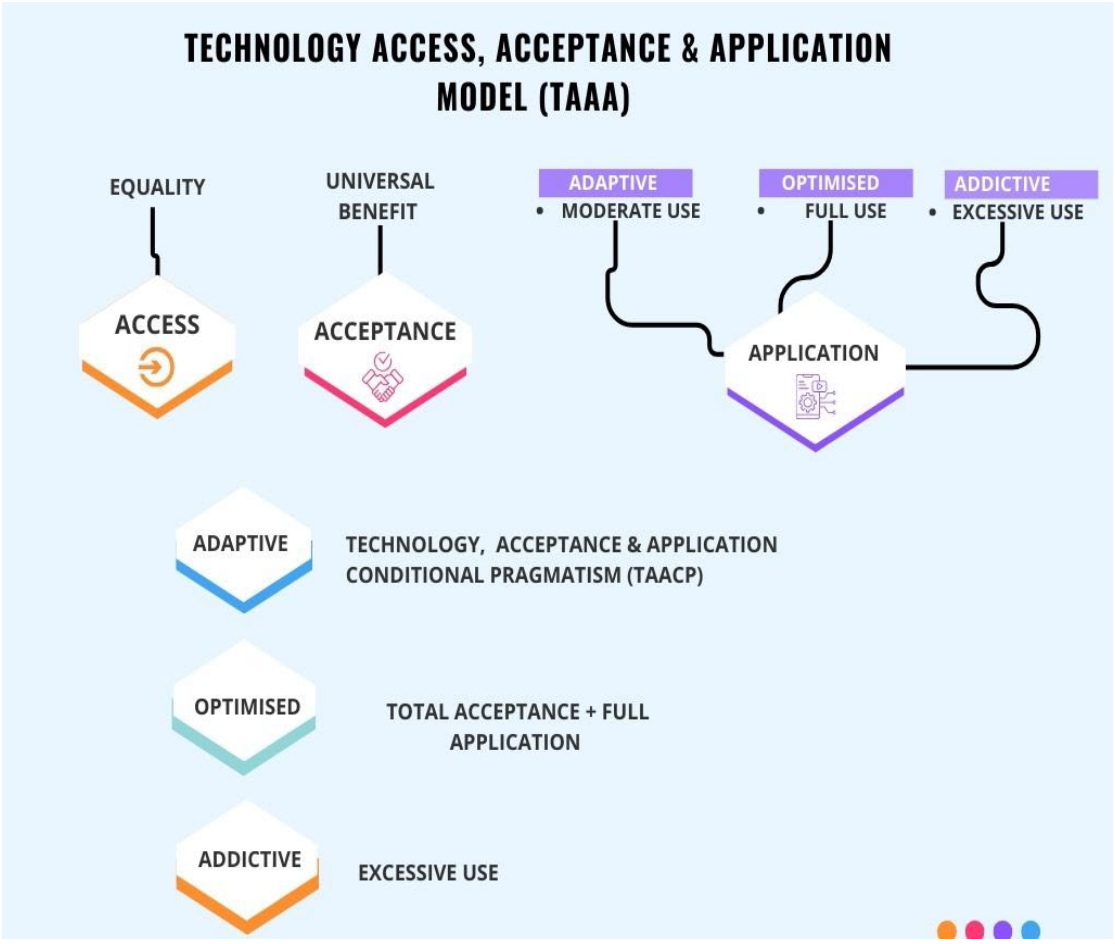

Figure 1: Technology access, acceptance and application model (TAAA)

interwoven in these discussions and contributes to the data being gathered. PCI has a strong insider's perspective, the emic view and reveals important insights from participants who are exposed to the internal environment and its inherent cultures. It is expected that these conversations reveal:

- The dominant Environmental Forceful Factor (EFF), that is, the culture and conditions under which technology-assisted education occur. Technology Application in educational settings can either occur in ways that retain operational efficiency or lead to disruptions of entrenched cultures and practices so that a state of entropy exists and requires new ways of doing and new practices.
- The dominant factor set and how it explains the level of technology application in education and whether it is at an adaptive, optimal or addictive levels. Furthermore, these conversations identify whether FS-1 or FS-2 is a preferred approach to technology application and the implications of such technology applications to the future of a

university and students learning as society migrates into deep cyberspaces.

- The changing roles of teachers as technology-assisted education takes precedence.
- Technology infrastructural challenges in terms of ensuring equal access to resources irrespective of socio-economic conditions of students.
- Key constructs of society 5.0 and its strong inclination towards epistemic, social and economic justice, green economy and domination-free society with diverse cultures that make our global society a cosmopolitan society.

Exploratory, secondary descriptive qualitative research design

The design of this type of research is applicable when the topic is generally emerging, vague and there is an attempt to describe the rationale behind the functionality of a particular phenomenon (Hunter, McCallum and Howes 2019). Polit and Beck (2012) suggest that such a research design is intended to uncover the full nature of a poorly understood phenomenon such as a post-pandemic technology-assisted university education. In our research design, we used secondary exploratory descriptive design to search and identify articles on post-pandemic technology-assisted university education. Furthermore, we restricted our search to research articles of 2020-2023 as they cover both the pandemic and post-pandemic era of remote learning and latest theorisations about technology-assisted university education. It was necessary to use such a timescale because conditions of remote learning and post-pandemic technology-assisted university education are equally under investigation and range from societal, university and individual levels. This would aid analysis and identification of challenges and opportunities that post-pandemic era impose on technology-assisted university education. We categorise these challenges and opportunities at a societal, university and individual level. We have reason to believe that this is an exploratory endeavour that is based on current analysis of literature mainly on remote learning. Figure 2 under the Theory of Technology-assisted Education sub-section provides the basis for analysis of post-pandemic theorisations about technology-assisted university education.

RESULTS

PCI Results

The relationship between university education and technology at the level of students learning has gone through some variations. Increasingly prior to the Covid-19 pandemic, contact universities have been attempting to implement blended learning defined as technology-mediated instruction. Evidence adduced from PCI which involved eight experts (N=8) that

Table 1: Data Analysis Matrix (Interviewed undergraduate lecturers: L-1 to L-8)

	Under five years of teaching experience			**More than fifteen years of teaching experience**				
Used blended learning prior pandemic	L-1 MS No	L-2 ASC Yes	L-3 ASC Yes	L-4 E&T No	L-5 E&T Yes	L-6 HS No (Trained to use Blackboard before)	L-7 HS No	L-8 HS No
Used remote learning during the pandemic	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Digital resources used	Laptop Cell-phone	WhatsApp Voice-Notes Teams Zoom	WhatsApp Slides Blackboard Zoom Teams	Digital textbooks Vutela (VUT Blackboard) Aeon XR Videos	Blackboard Cengage Zoom Webex	Voice-notes Blackboard Collaborate WhatsApp	Computer iPad iPhone	Cengage Google Blackboard Moodle
Used strict timetable schedule to meet with students during remote learning sessions	Yes		Yes	Yes Provision for online consultation	Yes	Yes Provision for other online lessons Consultation	No	Yes Flexible for online consultation
Students accessed online learning at their own time, anywhere during the pandemic	Yes Recordings		Yes Recordings	Yes Recordings		Yes	Yes	Yes
Students meet with teachers post-pandemic online most of the time	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Students meet with teachers post-pandemic least of the time	Yes	yes	Yes No money to attend classes Failure to adjust to campus life Anxiety meeting other students	Yes	Yes	Yes	Yes	Yes
Students access educational courses or lessons online most of the time post-pandemic	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Students access educational content	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No

	Under five years of teaching experience			More than fifteen years of teaching experience				
least of the time post-pandemic								
Students have all the necessary resources to study online	No		No	No	No	No	No	No
Lack of resources such as electricity, technological gadgets, data affect full use of technology in education	Yes Network presence Dependence on limited online resources No extra effort by students		Yes No data No laptops No Internet connection No electricity	Yes No resources No equipment No laptops No cell-phones	Yes No WIFI Loadshedding No network No laptops No data	Yes No data No network	Yes Connectivity Electricity outage Other sophisticated devices/ gadgets (for students)	Yes No network (in remote areas) Loadshedding
Other challenges	No concentration (students) Absenteeism No agency (active participation in class) Over-reliance on recordings for assessments Lack of interest to read		Anxiety/ Uncertainty Absenteeism	Not accustomed to blended learning	Student resistance Lack of funding	Number of students (Many students) Absenteeism Shortage of space (classes) Cleanliness	Lack of class attendance (post-pandemic)	Lack of class attendance (post-pandemic)
Management attitudes toward technology use in education is positive or negative	Not clear	Positive	Negative	Positive but bought sub-standard devices for students	Positive	Positive	Positive	Positive
The university environment supports full application of technology in education	Not fully		No University is a contact learning institution	No No funds for software	No No data, no quality laptops, no internet, no electricity	No No resources, no equipment, no laptops, no university cell phones	Yes No WIFI, loadshedding, no network, no laptops, no data	No (Computers not working)

Management Sciences (MS), Applied Science and Computer Studies (ASC), Engineering & Technology (E&T), Human Sciences (HS)

teach undergraduate studies at one university shows that despite blended learning implementation at this university prior pandemic, it had not reached all undergraduate teachers (five of the eight respondents have not been using blended learning). There is also a tendency that emerges in the qualitative data that shows that undergraduate lecturers that apply blended learning come from the IT and Engineering departments (three of eight respondents). This does not mean that that all lecturers in IT and Engineering necessarily applied blended learning indicating that technology application in this university's education is not necessarily a priority. This finding is consistent with literature on blended learning implementation in universities (Ma'arop and Embi 2016; Tshabalala, Ndeya-Ndereya, and Van der Merwe 2014; Cloete 2020; Ali 2022).

Blended learning essentially involves lecturers and students meeting online to foster students-learning based on a strict timetable, meaning a synchronous application of technology to education. The pandemic implementation of remote learning appears to have signified the role of online learning implementation as all interviewed respondents made use of it. The infrastructural capacity to implement remote learning, compelled *force majeure*, was hastily organised as students had access to laptops but proceeded synchronously at this university and across the globe. Another way of effecting remote learning involved lesson recordings that, while not too popular, ensured an asynchronous application of technology in education. The interviewed respondents all agree that the infrastructural capacity to implement remote learning was generally poor during the pandemic, pointing out challenges around the internet, WIFI, electricity outages, data availability, funding availability for software, uneven distribution of laptops, health issues related to remote learning such as anxiety and, low motivation of students in using technology. On the whole, this university lacks the infrastructural capacity to successfully implement technology-assisted education and its environment is generally inimical to technology-assisted education.

Some of the respondents' comments on technology infrastructural capacity of this university include: "dependence on limited online resources", "no data, no quality laptops, no funds for software updates, weak internet connection, load-shedding". All eight respondents agree that the infrastructural capacity of this university for application of technology-assisted education is poor, and the institutional ambience is more reflective of EFF-1 which limits the optimal application of technology-assisted education.

However, there is growing tendency that students prefer online learning, and their physical contact attendance is dropping. Six of the respondents complain about high students' "absenteeism", "lack of class attendance".

Lastly, there appears to be no significant difference in the application of technology

between lecturers teaching experience as the main motivating factor appears to be the academic discipline that appears to show a strong relationship between academic disciplines inclined towards IT and Engineering and positive application of technology in education.

Exploratory descriptive secondary research

Table 2 outlines variations in use of technology in different contexts and the challenges experienced in each context drawn from the exploratory descriptive, secondary research.

CONCLUSIONS AND CRITICAL DISCUSSION

Primary and secondary data from this study show that two main factors contribute to the successful or unsuccessful application of technology-assisted education. The first of these factors is infrastructural capacity of an institution. Proper evaluation of this institutional capacity determines issues relating to access to technology devices and gadgets for both lecturers and students. It can reasonably be inferred that without proper infrastructural capacity of an institution, efforts to implement technology-assisted education would amount to nought. Huge investment to technological infrastructure is a prerequisite for successful application of technology-assisted education. The Environmental Forceful Factor is also a key determinant in the successful application of technology-assisted education. Institutions with a string EFF-2 are more likely to support and successfully apply technology-assisted education. There is also a strong indication that these institutions are more likely to allow an asynchronous application of technology to education allowing for the complete overhaul of education alongside what Pitso (2023a; 2023b) calls telagogy, an online asynchronous streaming learning that can be accessed anywhere and anytime at the behest of students. It can also be argued that the role of lecturers, particularly at an undergraduate level, would change significantly under technology-assisted education leading to new challenges and opportunities. Challenges would involve a shift from direct involvement in students learning to background work that input technology-assisted education, developing online learning techniques and support to optimise students learning and assisting students to curate new learning pathways. It can thus be argued that institutions that seek to fully embrace technology-assisted education have to overcome the following challenges as adduced from evidence collected in this study:

- Weak infrastructural capacity. Staff and students access to relevant technological gadgets and devices is a prerequisite.
- Access to unlimited electricity and data.

Table 2: Challenges of Technology Use (access, acceptance, application) in Universities

	Articles used	Pre-pandemic Challenges	Pandemic Challenges	Post-pandemic Challenges
Society 5.0 technology use	Owusu-Agyeman, Y., T. Mugume. 2023. "Academic adjustment of first year students and their transition experiences: The moderating effect of social adjustment." *Tert. Educ Manag* 29: 189–209. https://doi.org/10.1007/s11233-023-09120-3. Patrick, H. O., R. T. I. Abiolu, and O. A. Abiolu. 2021. "Reflections on COVID-19 and the viability of curriculum adjustment and delivery options in the South African educational space." *Transformation in Higher Education* 6(0), a101. https://doi.org/10.4102/the.v6i0.101. Pokhrel, Sumitra and Roshan Chhetri. 2021. "A Literature Review on Impact of COVID-19 Pandemic on Teaching and Learning." *Higher Education for The Future* 8/1: 133– 141. https://doi.org/10.1177/2347631120983481. Tsegay, Samson Maekele, Muhammad Azeem Ashrag. Shahnaz Perveen, Mulugeta Zemuy Zegergish. 2022. "Online Teaching during COVID-19 Pandemic: Teachers' Experiences from a Chinese University." *Sustainability* 14(1): number 568. https://doi.org/10.3390/su14010568. Pitso, T. 2023a. "Telagogy: New Theorisations about Learning and Teaching in Higher Education Post-Covid-19 Pandemic." *Cogent Education* 10(2): 1–17. Haldane, J. 2022. Editorial Comment. *Journal of Education* 10(÷): 1.	• Societal and universities transition from information to digital age infrastructural capacity • Leveraging capabilities of the 4th Industrial Revolution. Moderate acceptance of advanced technologies • Eliminating all forms of injustice, epistemic, social and economic • Digital divide • Equal access to technological infrastructure including rural areas, people in low socio-economic status	• Under preparedness of universities to implement remote learning	• Universities transition to telagogy, a web-based online streaming learning practice is low (Pitso 2023) • Elimination of schadenfreude & epicaricacy lacks universities commitment • Use of equitable and just frameworks in cosmopolitan society remains elusive (Haldane 2022) • Society remains insulated and far-removed from the theoretics of the university world.
University technology use	Wangenge-Ouma, G. and T. Kupe. 2020. "Uncertain Times: Re-Imagining Universities for New, Sustainable Futures." https://www.usaf.ac.za/wpcontent/uploads/2020/09/Uncertain-Times-Paper.pdf. Anthony, W., P. Levine-Brown, N. Fynn, P. Gadzekpo, and M. Spinks. 2020. "Technology Considerations and Opportunities in Higher Education." *Journal of College Academic Support Programmes*. National Center for Developmental Education.	• Ensuring equitable access to technological infrastructure by all students • Equal access to affordable data • Cost effective for both the university and student • Issues of safety regarding the housing of special instruments	• Remote working • Internet connectivity • High Costs of Data	• Internet Connectivity and High Data costs remain • Sourcing, procurement, and supply chain management of technology has not been a straightforward or easy task • The perils of social media
Student use of technology	Zawacki-Richter, O., V. I. Marín, M. Bond, and F. Gouverneur. 2019. "Systematic review of research on artificial intelligence	• Costs • Connectivity	• Without free Wi-Fi and forbidden	• Challenges remain though students are definitely

	Articles used	Pre-pandemic Challenges	Pandemic Challenges	Post-pandemic Challenges
	applications in higher education – Where are the educators?" *International Journal of Educational Technology in Higher Education*. https://doi.org/10.1186/s41239-019-0171-0. Star, M. G. 2020. *Online education becomes a teacher's pet in COVID 19 crisis*. https://www.forbes.com/sites/mergermarket/2020/03/20/online-education-becomes-teachers-pet-incovid-19-crisis/#493ddfee1aa1.	• Safety of devices	from campus, technology suffered greatly	more versed and familiar with technology • Are cell phones a pivotal tool in education? Have they replaced the need for laptops? It is a question worthy of examination
Society 5.0 Technology Use	Salgues, B. 2018. *Society 5.0: Industry of the Future, Technologies, Methods and Tools*. John Wiley & Sons Tania, M. L. and F. C. Santos. 2020. "Industry 4.0 and Society 5.0: Opportunities and Threats." *International Journal of Recent Technology and Engineering (IJRTE)*. 8(5). ISSN: 2277-3878.	• Technology used a tool to make life simpler	• The growth of fear in technology such as vaccines	• Society has a general greater appreciation for technology
University Technology Use	Nyar, A. 2021. "The 'Double Transition' for First-Year Students: Understanding the Impact of Covid-19 on South Africa's First-Year University Students. Journal of Student Affairs in Africa." 9(1): 77-92. |2307-6267. DOI:10.24085/jsaa.v9i1.1429. Cloete, J. 2020. "SA universities are failing to meet the challenges of teaching during the Covid-19 lockdown." *Daily Maverick 9 April 2020.* https://www.dailymaverick.co.za/opinionista/2020-04-09-sa-universities-are-failing-to-meet-the-challenges-of-teaching-during-the-covid-19-lockdown/.	• Technology existed as an aid, albeit a non-compulsory aid	• Technology exists as a compulsory tool	• Technology, its devise role in teaching and learning became accentuated during the pandemic. Many now more 'aware' of the dangers of technology
Student Use of Technology	Goh, P. and J. E. Sandards. 2020. "A vision of the use of technology in medical education after the Covid-19 pandemic." *MedEdPublish* 9(1). https://doi.org/10.15694/mep.2020.000049.1. Daniel, John. 2020. "Education and the COVID-19 Pandemic." Prospects 49(1–2): 91–96.	• Technology as a tool to connect and make the world a smaller place	• Technology was limited. Telecommunicati on companies partnered with universities to promote a cheaper online experien9ce	• The juror is technically still out on the overall deployment of technology. If technological advancements are being reversed, then • research shows that learning has moved from content consumption to conversations around content production

- Funds to update software and buy quality gadgets. There is a view amongst some of the respondents (5 of 8) that management during the pandemic seemed to support technology-assisted education but in essence, there was no alternative. There is also a perception that the technological gadgets bought for students in the form of laptops were of poor quality and there were suspicions that what Jansen (2023) identified as chronic dysfunctionality at this university had not been successfully overcome during the pandemic. The veracity of the poor quality of laptops requires further investigation given that post-pandemic, this university and others need to embrace technology-assisted education. It is also important to determine whether these claims do not represent *ex post facto* fabrications despite the chequered history of this institution. The relevance of this claim in this study is in delineating a particular Environmental Forceful Factor that Jansen (2023) study confirms as operationally dysfunctional and, given its generally weak technological infrastructure, then it shows that technology-assisted education would not be accepted and applied optimally in the near future in this institution.
- Favourable Environmental Forceful Factor that eliminates corporate culture and restores university principles of academic freedom and reduce the undue influence of administration in matters of academia and research.

Institutions also need to leverage opportunities technology-assisted education offer such as:

- Allowing an asynchronous application of technology so it can allow technology-assisted education to optimise to its highest possible design such as the telagogic levels of learning and beyond. Use of advanced variations of chat-GPT, meta-verse, immersive technologies, cloud computing collaborations and many other such techniques.
- Shift of university business into deep cyberspaces that de-distances distance so that university education can be accessed across the globe and educational courses can be curated from any university compelling for development of universal accreditation system.
- Allow students to learn from across the globe and prepare them for a cosmopolitan global society with a strong recognition and respect for diversity.
- Transition to productive thinking and complex problem-solving away from the entrenched traditional epistemology of mimesis leading to students developing technology savviness, intelligence and ingenuity.

Adumbrating Contours of a Theoretical Framework for Technology-Assisted Higher Education

The following are emerging elements of a theory that could better explain technology

application in higher education institutions based on findings and emerging literature on technology-assisted university education:

- The supportive Environmental Forceful Factor in adhocratic organisational culture (EFF-2) with a strong emphasis on individual initiatives, self-determined programme under a flat management structure where rigid bureaucratic culture is banished. This environment is most likely to provide necessary technological infrastructure to enable all to access technology use and acceptance making its applications to be optimised in learning.
- It allows for asynchronous, technology-as-essence factor set (FS-2) that leverage latest advances in technology that support higher design of higher education at the level of online streaming educational courses similar to Netflix. It also allows use of chat-GPT and its variants, metaverse and other technology-based learning devices to facilitate mostly productive thinking. The concern with advanced technologies such as chat-GPT are weak. Firstly, chat-GPT and similar technologies can be used without plagiarism when universities shift from reproductive thinking epistemology to productive thinking that enable individual initiatives. It is the reproductive questions that encourage plagiarism not the students. It is university teachers that need to shift to productive thinking questions and allow use of these technologies in education in ways that develop students productive thinking capabilities.
- Students have to summon knowledge first from within, that is, from their regional ontologies and supplement it with knowledge from other contexts and not restricted to Global North episteme. *Know first thyself* is an aphorism first noted 14 000 years ago in Ancient Africa pre-Greek period. It refers to the need that education has to develop a strong Global South epistemic understanding, solve real problems from within communities and engage the global world in addressing global problems using a multi-disciplinary approach to complex problem-solving.

  This way, accessing and incorporating regional and global collaborators into these real problems would require use of technology to ensure e-collaborations, metaverse and chat-GPT variants in problem-solving endeavours. Universities have to leverage advanced technologies not only to facilitate online learning of Global North knowledge but to seek epistemic and other forms of justice. Historically, there has been marginalisation of Global South episteme which led to 2016 students protests in South Africa seeking a decolonised curriculum, that is, one that is based on epistemic and social justice. In order to develop a better analysis of the university study and its tendencies to legitimise a perennial epistemic

and social justice, we make use of the concept of *schadenfreude*. This German concept refers to the legitimised, socially and educationally sanctioned acts of estrangement and separateness of Global South episteme and its regional ontologies from university education. It would, in this sense, be extremely unhelpful to narrowly focus on migrating a Eurocentric knowledge with its embedded yet *infra dignitatem* pedagogy into cyberspaces. University students are young adults, and it is extraordinary that a child-centred education focused around the early 18th century on the education of the child of the west would gain global appeal and remain unproblematised and uncritiqued.

University students require heutagogy (self-determined learning), paragogy (peer learning where peer extents to robots and other advanced technologies) and telagogy (web-based online streaming learning experience). The alienation goes beyond just educational estrangement and includes loss of African identity and estrangement from one's milieu and context in order to embrace a Eurocentric posture. Universities have been implicated in this sustained estrangement of students from their conditions of their own contexts. This has resulted in powerlessness, inferiority complex, lack of control of one's destiny and real mission. Students in the Global South have been reduced to troglodytic, reactionary individuals with poor individual or collective initiative and self-organisation necessary to regain control instead of reacting to situations imposed on them by society and education institutions. Critical to addressing a sense of alienation and estrangement that university education fosters, not only should universities migrate to online learning, but their entire education has to be reworked to eliminate *schadenfreude,* the meaning of which is similar to an English equivalence of epicaricacy, a debilitating, sadistic and morbid derivation of comfort from others state of deprivation and marginalisation. In a useful study of the 2015 Fees-Must-Fall Students protests, Linden (2017) master's dissertation focused on mainly university values that were eroded in the exercise of learning, teaching and curriculum. Furthermore, students demanded reconstructed meanings of teaching, learning and curriculum with a strong elimination of coloniality and white supremacy discourses. It was a demand to remove epicaricacy in hallowed spaces of a university and a recognition of the Global South episteme as an equally legitimate discourse of university study. The Global North-Global South discursive divide had to be tackled, challenged and eliminated in university studies. Technology-assisted education goes beyond just the use of cyberspaces to enable university education but also to deal with inherent, perennial epistemic and social injustices of the past that fed on epicaricacy.

Another concept of *schadenfreude,* in addition to estrangement, is deviance, a notion that

denotes evisceration and deprivation of one's African cognitive content in order to impose foreign culture and values leading to othered self. Pitso (2023c) describes the othered self as one who abandons own culture and values to subscribe to others' cultures and values as behavioural models. It is this cognitive essence that has led to 2015 students' rebellion against university institutions that sought to sustain glaring racist epithets of a dominant western, colonial ideology and general alienation of African essence in the education of an African. The university education that makes students lose their sense of true self and lose touch of one's African cognitive content is not education at all but an indoctrination of a special kind running on the pretext of a neutral universal knowledge when in essence it is a Global North episteme which 2015 students protest sought to challenge fiercely. This 2015 debate cannot be left behind as universities migrate into deep cyberspaces. In this sense, the broader macro-level societal issues have to guide the meso-level university conditions in ways that are reciprocal such that society and universities act in such a manner as to be mutually beneficial. Universities are generally considered as leading society but where there are glaring lapses in universities then society has a responsibility to reign in universities. If this happened during apartheid and professors refused to work under apartheid university conditions, then apartheid would not have survived beyond its early stages. There was therefore no total rejection of abhorrent acts of estrangement and marginalisation of Africans by apartheid educational and social re-engineering policies. Technology-assisted education is more than just application of advanced technologies but has to focus on eliminating epistemic and social dominance, in essence, a total extirpation of epicaricacy. The last concept of *schadenfreude* worthy of attention is its inherent lack of empathy. Without empathy, university education fostered institutional conditions that led to estrangement and alienation of an African student resulting in a strong sense of dehumanisation and a sense of psychological loss. Technology-assisted education has to eliminate *schadenfreude* and de-alienate African students so a more equitable and just frameworks (Haldane 2022) could be applied to university education that is migrating into deep cyberspaces. It is loss in these university ethics that 2015 students protests sought to challenge and universities responsiveness on these 2015 debates is crucial, in the South African context, as we enter technology-assisted education precincts and journey in pixels in deep cyberspaces. Universities need to decline to decline into *schadenfreude* as was the case during apartheid and ought to pursue academic ideals of justice for all and at all levels, epistemic, social and economic if they are to function optimally in society 5.0 (Fukuyama 2018; Yaras' and Oxturk 2022; Salgues 2018; Ferreira 2018; Pitso 2023a; 2023b). All vestiges of epicaricacy have to be eliminated in order for technology-assisted education to thrive so that these cyberspaces do not become deposit boxes of bigotry, bias, epistemic, social and economic injustices of the recent

South African past. Figure 2 describes an emerging theory of technology-assisted education.

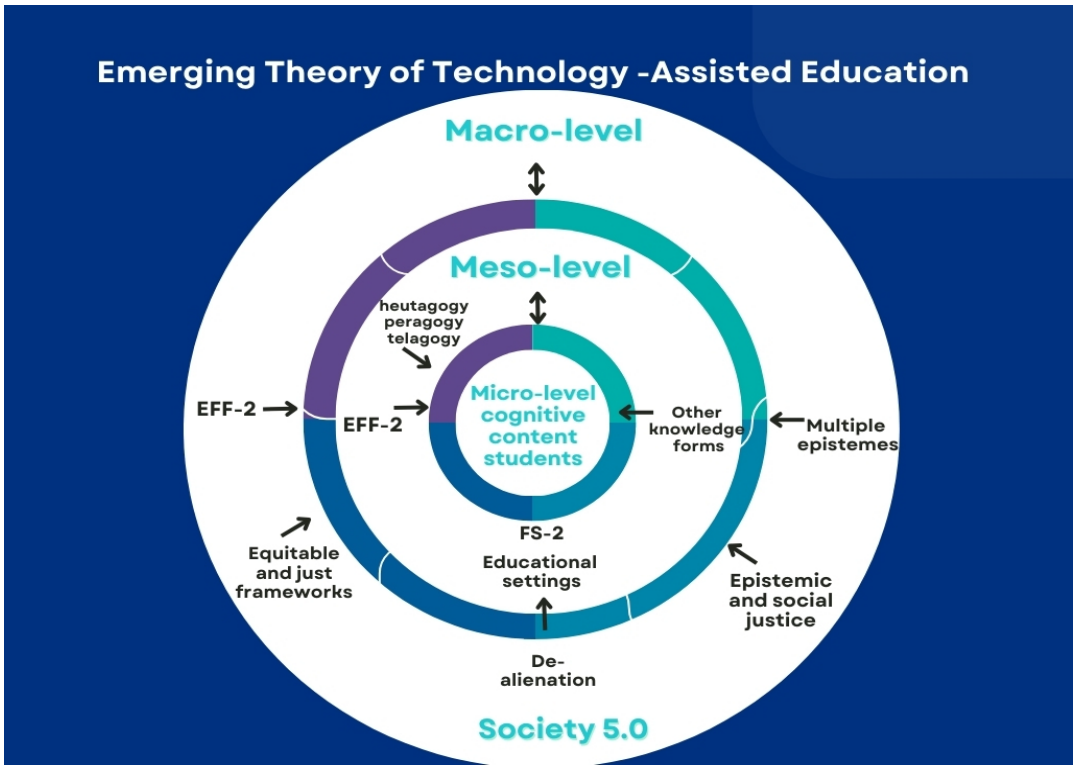

Figure 2: Emerging theory of technology-assisted education

In Figure 2, the basis of applying technology-assisted university education is the symbiotic relationship between society and universities. Given that our society is going deep into cyberspaces and optimally leverages technology in its life, learning and work, universities are increasingly compelled to rethink and reimagine their mission which remain essentially research and teaching focused. The twist is on the increasingly popular technology application and how it would iterate to telagogy beyond 2030, an online streaming learning experience (Pitso 2023a; 2023b). These emerging society 5.0 environmental conditions increasingly put pressure on universities to adopt EFF-2 working and learning conditions where active agency goes to lecturers, researchers and students with bureaucratic administration reduced to its proper status away from attempting to usurp the role of faculties and professors on teaching, research and community engagement. This would also enable the autonomy and academic freedom of researchers, scholars and lecturers to be restored. University students learning would increasingly empower students to take greater control of their learning and curriculum. These EFF-2 conditions have to guide universities conditions so that universities not only align their initiatives and operations with society 5.0 precepts, but self-correct quickly and lead society 5.0

as they currently lag behind. These societal and universities conditions would benefit individuals in society and students in universities in very important ways as their self-initiative, self-determination and self-organisation would thrive under these conditions. It is these conditions that allow FS-2 technology application in society and universities. This would, in turn, allow individuals and students to decide on the cognitive content they need to develop as a free will exercise.

The educational setting has a direct effect on choices individual students make on their cognitive content. Educational settings whose curriculum is dominated by Global North episteme would have students' cognitive content dominated by foreign knowledge and mostly bereft of contextual cognitive content, thus leading to the students protests of 2015 that demanded a decolonised curriculum. Given that South African Universities have not dealt with curriculum decolonisation in any meaningful way or even address issues of epistemic injustice between Global-South episteme then students riots may be repeated. Universities ought to realise that a new form of students' protest is brewing but would most likely assume a rejection of university curriculum as students looks elsewhere to meet their educational needs. Educational settings and technological infrastructural capacity become critical in proper implementation of technology-assisted education and broadening students access to educational courses across global universities.

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