Educational Administration: Theory and Practice
2024, 30(10), 139-148
ISSN: 2148-2403
https://kuey.net/

Research Article

Impact Of 4IR On Accounting Education In Higher Education

Dr. Mthimkhulu Terrence T[1*], Prof. Bongani Thulani Gamede[2], Dr. Joseph Chikwendu Ezennia[3]

[1*]Department of Accounting and Auditing, University of Zululand, South Africa, MthimkhuluT@unizulu.ac.za
[2]Department of Languages & Social Sciences, University of Zululand, South AfricaGamedeB@unizulu.ac.za
[3]Department of Languages & Social Sciences, University of Zululand, South Africa, EzenniaJ@unizulu.ac.za

Citation: Dr Mthimkhulu Terrence T, et.al (2024), Impact Of 4IR On Accounting Education In Higher Education, *Educational Administration: Theory and Practice, 30(10), 139-148*
Doi: 10.53555/kuey.v30i10.5075

ARTICLE INFO

ABSTRACT

The adoption and full use of the Fourth Industrial Revolution (4IR) by South Africa is a worrying national economic issue. Hence, using the World Economic Forum's benchmarkingframework, South Africa's readiness for the 4IR has been found wanting as it is still in the nascent quadrant and has not gone beyond the rudimentary stage yet. The aim of this study is to establish the impact of the Industrial Revolutions with special emphasis on the 4IR in HigherEducation. The study employed a qualitative research method. Structured and semi-structured interviews were conducted with 6 university lecturers in the province of KwaZulu-Natal, South Africa. Only lecturers in the field of Accounting Education were interviewed, based on the assumptions that the accounting lecturers have the knowledge, experience and skills that wouldenrich the study. The empirical findings reveal that 4IR has a significant influence and therefore compels the Higher Education institutions to adapt to the new changes to fit into the new era of advancement. The study also demonstrate that the Higher Education institutions need to recognize the necessity of adapting and scaling up the new 4IR forms of education rapidly to assure the sustainability of the environment and economy, as well as to sustain the relevance of Higher Education as a responsive and vital component of the society. The study recommendsthat universities should develop a plan that will ensure that student graduates are ready for theadvancing working world as propelled by the Fourth Industrial Revolution.

Keywords: Fourth Industrial Revolution, Higher Education, Accounting, University, Lecturers.

1. Introduction

The world is in a moment of transition between the Third Industrial Revolution (3IR) and the Fourth Industrial Revolution (4IR); however, it is steadily moving toward the 4IR with all of its accompanying problems and apparent opportunities (see the figure below). Although the Third Industrial Revolution originated in the 1980s and 1990s, society, politics, economics, and education are currently being affected by its aftershocks. Consequently, the development of computerization and web-based interconnectivity supports the Third Industrial Revolution'sexpressions. Access to Higher Education considerably increased throughout in the Third Industrial Revolution, as seen by the increased diversity on campuses and the global acceleration of academic research, thanks to online technologies (Penprase, 2018).

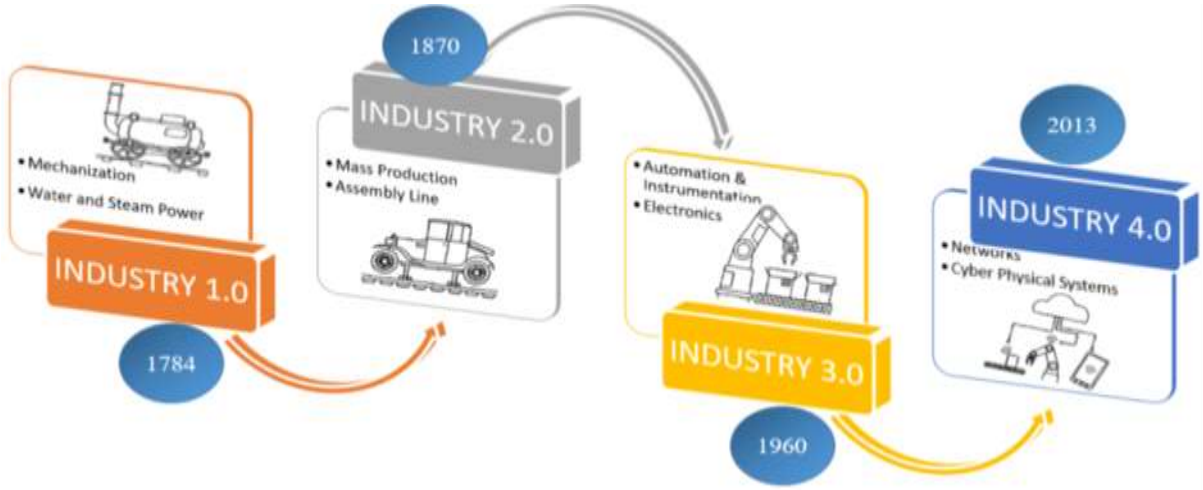


Figure 1: Linear graphic representation of the Industrial Revolutions (1-4) (source: adapted from Dargar and Srivastava, 2020)

It is important to recognize that the 4IR is gradually replacing the performing of tasks using human labor and is having the performance of tasks substituted with the use of machines. This replacement of human labor with the use of machines is occurring against the backdrop of themajor developments during the different Industrial Revolutions that support the significant improvement of required skills (Erboz, 2017). This is consistent with its primary goal of developing network integration and digitized systems using smart systems, with the incidental benefit of doing away with the need for human labor to make the systems work. Sackey and Bester (2016) give several facets of the definition of 4IR, one of which is as follows: "An umbrella term for value chain organization technology and concepts that brings together Cyber-Physical Systems, the Internet of Things, and the Internet of Services." Therefore, this study seeks to establish the impact of the 4IR in Higher Education. The objective of the study is to determine accounting education lecturer's understanding of the 4IR ad how 4IR technologies influenced their teaching methods in Accounting Education.

2. Literature review

As accounting functions become more technologically advanced, the role of the accountant ischanging and job mobility is on the rise. Also, there is a rising need for the accounting professionals to possess advanced IT knowledge and abilities (Pan and Seow, 2016). It has alsobeen discovered that the primary competency area where professional accountants lack proficiency is in knowledge of digital technology (Association of Chartered Certified Accountants [ACCA], 2016). Therefore, it is impossible to imagine how accountants who can provide service in the digitalized environment that is informed by the 4IR work environment can be developed without providing the students with the most up-to-date and best information and knowledge in relation to the scientific, technological, economic, and social development of the world at large (Xing and Marwala, 2017).

2.1 Role of universities in the teaching of accounting in line with the demands of the 4IR

It has been contended and conceded in some educational circles that the core mission of HigherEducation is to educate students and thus deliver highly competent professionals for employment in the corporate world (Papert, 1990 and Veldsman, 2019). This core mission will neverchange regardless of the era (IR) in which it is executed. Hence, Jackson and Meek (2021) areof the view that to shape accounting curricula to better prepare students for the future of workand the expectations of the accounting profession, is the collective responsibility of the stakeholders. That fact notwithstanding, it is noted that during the 3IR, the focus was more on the educator as opposed to now where the focus has shifted to student-centred teaching and learning. It is interesting to note that where educational activities of the 'educational practices' that are not only teacher-focused and skill-based but also are product-oriented and non-interactive as they are highly prescribed' constitute what is termed 'instructionism' (Papert, 1990; Johnson, 2005; Sawyer, 2008; Brown-Martin, 2018). However, a marked shift has set in with the dawn of the 4IR towards student-centred teaching and learning which is a practice that has already been contentiously debated for quite a while albeit still not really implemented widely, specifically not in South Africa (Piaget, 1964; Vygotsky, 2019; Brown, Collins and Duguid, 1989; Williams, 2017). As noted by Xing and Marwala (2017), to equip students with the mostrecent and best information and knowledge to develop societies that can deliver service is the principal task. This is corroborated by an assertion in Masinde and Roux (2020) that universities create new programmes and even new schools to focus on developing new- mindsets as new innovations happen.

Further, it has become an indisputable fact that the 4IR will 'revolutionize' the HigherEducation sector (Butler-Adam, 2018) and perhaps end up with Higher Education Revolution 4.0 (HE 4.0) (Xing and Marwala, 2017). In attempting to explore the impacts of 4IR is likely tohave on the mission and/or vision of universities globally,

Xing and Marwala (2017) coined the phrase 'Higher Education in the Fourth Industrial Revolution as HE 4.0'. One widely published consequence of 4IR in the Higher Education space is an interdisciplinary teaching, research, and innovation (Boehm, 1988 and Schwab, 2016). That 4IR-related content is important in commerce degrees is acknowledged by the South African universities. As a result, there is no mass overhaul of curricula in most parts since core modules remain largely the same as theyare supplemented by added modules that address topics which are related to the 4IR educational issues (Coetzee, Neneh, Stemmet, Lamprecht, Motsitsi, and Sereeco, 2021). It can, thus, be contended that to ensure meaningful curriculum changes 'authentic engagement' between the relevant stakeholders, requires ongoing conversations as the process becomes increasingly more dynamic amid the 4IR (Coetzee et al., 2021).

Although South African universities offer traditional commerce degrees, they have introduced modules which are 4IR-related as either electives or as part of the core modules. This educational development is typified by the fact that students studying towards a BCom at the University of Cape Town (Curriculum Change Working Group [CCWG] University of Cape Town [UCT], 2018) can specialize in 'traditional' areas to the inclusion of accounting, actuarial sciences, economics, and management, and those studying towards a Bachelor of Business Science degree can specialize in 12 areas (CCWG UCT, 2018). These modules include analyticsand information systems which deal specifically with analytical methods that are pertinent to advances in the 4IR or modules more interdisciplinary by nature with cognitive neuroscience being a typical example in this regard. Moreover, Masinde and Roux (2020) makes an observation based on their investigation that curriculum in some universities has been tailored towards meeting the demands of 4IR. For example, in mathematical statistics at Stellenbosch University (SU), a BCom is offered with afocus on data science and thus requires students specifically to gather, store, transform and graphically represent data. At the University of Pretoria (UP), in the field of business management, there have been substantial changes with the introduction of modules, such as design thinking and business innovation, business analytics [including topics such as data mining, big data and data stream analysis], and responsible leadership (Masinde and Roux, 2020). South African universities showed the important role of data and information management in their commerce degrees by introducing and integrating modules that specifically address the potential 4IR skills.

Masinde and Roux (2020) further note that the University of the Free State (UFS) includes specializing in business and financial analytics, thus integrating traditional banking and financetopics with those typical of data analytics, such as programming and problem solving, databases and database management systems, as well as data analytics for business. Meanwhileother universities such as the University of the Witwatersrand (WITS), the University of Pretoria (UP), the University of Cape Town (UCT) and the SU offered modules on the management of information systems, manipulation of data and computer programming (CCWG UCT, 2018; Masinde and Roux, 2020). The modules enable students to develop software, manage information systems and program. What transpires from the explication above is that the provision of 4IR content is far from being limited to the traditional departmentswithin the faculties of commerce as it extends to the offerings of business schools in certain instances.

2.2 Challenges and Implications of the 4IR for the education sector

Arguably, if these technologies are not embraced by humans, then challenges would be inevitable. Butler-Adam (2018) asserts that in the education sector curriculum**,** learning and teaching, as opposed to robotic tutors, constitute one of the implications of the 4IR**.** Thus, cross-sector teaching and learning must be there. To successfully implement the 4IR, different factorsinvolved need to be learned by the students and educators from various fields**.** Debatably, political and social tensions which are informed by the rapid pace of the advancement of technology should be responded to (Penprase, 2018). Nonetheless, Jamaludin, McKay and Ledger (2020) refer to knowledge as being the personal**,** the curriculum and the pedagogical readiness which is encompassed by education in 4IR with the curriculum going beyond pedagogy and andragogy.

Sequel to the above, in contemporary education, unconventional teaching and learning methods have been introduced, such as heutagogy, peeragogy and cybergogy. Heutagogy was developedby Hase and Kenyon (2000) as learning which is self-determined. According to Blaschke (2012), to become self-directed students, heutagogy empowers students by allowing them to determine how they learn by focusing on the role of online instructors which includes the coach, mentor or facilitator. Following on the development, students could use mere digital tools to construct knowledge and connect. Then, Wang and Kang (2006) coined cybergogy, which involves 'cyber' connections, artificial intelligence, and the internet. Cybergogy focuses on helping adults to learn effectively in an environment which is virtual. Despite the challenge of accepting the concept that the computer age is essentially over, the society is transitioning from a phase of integrating computer usage into the industry and daily life.

Moreover, current students still assemble at a scheduled time and venue to listen to the wisdomof scholars though the business of Higher Education has remained unchanged since the times of Aristotle. A new form of a university which does teaching, research and service differentlyis emerging given the Fourth Industrial Revolution. Notably, this university is characteristicallyinterdisciplinary and has classrooms, laboratories, libraries, and teachers that are virtual. Despite being virtual in every respect relating to its operations, the

university boosts the educational experience in every way possible as opposed to degrading it.

2.3 Benefits of blended teaching and learning to Accounting Education

2.3.1 Time and place convenience

It is a rebuttal presumption that with blended teaching and learning diverse students coming from varying socio-economic backgrounds are afforded the space and opportunity to participate in online educational learning activities with relative ease. Hence, Mhlanga (2021)avers that if students have adequate digital connectivity, blended learning comes in handy for them especially those who reside in distant rural communities as they are situated far away from the center of learning. Similarly, Kintu, Zhu and Kagambe (2017) are of the view that, for students who might be engaged in other professional and academic activities, blended learning is an important factor in relation to time and place. It is, thus, argued that even with comparatively meager resources, accommodative access to intellectual resources by students can be attained. It is debatable that a tailored education approach where students learn what they need to learn is facilitated through the adoption and use of blended teaching and learning.

2.3.2 Cost-effectiveness

Mhlanga (2021) asserts that the admission and inclusion of huge numbers of students into an accounting profession can be facilitated by blended teaching and learning, since in comparisonto the traditional face-to-face teaching approach it (blended teaching and learning) has the potential of reducing various learning expenses. For instance, the cost of travelling daily to theuniversity and accommodation for those who would have had to reside in student residence areautomatically canceled. The delivery of a significant number of lessons to significantly huge groups through blended learning enables the institution to reduce the unit cost of having one student educated.

2.3.3 Students engagement

Notably, students exhibiting a greater sense of personal responsibility and self-management are, arguably, not a common feature among all students (Bojko, 2021). Hence, as a matter of logical consequence, blended teaching improves engagement in students with high instilled self-management and self-motivation abilities to cope with the demands posed by blended teaching and learning. As noted by the United Nations (2020), self-motivation by students andcapacitation are critical components which institutions need to address in blended teaching environments.

2.3.4 Increased access to education

According to Mhlanga (2021), blended learning can increase the access of accounting studentsto training and education in the South African Higher Education and vocational training environment that is characterized by low admission opportunities. The author's reference is directed to the South Africa National Development Plan about TVET colleges admissions targets which the country continues to miss. For instance, 2016, 2017 and 2018 were missed because of the challenges of resources. However, the NDP target is to attain 2.5 million TVET admissions by 2030 with annual target needed to achieve this including those already missed for 2016, 2017 and 2018, respectively. It is against this backdrop, therefore, that blended teaching could come in handy as an intervention towards increasing the much-needed admission space availability. What makes blended teaching apposite given the circumstance isfirstly, its low demand of resources and secondly, it is easier for accounting students in remoteand poorly served areas to secure TVET college places.

2.4 Perceptions of the lecturers on using technology

It can be contended that the 4IR somewhat speaks to the needs of the individual, and this is made possible by the new teaching and learning environment produced by the twenty-first century that is driven by mobile devices. Arguably, articulate comprehension of the personal "who" question of education is demanded by the 4IR within the confines of its operative educational domain (Schwab, 2016) to address the philosophical 'why' question of education when accounting lecturers reflect on their educational practice (Khoza, 2019; Mpungose 2020).Invariably, education is driven by knowing and comprehending who is teaching or learning and such understanding must be amenable to demonstrable self-reflection. Although there is no overt articulation of this, it can be asserted with unswerving conviction that accounting lecturers should reflect on (professional), in (societal), and *for* (personal/pragmatic), and whattheir teaching is suggesting. In doing so, the educational identities of the accounting lecturers will be known and understood by them. This will enable them (lecturers) to choose and use apposite digital technologies that first address their needs as lecturers and the needs of the students, before professional and societal needs (Biesta, 2015; Czerniewicz and Brown, 2014; Mpungose, 2020).

Although there has been an early engagement with the concept '4IR' by businesses and governments, very little can be said to be African about the concept. As a matter of fact, greatdiversity of industry across the continent obtains with very different commercial and institutional capacities which are likely to generate quite different responses to the technologies encompassed in 4IR and these technologies exclusively trace their origin from other continents.The adoption of 4IR technologies relies on infrastructure, intellectual property rights and

skills,which are the areas where governments have not been very effective (Akileswaran and Hutchinson, 2019).

3. Research Methodology

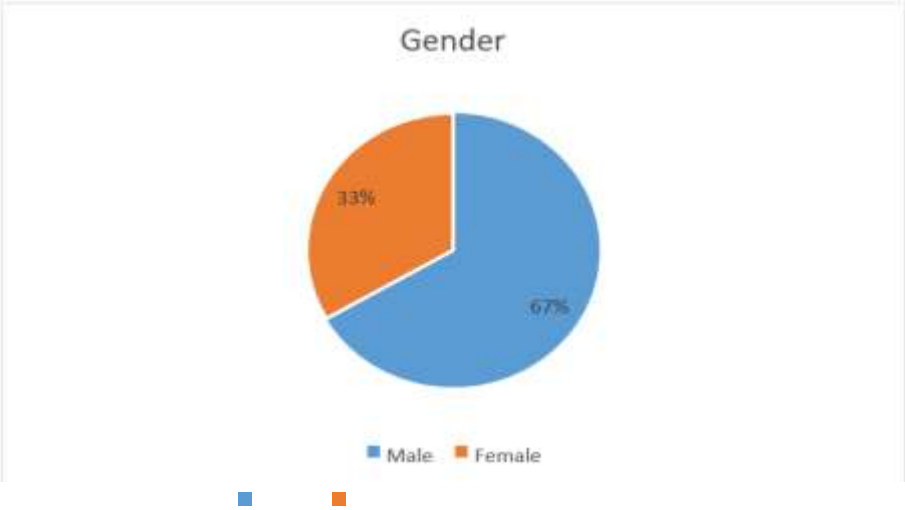
Inductive approach was used in the study. For the reliability of the study, it was ensured that the identified weakness did not compromise anything in the study. In the implementation of the inductive approach, the study had the entire process premised on observation, thus giving due consideration to the context wherein the activities of data collection were happening. Purposeful sampling was employed in the identification and selection of accounting academicsthat are especially knowledgeable on or experienced in the phenomenon of the 4IR.

The qualitative data was collected using structured and semi-structured interviews schedule. Questions were open ended to allow for a comprehensive and detailed responses by the respondents. Researchers suggest that thematic analysis is a good first analytic method for novice qualitative researchers to master. It is for this reason that the method was used in this study. To ascertain the validity and reliability of the instruments used for this study, the designed instrument was subjected for face and content validity criticism of the supervisor, accounting expert in the field, and the interviewees. The collected data were analyzed using thematic analysis.

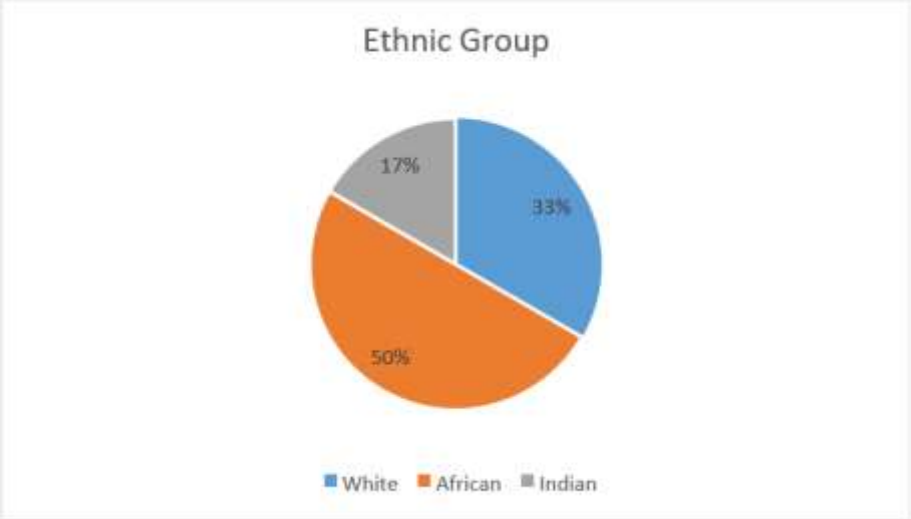
4. Result and Discussion

4.1 Demographics

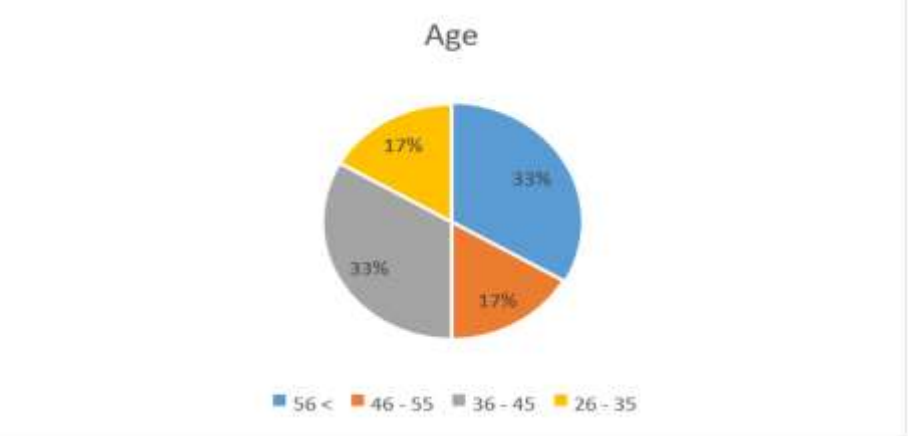
4.1.1 Gender: It can be seen in Figure 4.1 below, that the males were dominant in this study, constituting 67%, while the representation of female respondents constituted 33%. Participation was based on the availability and willingness of the respondents to be part of the study and more males were willing to participate when compared to the females.



4.1.2 Ethnic group: In terms of the ethnic group of the participants, it can be seen in figure **4.2** below that 50% of them were Africans, while 33% were White and 17% were Indian. As explained above, when the study was recruiting the respondents, issues of gender and ethnicity were not used as a criterion for eligibility to be selected as a participant.



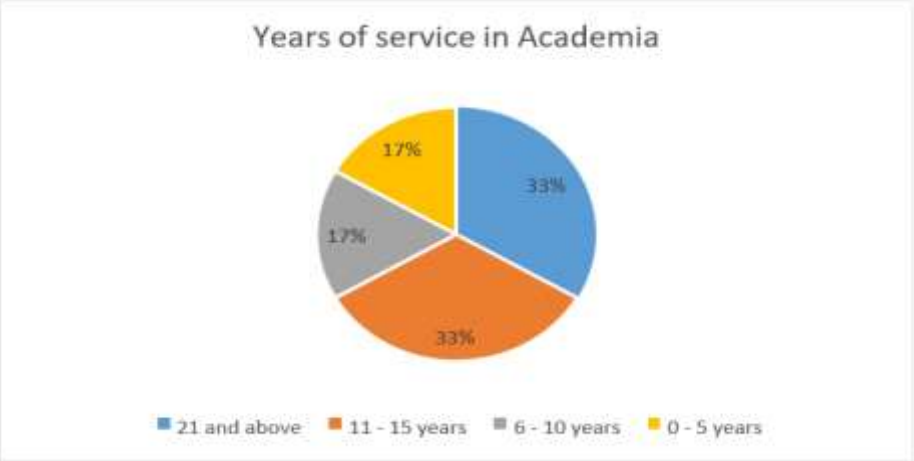
4.1.3 Age of the participants: Figure 4.3 below illustrates the age range of the respondents. Thirty-three percent (33%) of the respondents were aged 56 and above, and another thirty three percent (33%) were aged between 46 and 55 years. Apparently, the respondents' age range was split into seventeen percent (17%) for 36-45 and seventeen percent (17%) for 26-35. It is evident from the age of the participants that there was a mix of the older generation and the youth.



4.1.4 Qualifications of the participants: Figure 4.4 depicts the academic qualifications of the respondents. Fifty percent (50%) of them hold Masters' degrees, while thirty-three percent (33%) of them hold Honours degrees, and seventeen percent (17%) hold a PhD degree.

4.1.5 Years in academia: Figure 4.5 below shows the years of service the respondents had already rendered in the accounting profession. Thirty-three percent (33%) of them have been in academia for 21 years and above, another thirty-three percent (33%) of them have been in academia for 11-15 years. Another

seventeen percent (17%) of the respondents have been in academia for 6-10 years, and the last seventeen percent (17%) have been in academia for almost5 years.



4.2 Discussion

The first question seeks to understand accounting education lecturers' perception of the 4IR, and it became evident that generally, almost all of them linked 4IR to technology. The verbatim responses of the participants were captured in line with the actual responses elicited during the interviews.
In this regard, P1 stated that 4IR is *"technology and how artificial intelligence can influence our lives and how we work."*

P2 *"the change driven by technology and robotics."*
P3 *"I think that 4IR is the promotion of innovation using technology between human and technological interaction."*
P4 *"in my view,4IR is primarily about the automation of a substantial number of activities that were historically performed by humans. This is a major advancement that has the potential to achieve greater efficiencies and effectiveness - especially in doing business."*
P5 *"in my opinion 4IR is the current and developing era of ground-breaking technology and trends like internet, artificial intelligence, robotics, mobile devices, 3D printing, virtual reality with an impact and change on how people interact, work and daily lifestyle."*
P6 *"I think that the Industrial Revolution is about moving from labour intensive to capital intensive for example movement from manual labour to new technological life. New technologies that create entirely new ways of serving existing needs and significantly disrupt existing industry value chain."*

According to the views of one of the respondents, 4IR is about technology and the way artificial intelligence has influenced teaching and learning in the 4IR context. In this regard, the changesalluded to by the respondents are those which have been brought by the technology as many things have been adapted to robotics, including some of the processes in Higher Education. This implies that 4IR promotes innovation and the advancement of interaction between humans and technology. One of the respondents perceives 4IR as a system that introduces machine automation to the extent of replacing humans and a new approach to doing business. In essence, 4IR is the expansion of technology to a different level, making it possible for virtual organisations to thrive. In this regard, as 4IR continues to expand rapidly, numerous changes should also be expected in various sectors, the business sector, the education sector, and the labour market. The views as they were expressed by the respondents, show that academics understand what constitutes 4IR as they further shared the inadvertent consequences of this phenomenon.
Academics' understanding of 4IR is equally in line with existing literature. Schwab (2018) indeed concurs that 4IR is a term describing an emerging work environment shaped by a range of new technologies which are fusing the physical, digital, and biological worlds, thereby impacting almost all disciplines, economics, and industries. This system brings with it new ways of doing things which challenge the existing conventions and ideas about what it means to be human. Concurring is Erboz (2017), who views 4IR as a collective term for technologies of value chain organisations. Reasoning on the literature, it can be argued that academics understand that 4IR will revolutionize disciplines, including that of conventional teaching and learning Accounting Education at the university. According to the scholars, no individual can be certain that his/her discipline will not have to adapt to the 4IR effects in the organisations. Higher Education institutions cannot continue to train future employees using the obsolete curriculum. Therefore, the changes brought forth bythe 4IR should be equally accommodated in the curriculum design to ensure that future graduates match the contemporary industrial requirements.

For the second objective, respondents were asked how has 4IR technologies influenced their teaching. The views, as expressed by the respondents in this regard, suggest that 4IR has a significant influence. Various responses were provided;

P1 “at the moment I am currently using the Microsoft suite and LMS and some specialized accounting packages.”
P2 “currently I am utilising www, video conferencing, WhatsApp, SMS, LMS- Moodle, YouTube and Google.”
P3 “I am currently conversant with Learn (Moodle), Microsoft Teams, Zoom.”
P4 “Primarily, I use platforms such as Zoom and MS Teams as the platforms for teaching. I also make use of Kwik-Surveys and the Moodle platform to run short quizzes - as part of the teaching and learning process.”
P5 “when I am in the workplace, I normally use Moodle, Zoom, Microsoft (MS) Teams.”
P6 “I use word processors; spreadsheets; database software; desktop publishing; process writing software; keyboarding training software; telecommunications; web browsers and search engines; web authoring; presentation.”

The views expressed by the respondents show that they are using different technological systems, which is an indication that they have the skills to interface with the 4IR technologies.However, the missing link from the responses of the respondents is their level of competency to use the technology software they are currently utilizing. In any case, this study was not interested in that aspect but was interested in the self-report on the technology applications used currently. From the literature reviewed, the researcher established that “knowledge of digital technologies is the key competency area where professional accountants have skills lacunas” (ACCA Report, 2016).
According to the respondents, the Higher Education institutions have had to adapt to the new changes to fit into the new era of advancement. This is in line with existing literature, as Krishnannair and Krishnannair (2021) indicate that indeed 4IR embodies a magnificent period of technological advancement to which Higher Education institutions are expected to respond accordingly. These scholars pose a critical thesis in that with the advent of 4IR there remain issues of social transformation with which its ideological foundations seem to be in direct conflict. Other scholars such as Fataar (2020), on the contrary, suggest that 4IR is a phenomenon that is presented as holding the promise of addressing and resolving societal challenges such as health, welfare, and climate change. Irrespective of the debate around 4IR,some scholars attest to the findings of the study that the institution should take a leading role in championing the changes brought about by 4IR.

Furthermore, Aprianti and Sahid (2020) add that since the 4IR era is among us, educational institutions have the responsibility to provide students with information and literacy in education, especially those related to preparation for the 4IR. From the findings, it is evident that academics should also play a significant role to assist in the delivery of the university’s curriculum especially since students should develop critical thinking skills as presupposed by the critical pedagogy theory. As the institutions advance their technology prowess, the academics ought to engage in the process, as described by Leal (2021), which is to ensure thatnegative and unjust aspects of education are eliminated, reformed, or replaced since 4IR could have elements that might disfavour social transformation which is a phenomenon embraced fully by critical pedagogy.

5. Conclusion

The study finds that with considerably increasing diversity on campuses and the acceleration of worldwide academic research by internet technologies throughout the Third Industrial Revolution, the extension of access to Higher Education gained even more relevance. The empirical study also reveals that the influence of the Fourth Industrial Revolution compels the Higher Education institutions to adapt to the new changes to fit into the new era of advancement. It also reveals that lectures should review and adept their teaching methods in order to enable individualized learning for creativity, innovation, and problem solving, and to have more time for one-on-one instruction. 4IR has been one of the most effective revolutionsin influencing the activities in Higher Education institutions. Indeed, the study results demonstrate that the Higher Education institutions need to recognize the necessity of adapting and scaling up the new 4IR forms of education rapidly to assure the sustainability of the environment and economy, as well as to sustain the relevance of Higher Education as a responsive and vital component of the society.
Taken together, these new formsof 4IR education, together with a curriculum that develops both technical mastery and a deep awareness of ethical responsibility toward the human condition will prepare both students and lecturers for leadership roles in a world of rapidly accelerating change. Adapting to the new reality is an imperative objective since working efficiently with emerging technologies requiresaccountants to develop a range of new technical and generic skills. It is against this back drop, therefore, that the averment to the effect that the paradigmatic shift brought about by the 4IR has huge implications for the world of work. Also, in the context of Higher Education, and the‘accounting students of the future’, it is rendered more intelligible.

As for the future needs of the new demands posed by the 4IR, universities must incorporate new units, such as

cloud computing, big data, digital technology, integrated reporting, carbon emission accounting and so on, for accounting students. Thus, to collate expert lecturers in thenew areas and run new courses, professional accounting organizations should consult with universities (ACCA, 2018). A well-developed strategy for the 4IR at Higher Education will need to ensure that students graduate into a world where they can help make a change with wisdom and talent, while establishing a future society in which the future generation will wish to live.

References

1. ACCA. (2016, June). Professional accountants – The future: Drivers of change and future skills(pp. 1–88). The Association of Chartered Certified Accountants. https://www.accaglobal.com/gb/en.html.
2. ACCA. (2018, October). Learning for the future (pp. 1–50). The Association of Chartered Certified Accountants. https://www.accaglobal.com/gb/en.html.
3. Akileswaran, K., And Hutchinson, G., 2019. How Africa Can Adapt to the Digital Revolution.12 August 2019. Available at: https://www.project-syndicate.org/commentary/africa-digital-revolution-adaptive-government-by-kartik-akileswaran-1-and-georgina- hutchinson-1-2019-08?barrier=accesspaylog (accessed 30 November 2021).
4. Aprianti, V. and Sahid, S., 2020. The relationship between teachers' competency and Fourth Industrial Revolution (4IR) learning among economics teachers. *Universal Journal of Educational Research*, *8*(11).
5. Biesta, G., 2015. What is education for? On good education, teacher judgement, andeducational professionalism. *European Journal of education*, *50*(1), pp.75-87.
6. Blaschke, L.M., 2012. Heutagogy and lifelong learning: A review of heutagogical practice and self-determined learning. *The International Review of Research in Open and Distributed Learning*, *13*(1), pp.56-71.
7. Boehm, B.W., 1988. A spiral model of software development and enhancement. *Computer*, *21*(5), pp.61-72.
8. Bojko, J., 2021. *Will blended learning become the new normal?* 27 August 2021. Available at: https://www.unssc.org/news-and-insights/blog/will-blended-learning-become-new- normal (accessed 30 November 2021).
9. Brown, J.S., Collins, A. and Duguid, P., 1989. Situated cognition and the culture oflearning. *Educational researcher*, *18*(1), pp.32-42.
10. Brown-Martin, G., 2018. Education and the Fourth Industrial Revolution. *Group Media TFO*.
11. Butler-Adam, J., 2018. The fourth industrial revolution and education. *South African Journalof Science*, *114*(5-6), pp.1-1.
12. Coetzee, J., Neneh, B., Stemmet, K., Lamprecht, J., Motsitsi, C. and Sereeco, W., 2021. SouthAfrican universities in a time of increasing disruption. *South African Journal of Economic and Management Sciences*, *24*(1), pp.1-12.
13. Curriculum Change Working Group UCT, 2018. Curriculum Change Framework. Availablefrom:chrome-
14. extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.news.uct.ac.za/images/us erfiles/downloads/media/UCT-Curriculum-Change-Framework.pdf
15. Czerniewicz, L. and Brown, C., 2014. The habitus and technological practices of rural students:a case study. *South African Journal of Education*, *34*(1).
16. Erboz, G., 2017. How to Define Industry 4.0: The Main Pillars of Industry 4.0. *Research Gate*.
17. Fataar, A., 2020. The emergence of an education policy dispositif in South Africa: An analysis of educational discourses associated with the fourth industrial revolution. *Journal of Education (University of KwaZulu-Natal)*, (80), pp.5-24.
18. Hase, S. and Kenyon, C., 2000. From andragogy to heutagogy. *UltiBASE In-Site*.
19. Jackson, D. and Meek, S., 2021. Embedding work-integrated learning into accounting education: the state of play and pathways to future implementation. *Accounting Education*, *30*(1), pp.63-85.
20. Jamaludin, R., McKAY, E. and Ledger, S., 2020. Are we ready for Education 4.0 within ASEAN higher education institutions? Thriving for knowledge, industry and humanityin a dynamic higher education ecosystem? *Journal of Applied Research in Higher Education*, *12*(5), pp. 1161-1173.
21. Johnson, M.H., 2005. Subcortical face processing. *Nature Reviews Neuroscience*, *6*(10), pp.766-774.
22. Khoza, S.B., 2019. lecturers' reflections on curricular spider web concepts as transformation strategies. In *Transformation of higher education institutions in post-apartheid South Africa* (pp. 15-26). Routledge.
23. Kintu, M.J., Zhu, C. and Kagambe, E., 2017. Blended learning effectiveness: the relationship between student characteristics, design features and outcomes. *International Journal ofEducational Technology in Higher Education*, *14*(1), pp.1-20.
24. Krishnannair, A., Krishnannair, S. and Krishnannair, S., 2021. Learning environments in highereducation: Their adaptability to the 4th industrial revolution and the'social transformation'discourse. *South African journal of higher education*, *35*(3), pp.65-82.
25. Masinde, M. and Roux, P.A., 2020. Transforming South Africa's universities of technology: aroadmap through 4IR lenses. *Journal of Construction Project Management and Innovation*, *10*(2), pp.30-50.
26. Mhlanga, D., 2021. Financial inclusion in emerging economies: The application of machine learning and artificial intelligence in credit risk assessment. *International Journal of Financial Studies*, *9*(3), p.39.

27. Mpungose, C.B., 2020. Emergent transition from face-to-face to online learning in a South African University in the context of the Coronavirus pandemic. *Humanities and SocialSciences Communications*, *7*(1), pp.1-9.
28. Pan, G. and Seow, P.S., 2016. Preparing accounting graduates for digital revolution: A criticalreview of information technology competencies and skills development. *Journal of Education for business*, *91*(3), pp.166-175.
29. Papert, S., 1990. Children, computers and powerful ideas. *New York: Basic Books*, *10*, p.1095592.
30. Penprase, B.E., 2018. The fourth industrial revolution and higher education. *Higher educationin the era of the fourth industrial revolution*, *10*, pp.978-981.
31. Piaget, J., 1964. Part I: Cognitive development in children: Piaget development and learning. *Journal of Research in Science Teaching, 2*, 176–186.
32. Sackey, S. M. and Bester, A., 2016. Industrial engineering curriculum in Industry 4.0 in a South African context. South African Journal of Industrial Engineering, 27(4), pp. 101-114.
33. Sawyer, R.K., 2008. Learning music from collaboration. *International Journal of EducationalResearch*, *47*(1), pp.50-59.
34. Schwab, K., 2016. *The Fourth Industrial Revolution. Geneva*. Crown Business.
35. Schwab, K., 2018, October. The global competitiveness report 2018. World Economic Forum. United Nations, 2020. *Policy brief: Education during COVID-19 and beyond*. New York
36. Veldsman, N., 2019. *The Relationships between PsyCap, Academic Engagement and Academic Performance amongst Postgraduate Students in a South African Higher Education Institution* (Master's thesis, University of Cape Town).
37. Vygotsky, L.S., 2019. Mind in Society, Mind in Society. Harvard University Press.
38. Wang, M. and Kang, M., 2006. Cybergogy for engaged learning: A framework for creating learner engagement through information and communication technology. In *Engaged learning with emerging technologies* (pp. 225-253). Springer, Dordrecht.
39. Williams, M.K., 2017. John Dewey in the 21st century. *Journal of Inquiry and Action in Education*, *9*(1), p.7.
40. Xing, B. & T. Marwala, T., 2017. Implications of the Fourth Industrial Age for Higher Education. *Science and Technology*.