

Blending Digital and Technological Skills with Traditional Commerce Education Knowledge in Preparation for the 4IR Classroom: The COVID-19 Catalyst

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Abstract

In an era characterised by unprecedented technological developments in all spheres of life, the current 4th Industrial Revolution (4IR) requires a workforce that can blend digital and technological skills with traditional subject matter expertise. These individuals are also expected to possess other human skills including problem solving, creativity and critical thinking. Higher education institutions are tasked with the responsibility of producing such graduates for the workforce. Considering the current wave of global lockdown in almost all spheres of life arising from the COVID-19 pandemic, e-Learning is a viable option for education. The University of KwaZulu-Natal (UKZN) School of Education embraces this idea and provides an enabling environment to support virtual learning. However, the extent to which the teacher-education programme is developing student teachers via e-Learning platforms who can thrive in the 4IR digitized school classroom is not apparently clear. The emergence of the COVID-19 pandemic has created a catalyst for academics to test this development. Using the Commerce Education discipline in the School of Education at UKZN as a case study, this chapter draws on the Technological, Pedagogical and Content Knowledge (TPACK) model to determine the extent to which academics have blended digital and technological skills with traditional Commerce Education knowledge. Document analysis was

performed on the revised module templates for the Accounting Education 113 and Economic Management Science (EMS) 111 modules that were prepared for emergency remote learning during the lockdown period. The findings make a case for further empirical research to focus on the lived pedagogical experiences of both academics and students who undertook such modules via the e-learning platform. It is envisaged that this chapter will make timeous theoretical contributions in the light of the COVID-19 pandemic that has catalysed the need to prepare Commerce Education academics and students for the current 4IR classrooms during and after the pandemic from a technological, pedagogical and traditional knowledge perspective.

Keywords: COVID-19 pandemic, 4th industrial revolution classroom, digital and technological skills, traditional Commerce Education knowledge, e-Learning

Introduction and Background

In the wake of the 4th Industrial Revolution (4IR), the world is currently being steered into a wave of digital revolution powered by rapidly advancing technologies that are redefining the way things are done in all spheres of life. In this era, it is believed that the critical success factor is not necessarily the physical or financial resource of the entity; rather, it is its talent pool (Schwab 2015) of humans that are the drivers of the impending change through their creativity and ideas (Gleason 2018). As such, employers are seeking graduates who are ready to contribute in steering their businesses to success in the ever-competitive globalised work environment (Susanti *et al.* 2020; Lestari & Santoso 2019; PWC 2019). The onus is on the Higher Education Institution (HEIs) to produce graduates with the required knowledge, skills and attitudes (Jananian 2020; Yuhasriati *et al.* 2020; Lestari & Santoso 2019; Oliveri & Markle 2017; Webber-Youngman 2017) who are immediately employable (Gleason 2018). The World Economic Forum (WEF) holds that the 4IR workforce ‘are those who can blend digital and STEM (Science, Technology, Engineering and Mathematics) skills with traditional subject expertise’ (2017: 9). Skills expected of the 2020 workforce includes critical thinking, creativity and complex problem solving, amongst others (Jananian 2020; PWC 2019; Webber-Youngman 2017; WEF 2016). As such, HEIs are expected to

embrace the digital age to stay relevant and simultaneously blend the traditional knowledge required of each disciplinary domain of the university- (PWC 2019).

From its strategic plan, UKZN, in its commitment to excellence has undertaken to offer world-class infrastructure to support its teaching and learning activities, among others (UKZN 2017). This strategic goal for excellence underpins the University's teaching and learning policy (Vithal 2013). Principle 8 of the policy emphasises the institution's support for 'multiple modes of teaching and learning, including experiential and on-line/e-Learning' (Vithal 2013:5). In the School of Education, existing lecture facilities have been upgraded to incorporate modern audio/visual equipment; huge lecture theatres with state-of-the-art facilities for teaching and learning have been commissioned; the local area network has been expanded; and all first-year students who have joined the institution since 2017/18 have been issued with individual laptops. Faced with the global lockdown arising from the COVID-19 pandemic, these state-of-the-art facilities can no longer be accessed, compelling universities to deliver their programmes online. Academics at UKZN, including those in Commerce Education, are thus expected to harness the available technology and digital infrastructure in the pedagogical process to enhance learning via e-learning platforms (Lestari & Santoso 2019; Hussin 2018). This move is in keeping with preparing their students to thrive as teachers in the 4IR secondary school classroom upon graduation. However, the extent to which the Commerce teacher-education programme has been developing student teachers who can thrive in the 21st century/4IR digitized classroom using e-learning platforms is not clear. The emergence of the COVID-19 pandemic and the mandatory move to online teaching have served to catalyse this process. This chapter therefore seeks to explore how Commerce academics in the School of Education at UKZN responded to the COVID-19 pandemic in their preparation for emergency remote and online learning.

Guided by the Technological, Pedagogical and Content Knowledge model (TPACK), document analysis was performed on two revised module templates (Accounting Education 113 and EMS 111) with a view to determining the extent to which digital and technological skills were blended with traditional Commerce Education knowledge to prepare undergraduate students for the 4IR secondary school classroom. The chapter further makes a case that the COVID-19 pandemic has catalysed this process and therefore

creates an opportunity to determine whether academics themselves are ready to deliver a programme that blends digital and technological skills with traditional knowledge in order to prepare their graduates for the 4IR classroom.

Response to 4IR

Like many other countries in the world, South Africa embraces the 4IR with plans to transform into a digital society by 2030, powered by appropriate infrastructure and a promise of universal access to affordable devices by all South Africans irrespective of their socio-economic background (Department of Telecommunications and Postal Services [DTPS] 2017). The South African President commissioned a task team in 2018 to formulate an integrated strategic plan to respond to and fully harness the potential of the technological advances afforded by the 4IR by 2030 (Ramaphosa 2020). In order to provide the talent pool to drive the 4IR, reskilling/upskilling is deemed imperative. There is a need to modernize the education system, because many students may find themselves unemployed if the education system continues with traditional methods of instructive rote learning (Lekhanya 2019). This calls for HEIs to turn from the old ways of delivering education and embrace the change and innovation that comes with the 4IR to ensure survival (Mezied 2016). In the 2020 State of the Nation Address debate, the Minister for Higher Education and Training, Minister Blade Nzimande, reiterated the commitment of the government to provide all HEIs with 'high-speed broadband interconnectivity' by 2021 in readiness for 4IR. Also included in his speech is the planned development of a National Open Learning system aimed at providing top quality learning resources via online platforms.

In an article published in the African News Agency, The Minister of Basic Education, Minister Angie Motshekha, also confirmed her Department's readiness to tackle the 4IR evidenced by curriculum review to incorporate robotics and coding in addition to the gradual rollout of ICT infrastructure and internet connectivity at schools (Ndledle 2019). In other words, the 4IR classroom is technologically and digitally resourced, not only to aid learning, but to instil digital and technological competences needed for learners to live and excel in their future workspace. While acknowledging the fact that many classrooms in present-day South Africa trail behind the ideal 4IR classroom, the government is advancing towards the 4IR, and so should teacher education.

HEIs therefore have a responsibility to prepare competent teachers who can ‘adapt to the changing trend and new knowledge and skills based on the cyber-physical system as part of everyone’s life to face the future generation Z students through the instructional subject’ (Syaddad 2019:1166). For example, Accounting students are expected to be technologically literate so that they can at least use accounting software to process transactions, prepare financial statements and perform basic simulations (Lestari & Santoso 2019). With digital literacy, they should be able to access data from various sources on different teaching strategies that can be implemented in the classroom with ease. To enhance technological literacy, the programme of instruction may be modified to incorporate an understanding of the latest software/technology related to Accounting; while digital literacy can be enhanced by providing students with internet facilities and the instruction modified to make room for students to access necessary information from the internet (Lestari & Santoso 2019). At the same time, the students are required to gain the traditional disciplinary knowledge of Accounting.

Traditional Commerce Education Knowledge

Traditional knowledge in a school setting is academic knowledge. Knowledge is acquired in an institution of learning. It is domain specific, comprising factual, conceptual, procedural and metacognitive knowledge (Anderson *et al.* 2001). These comprise terms, concepts, procedures and ways of thinking that the students must become familiar with in their quest for expertise in any discipline (Anderson *et al.* 2001). In other words, traditional knowledge in any field consists of the disciplinary knowledge, skills, values and other behaviours that the students must acquire in order to communicate, solve problems and thrive as graduates of that discipline (Anderson *et al.* 2001).

The School of Education in UKZN aims for an education that is of high quality that contributes to life-long learning (School of Education website n.d.). As a subset of the Social Science cluster, the Commerce Education Discipline (CED) undergraduate programme is tasked with educating students to teach Accounting, Business Studies and Economics Management Sciences (EMS) in South African secondary schools. Each of the three arms of the CED provides both method modules and core modules (disciplinary knowledge, skills and values) to equip students with the relevant knowledge and skills to teach secondary school learners. The method modules aim to develop students’

teaching skills as they apply various theories and approaches to the respective traditional disciplinary content.

The content of the core modules is derived mainly from the Curriculum and Assessment Policy Statements (CAPS) for the related secondary school subjects. The traditional or academic knowledge specified in the CAPS document for Accounting includes Accounting Concepts, Generally Accepted Accounting Practices (GAAP), Bookkeeping, Accounting Equation, Final Accounts and Financial Statements, Salaries and wages and other topics (Department of Basic Education [DBE] 2011). In Business studies, students are expected to acquire traditional knowledge related to the following topics: Business sectors, Entrepreneurship, Business plan, Creative thinking and problem solving, Social Responsibility, Business Functions and other topics. EMS, which broadly comprises financial literacy, entrepreneurship and the economy includes the following traditional knowledge: Money, Economic systems, Budgets, Bookkeeping, and The Entrepreneur, amongst others (DBE 2011). While Accounting and Business studies are taught in Grades 10 to 12, EMS is taught to Grade 7 to 9 learners. As seen from the similarity of the topics, EMS is aimed at providing the foundational knowledge on which Accounting and Business studies' traditional content knowledge is premised. Future teachers are expected to acquire traditional content knowledge, skills and values relating to these topics to teach in the field of Commerce at secondary schools.

Following the revision of the Bachelor of Education (BED) curriculum in the School of Education, the Business Management curriculum is gradually being phased out, such that first-year students who are secondary school matriculants from the previous year can now opt for the module. Currently these first-year commerce majors (students) are mandated to study Accounting and EMS. As such, this chapter will focus on the core modules from the two disciplines, since the method modules are not available to students in their first year of study.

Accounting Education 113 aims to equip students with knowledge and skills to collate, categorise and communicate financial data specifically for the sole trader (UKZN School of Education, 2020). On completion of the module, students are expected to have acquired knowledge and skills necessary for the preparation of journals, ledger accounts, reconciliation of accounts, financial statements and the interpretation of accounts and financial statements guided by Accounting principles. Assessments in coursework comprise (50%) and exams (50%). Originally, the former is made up of online quizzes (20%) from

the Oxford learning platform – Dashboard allied to the prescribed textbook for the module and two written tests (40% each). Teaching and learning are mainly done via discussions guided by PowerPoint slides, and videos in the lecture theatre. Formative tasks from textbooks and other tutorials are used to support and consolidate learning. More often than not, examples and class activities are done on the board in lecture venues.

The focus of the first-year EMS 111 module is on the entrepreneurship component of the CAPS document. Students are expected to acquire introductory knowledge and skills relating to entrepreneurship including the qualities of an entrepreneur, business acquisition process, business plan, franchising in South Africa, factors of production and savings/investment opportunities (UKZN School of Education, 2020). Similar to the Accounting module, the planned mode of delivery was contact-based, comprising lectures guided by PowerPoint slides and tutorials. Assessments comprised assignments and class tests making up 50%, and examinations making up 50%.

With the COVID-19 Pandemic looming worldwide, the module templates have been revised because place-based learning can no longer hold. While the course objectives and traditional disciplinary content remains unchanged, the mode of delivery has changed to the online format only. EMS 111 will be delivered via zoom, online chat activities and pre-recorded lectures. From the Accounting Education 113 module template, teaching and learning will be done using a flipped classroom approach via Zoom, Google classroom and PowerPoint presentations with audio. Online quizzes continue to account for 20% of the coursework and two written tests will contribute the balance. The first test will be predominantly multiple-choice questions while test two will be based on financial statements. The extent to which the mentioned deliverables will be implemented, such that students are able to achieve the learning outcomes of the module, let alone be equipped to thrive in the 4IR classroom, remains elusive.

Blending Digital and Technological Skills with Traditional Disciplinary Knowledge

In order to produce graduates with the required skills set for the 4IR, it is apparent that many HEIs need to rethink their educational strategies and objectives (Wilson *et al.* 2017; Joshi & Chugh 2009). At some institutions,

there may be need to strengthen the digital base, amend the curriculum to accommodate new content and adapt pedagogical strategies to facilitate learning in the 4IR (Yuhasriati *et al.* 2020; Penprase 2018). Although digitalization and interconnectivity allow for flexibility in lesson delivery via e-Learning platforms, caters for access/massification, and is relatively cheaper in terms of staff and facility costs, not all courses can be delivered that way (Yuhasriati *et al.* 2020; Xing & Marwala 2017; Mezied 2016). Further, technological and infrastructural (ICT and electricity) issues (Manda & Dhaou 2019; Karuri-Sebina 2019) that are very real in certain contexts, including South Africa, tend to disrupt the effectiveness of e-Learning. To this end, some scholars (Xing & Marwala 2017; Mezied 2016) suggest a blend of traditional face-to-face interaction with e-Learning, such as Massive Open Online Courses (MOOCs), video conferencing, forums or chats, etc. Blended learning can also be in the form of a flipped classroom using innovative approaches such as the use of Zoom and Google Classroom, among others. They can be employed in delivering abstract concepts to enhance understanding, especially in courses with practical and social components (Xing & Marwala 2017). Such methods, together with video conferencing, forums or chats are known to ‘develop analytical expressions and problem-solving capabilities related to mathematical matters’ (Xing & Marwala 2017:4).

Without undermining the importance and effectiveness of the place-based learning, there is no better time for HEIs worldwide to adopt e-Learning platforms than today. The current global lockdown arising from the COVID-19 pandemic has compelled everyone to remain at home. In South Africa, all schools and learning institutions have been closed for at least one month, instead of the planned holiday of one week. No-one is sure of the state of academic affairs after the lockdown period. As such, the e-Learning platform becomes the only viable option at this stage.

For academics to be pedagogically competent in blending digital and technological skills with traditional disciplinary knowledge, some may need to retrain in certain areas and be equipped with relevant technology and digital tools (Lestari & Santoso 2019; Hussin 2018). According to the Education Technology and Mobile website (2016), a 21st-century educator should be able to,

... record and edit audio clips; create interactive video content; create infographics and posters; create personal learning networks, connect

and grow professionally; use blogs and wikis to create participatory spaces for students; create engaging presentations; create digital portfolios; curate, organise and share digital resources; and create digital quizzes such as 'Kahoot'.

In preparation for remote teaching and learning via the e-learning platform, UKZN has initiated a series of online workshops and webinars to prepare academics to convey learning and interact via online platforms such as Moodle, Zoom and Google classroom, to name a few. To ensure uninterrupted internet connectivity, the university has provided data bundles to all staff and is in the process of rolling out data bundles to students. Undoubtedly, this would have come at no small cost to the institution. As such, the yield on this investment in terms of enabling the future teachers with the desired skills set and digital/technological capabilities needed to convey disciplinary knowledge in the 4IR classroom, needs to be ascertained.

Theoretical Framework

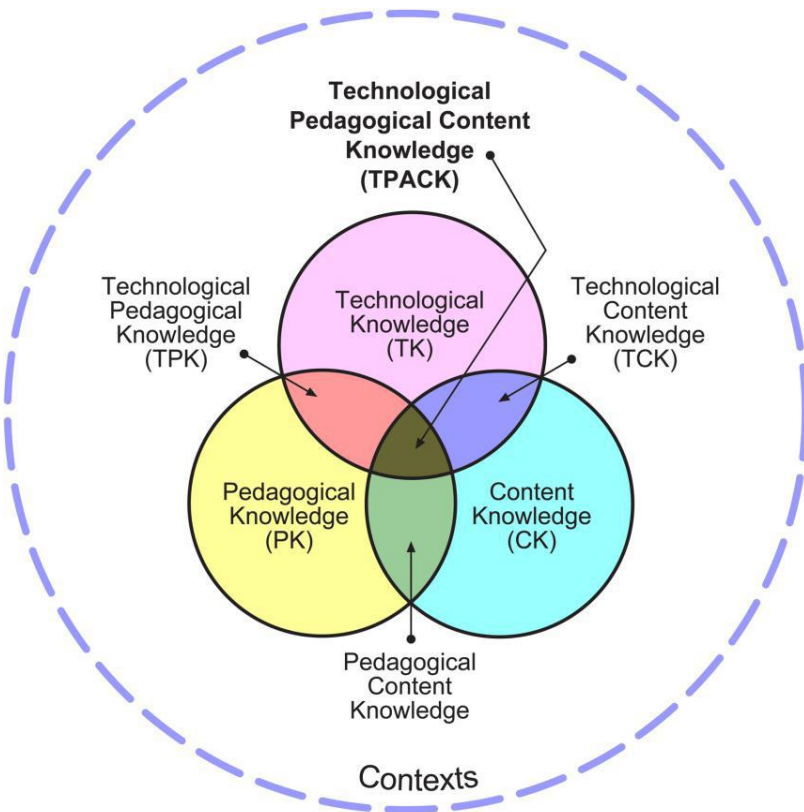
The TPACK model propagated by Koehler and Mishra (2009) served as the framework to understand whether the blending of digital and technological skills with traditional Commerce Education content knowledge was captured on the revised module templates for remote learning.

TPACK is the knowledge of utilizing suitable digital technologies to represent specific subject matter knowledge through successful instructional approaches and teaching strategies (Bingimlas 2018). Koehler and Mishra (2009) describe the different components of the framework as in the following:

- **Content Knowledge (CK)** relates to the traditional content knowledge that academics must possess in order to teach the subject. In Commerce Education, in the first year of study, this would include the knowledge, skills, values and other behaviours relating to accounting for the sole trader and entrepreneurship.
- **Pedagogical Knowledge (PK)** pertains to academics understanding of the diverse approaches and processes of teaching and learning. It covers learning theories, lesson planning, assessments and classroom management, amongst others.

- **Technological Knowledge (TK)** denotes fluency of information technology that extends beyond computer literacy to include digital literacy and in-depth understanding and mastery of ICT for ‘information processing, communication and problem solving’ (p. 61). Examples include ‘blackboard, applications, software, smart devices, and social media’ (Bingimlas 2018:2).

Figure 1. The TPACK framework and its knowledge components.



Source: Koehler and Mishra (2009:63)

- **Pedagogical Content Knowledge (PCK)** is the academic's means of transforming a particular content via multiple representation to enable learning. It 'covers the core business of teaching, learning, curriculum, assessment and reporting, such as the conditions that promote learning and the links among curriculum, assessment, and pedagogy' (Koehler and Mishra 2009:64).
- **Technological Content Knowledge (TCK)** is an understanding of how technology can be used to influence the content. Bingimlas (2018) describes it as the knowledge of technology to access content.
- **Technological Pedagogical Knowledge (TPK)** is an understanding of how technology can be used to support teaching and learning (Bingimlas 2018).
- **Technological Pedagogical and Content Knowledge (TPACK)** 'is an understanding that emerges from interactions among content, pedagogy, and technology knowledge' (Koehler & Mishra 2009: 66) that translates into meaningful and skilful teaching with technology.

This model is therefore useful in understanding teaching in a technological environment (Martin 2015) and deems the overlapping knowledge components as mutually dependent elements of a bigger, more composite knowledge system which need not be considered in isolation (Koehler and Mishra 2009). It is also beneficial in determining the knowledge that academics should possess in order to facilitate learning with technology effectively in diverse fields (Schmidt *et al.* 2009). As such, it describes how technology can be used to enhance student learning (Joo *et al.* 2018). The application of TPACK is, however, limited by lack of stable infrastructure, access to computers and readiness to embrace ICT amongst others (Joo *et al.* 2018; Kihzoza *et al.* 2016). Nonetheless, in the 21st-century e-Learning environment, TPACK is tending towards 'a required area of expertise for teachers' (Joo *et al.* 2018:48).

Generally, the learning environments or contexts determine how academics employ technologies in teaching any subject matter (Mishra & Koehler 2009; Bingimlas 2018). This chapter is limited in this regard since the

online teaching of the module will go live only when the university resumes online teaching. Thus, further empirical research is required to explore the full impact of the pedagogical elements of the framework.

Methodology and Presentation of Findings

The methodology employed was located within a qualitative, interpretive research paradigm using the CED at UKZN as a case study. This preliminary research is based on the document analysis of two revised module templates that served as curriculum exemplars to determine the extent to which Commerce Education academics have blended digital and technological skills with traditional Commerce Education knowledge. Cohen, Manion and Morrison (2011: 206), contend that ‘documents include official documents, which provide direct evidence of decisions that are directly or indirectly related to the phenomenon under inquiry’. In this case the selected revised templates (Accounting Education 113 and EMS 111) form part of the first-year Commerce Education revised curriculum that was prepared for emergency remote learning during the lockdown period. The documents outline the weekly learning outcomes, planned delivery mode and remote teaching activities, as well as the planned remote assessment strategies. Guided by the TPACK framework, a systematic examination and interpretation of the documents followed in order to ‘elicit meaning, gain understanding and develop empirical knowledge’ (Corbin & Strauss 2011:274) about the academics’ intention of blending digital and technological skills with traditional commerce knowledge. While triangulation is preferred and the lived pedagogical experiences of both academics and students should be considered, academics are yet to implement virtual learning; hence, the only basis for understanding in the present day is via the review of curriculum documents such as the revised module templates.

The revised templates for remote learning 2020 can be described as the intended curriculum for these modules in the light of the COVID-19 pandemic. By reviewing the templates one can ascertain the academics’ plan for achieving the objectives of the module. The analysis of the module template begins with a review of the learning outcomes followed by a discussion on how the template resonates with the themes from the TPACK model.

The planned learning outcomes for Accounting 113 are stated as follows.

Students should be able to:

- Apply and integrate business calculations and Accounting Education.
- Explain the nature and principles of Accounting as a discipline, with special reference to Generally Accepted Accounting Practice (GAAP).
- Outline the Accounting procedures in relation to bookkeeping (All Journals, including Salaries and Wages Journal).
- Analyse transactions based on the accounting equation.
- Prepare Reconciliations as it relates to Bank, Debtors and Creditors.
- Prepare Adjustments and closing entries.
- Prepare financial statements for a Sole Trader.
- Analyse, interpret and evaluate financial statements of a Sole Trader.
- Recommend appropriate internal controls (and auditing) for a Sole Trader.

From the EMS 111 revised template, students should be able to:

- Explain the qualities of an entrepreneur.
- Outline the process of acquiring a business.
- Develop a business plan for a new venture.
- Explain franchising in the SA context.
- Distinguish between Savings and Investment opportunities.
- Discuss the factors of production.
- Compare and contrast the different forms of ownership.
- Understand corporate social responsibility.

The above provides an indication of the knowledge, skills, values and other behaviours that students are expected to acquire as a result of their engagement with these modules. They specify the content and the planned cognitive attributes that students are expected to develop.

Drawing from the verb/ verb phrase, a fair proportion of the module outcomes for EMS aim to equip learners with higher cognitive attributes, differentiate concepts and develop a business plan. These skills are deemed essential for the 2020 workforce (Jananian 2020; PWC 2019). However, the Accounting module mainly engenders transfer of learning through the application of previously learned knowledge and skills, since only three outcomes target higher cognitive levels of analysis and evaluation. Since the ability to think

critically and solve problems creatively are mainly developed at higher cognitive levels (Anderson *et al.* 2001), it could be inferred that the Accounting 1 module does not equip students adequately with the human skills set expected of the 4IR teacher. This affirms the work of previous scholars that the accounting programme of instruction mainly promotes the transfer of learning (Arek-Bawa 2018), together with the fact that Accounting education students felt ill equipped with the relevant skills for the workplace (Lestari & Santoso 2019).

Also, teachers are expected to possess technological and digital skills to be able to work in the 4IR classroom. Avenues to enable such skills should be embedded in the curriculum and instruction (Lestari & Santoso 2019). However, there is no component of the module outcome aiming for the development of technological and digital skills in students, even though teaching and learning are expected to be conducted virtually, as catalysed by the COVID-19 pandemic. The learning outcomes in general then falls short in this regard.

As stated earlier on, themes from the TPACK model will be used in discussing the plan for remote learning included in the revised module templates. An excerpt from the templates for both modules are provided below: From the colour codes, red and green relate to PK; blue relates to CK; brown relates to TK; dark peach denotes reference to students; and online assessments is coloured purple, because it encompasses PK and TK.

Accounting Education 113 Planned session	Session Outcomes	Planned delivery mode and remote teaching activity
Week A: Session 3	General Ledgers	Flipped Classroom: Materials already uploaded on Moodle, Review and tutorials via Zoom; Students to work through practice materials in textbook and continue on-line assessment on Dashboard.

Week B: Session 1	Bank reconciliation	PowerPoint with audio; Students to work through practice materials in textbook and continue on-line assessment on Dashboard.
Week B: Session 2	Adjustments	Flipped Classroom: Materials to be uploaded on Moodle, Review and tutorials via Google classroom; Students to work through practice materials in textbook and continue on-line assessment on Dashboard.

EMS 111 Planned session	Session Outcomes	Planned delivery mode and remote teaching activity
Week A: Session 1	Business risk management and forms of ownership	Online Chat Activity
Week A: Session 2	Intellectual property and contracts	Live teaching with Zoom
Week A: Session 3	Entrepreneurial Leadership and Values	Zoom pre-recorded lectures
Week B: Session 1	Conflict Resolution	Zoom pre-recorded lectures

Technological Knowledge: Evidence from the template shows the use of technologies in the teaching and learning process all through the period. The template made reference to Moodle, Zoom, Google classroom, Dashboard, and online assessments, all suggesting the academics' familiarity with technologies needed to facilitate e-learning. While this is a good indication of technological savvy academics, it could also be a planned trial-by-error run of academics who are left with no other choice than to engage in virtual mode teaching catalysed by the COVID-19 pandemic. On a closer look, the variety of the technologies tilts the argument in favour of the former.

Content Knowledge: The content for the remainder of the semester specified in the module templates are *source documents and journals; general ledger; bank reconciliations; adjustments; financial statements; and ratio analysis* for Accounting, while the EMS content include *forms of ownership; Intellectual property and contracts; and entrepreneurial leadership and values*. Reference to *materials, PowerPoint and textbook* in the Accounting template could be an indication of the source for details relating to each topic. These academics are expected to possess an in-depth understanding of the content/subject matter in order to disseminate the same to students. However, the brevity of the content-related information contained in the template makes it difficult to ascertain the depth and extent of coverage.

Pedagogical Knowledge: The Accounting template mainly provides for a *flipped classroom* approach to teaching and learning, together with the use of *PowerPoint with audio*. The EMS template makes reference to *pre-recorded lectures* and *live teaching* with zoom. There are no details as to how teaching and learning will be conducted within the flipped classroom or live teaching experience. The information is rather scanty and deemed insufficient in assessing an educator's pedagogical competence. However, it is worthy to note that most sessions in the Accounting template make room for *review* and formative assessments in the form of *tutorials, practice materials* from the textbook and *online assessments*. The EMS template provides for an *online chart activity*. In spite of these, it could be argued that PK is broad. The inclusion of assessments in a flipped classroom or pre-recorded lectures may not engender the transformative learning power that is at the core of PCK expected of a competent academic (Lestari & Santoso 2019).

Technological Content Knowledge: The fusion of technological and content knowledge is mainly visible in the *uploading of materials on Moodle* and *Zoom pre-recorded lectures*. When using lectures, the content can be conveyed orally, guided by notes or slides. Indeed, PowerPoint is regarded as a technology-related vessel for content (Bingimlas 2018). An understanding of the workings of Microsoft Office, Zoom and PowerPoint are required to be able to encode the required content with audio on the slide.

Technological Pedagogical Knowledge: The use of technology to support teaching and learning is evident in the templates via planned *reviews and*

tutorials using zoom, Google classroom, live teaching with Zoom and Zoom pre-recorded lectures. The use of online platforms for chat activities, assessments and class tests also indicates the use of technology to support learning.

Technological Pedagogical and Content Knowledge: There is evidence of the interplay of technology, pedagogy and content knowledge in the planned enactment of the Accounting 113 and EMS 111 education programmes for the remainder of the semester. The use of a *flipped classroom approach* to review materials and tutorials already uploaded in Moodle via Zoom is a clear indication of some level of interaction of TK, PK and CK. However, the extent of integration is not readily ascertained from the template due to the brevity of the content description and the inclusion of only limited components of PK in the plan. One cannot categorically insinuate that the competences of an expert educator who simultaneously integrates subject matter expertise with pedagogical and technological knowledge to engender TPACK (Koehler & Mishra 2009) is manifest in the plan. This leaves room for future empirical studies that can engage or explore the lived experiences of academics to ascertain how TPACK is brought into play in the virtual classroom. On the whole we can conclude that some level of TPACK can be inferred from the plan, which can be likened to Bingimlas' (2018) conclusion that teachers in Saudi Arabia felt they were average in terms of TPACK. On the contrary, Kihoza *et al.* (2016) generally found low levels of TPACK knowledge amongst tutors and teacher trainees in Tanzania, even though the tutors were more technologically knowledgeable.

The module template for Accounting also suggests students' engagement in formative assessments as they are expected to *work through practice materials in textbook and continue online assessments on dashboard*. For students to carry on with online assessment indicates some familiarity with virtual assessments. Even though these first-year students barely spent two months at the School of Education before the closure of the academic session, most of them should be fairly familiar with accessing materials uploaded on Moodle, which was in process before they vacated campus. However, teaching via Zoom, Google Classroom and PowerPoint with audio is novel. Just as the academics have been trained, there is a need to train the students for them to develop the digital and technological skills (Martin 2015; Mayo, Kajs & Tanguma 2005) needed to acclimatize to the new digital learning environment

catalysed by the COVID-19 pandemic. These are skills that are not only relevant for the present-day academic success, but contribute to equipping them to thrive in their 4IR classroom (PWC 2019; WEF 2016). Lestari and Santoso (2019) emphasise the need to train Accounting student teachers on the use of accounting software for data processing and preparation of financial statements, amongst others. This is arguably applicable to the EMS student teachers, since 40% of the EMS school curriculum are drawn from Accounting. Such discipline-specific software skills based on the latest technology could be included in the accounting and EMS teacher education programmes by the university (Lestari & Santoso 2019) to obtain a technology-embedded curricula (Martin 2015). The TPACK framework, which has been found useful in teacher education programmes (Schmidt *et al.* 2009; Joo *et al.* 2018), will serve as a useful guide. Although the planned learning outcomes for the Accounting 113 and EMS 111 modules do not explicitly make provision for the development of technological and digital skills in students, the COVID-19 pandemic inadvertently catalyses the acquisition of these skills that have become mandatory for learning both at universities and schools.

Conclusion

Given the current COVID 19 pandemic that has necessitated the closure of place-based learning worldwide, this study sought to explore how Commerce Education academics in UKZN blend digital and technological skills with traditional content knowledge to prepare students for the 4IR classroom via e-Learning. The 4IR workforce are expected to possess digital and technological skills, in addition to traditional content knowledge with other human skills to excel in the workplace. Framed by the TPACK model, this chapter examined the content of the revised module template of the first-year commerce education programmes to offer an understanding of the blending of technological skills in disseminating content in a virtual environment. Even though the planned curriculum indicated some level of TPACK, which cannot be associated with that of an expert teacher, there are indications of the possible development of technological and digital skills catalysed by the COVID-19 pandemic. This study is limited in scope, due to the focus on first-year module templates, and calls for further empirical research to understand the lived pedagogical experiences of both academics and students who undertake such modules during this pandemic.

References

- Anderson, L.W., D.R. Krathwohl, P.W. Airasian, K.A. Cruikshank, R.E. Mayer, P.R. Pintrich & M.C. Wittrock 2001. *A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives*. Abridged Edition. White Plains, NY: Longman.
- Arek-Bawa, O. 2018. *Cognitive Demand of Assessment Activities in Level-One Financial Accounting Textbooks in Selected African Countries*. Doctoral dissertation, University of KwaZulu-Natal, Durban.
- Bingimlas, K. 2018. Investigating the Level of Teachers' Knowledge in Technology, Pedagogy, and Content (TPACK) in Saudi Arabia. *South African Journal of Education* 38,3: 1 – 12.
- Cohen, L., L. Manion & K. Morrison 2011. *Research Methods in Education*. Abingdon: Routledge.
- Corbin, J.M. & A. Strauss (eds.). 2011. Grounded Theory Methodology. *Handbook of Qualitative Research*. Hagen: Fernuniversität.
- Department of Basic Education (DBE) 2011. *National Curriculum Statement (NCS): Curriculum and Assessment Policy Statement (CAPS), Accounting*. Available at: <https://www.education.gov.za/> (Accessed on 24 April 2020.)
- Department of Telecommunications and Postal Services (DTPS) 2017. *South African National E-Strategy: Towards a Thriving and Inclusive Digital Future*. Volume 629, 10 November, 41242. Available at: https://www.dtps.gov.za/images/phocagallery/Popular_Topic_Pictures/National-e-strategy.pdf (Accessed on 30 April 2020.)
- Education Technology and Mobile Learning 2016. 9 Fundamental Digital Skills for 21st Century Teachers. Available at: <https://www.educators-technology.com/2016/12/9fundamental-digital-skills-for-21st.html> (Accessed on 02 April 2020.)
- Gleason, N.W. 2018. Singapore's Higher Education Systems in the Era of the Fourth Industrial Revolution: Preparing Lifelong Learners. In *Higher Education in the Era of the Fourth Industrial Revolution*. Singapore: Palgrave Macmillan.
- Hussin, A.A. 2018. Education 4.0 made Simple: Ideas for Teaching. *International Journal of Education and Literacy Studies* 6,3: 92 – 98.
- Jananian F. January 2020. *How Higher Education can Adapt to the Future of Work*. Available at: <https://www.weforum.org/agenda/2020/01/how-can->

- [higher-education-adapt-toconstantly-evolving-future-of-work/](#) (Accessed on 02 April 2020.)
- Joo, Y.J., S. Park & E. Lim 2018. Factors Influencing Preservice Teachers' Intention to Use Technology: TPACK, Teacher Self-efficacy, and Technology Acceptance Model. *Journal of Educational Technology & Society* 21,3: 48 – 59.
- Joshi, M. & R. Chugh 2009. New Paradigms in the Teaching and Learning of Accounting: Use of Educational Blogs for Reflective Thinking. *International Journal of Education and Development Using ICT* 5,3: 6 – 18.
- Karuri-Sebina, G. September 2019. Sustainable Development in Africa through the 4IR. Paper presented at the Proceedings of the 6th Annual DHET research Colloquium on the Fourth Industrial revolution (4IR): Implications for Post-Secondary School Education and Training. Available at: <http://www.dhet.gov.za> (Accessed on 02 April 2020.)
- Kihoza, P., I. Zlotnikova, J. Bada & K. Kalegele 2016. Classroom ICT Integration in Tanzania: Opportunities and Challenges from the Perspectives of TPACK and SAMR Models. *International Journal of Education and Development Using ICT* 12,1.
- Koehler, M. & P. Mishra 2009. What is Technological Pedagogical Content Knowledge (TPACK)? *Contemporary Issues in Technology and Teacher Education* 9,1: 60 – 70.
- Lekhanya, L. M. 2019. Public Outlook on Creative Methodologies for the 4th Industrial Revolution in South Africa. *International Journal of Entrepreneurship* 23,3: 1939 – 4675.
- Lestari, S. & A. Santoso 2019. The Roles of Digital Literacy, Technology Literacy, and Human Literacy to Encourage Work Readiness of Accounting Education Students in the Fourth Industrial Revolution Era. *International Conference on Economics, Education, Business and Accounting. KnE Social Sciences*. 513 – 527.
- Manda, M.I. & S.B. Dhaou 2019. Responding to the Challenges and Opportunities in the 4th Industrial Revolution in Developing Countries. In *Proceedings of the 12th International Conference on Theory and Practice of Electronic Governance*. Available at: <https://dl.acm.org/doi/proceedings/10.1145/3326365> (Accessed on 02 April 2020.)
-

- Martin, B. 2015. Successful Implementation of TPACK in Teacher Preparation Programs. *International Journal on Integrating Technology in Education* 4,1: 17 – 26.
- Mayo, N.B., L.T. Kajs & J. Tanguma 2005. Longitudinal Study of Technology Training to Prepare Future Teachers. *Educational Research Quarterly* 29,1: 3 – 15.
- Mezied, A, A. January 2016. *What Role will Higher Education Play in the 4IR*. Available at: <https://www.weforum.org/agenda/2016/01/what-role-will-education-play-in-the-fourth-industrial-revolution/> (Accessed on 02 April 2020.)
- Ndledle, S. 2019. Motshekga says Basic Education Ready to Tackle Fourth Industrial Revolution. *African News Agency*. Available at: <https://www.iol.co.za/news/politics/motshekga-says-basic-education-ready-to-tackle-fourth-industrial-revolution-29325459> (Accessed on 30 April 2020.)
- Nzimande, B.E. 2020. The Minister of Higher Education, Science and Technology Dr B.E. Nzimande's Address During the 2019 Sona Debate. Available at: <http://www.dhet.gov.za/SiteAssets/SONA%20Debate%20final.pdf> (Accessed on 07 April 2020.)
- Oliveri, M.E. & R. Markle 2017. Continuing a Culture of Evidence: Expanding Skills in Higher Education. *ETS Research Report Series* 2017,1: 1 – 8.
- Penprase, B.E. 2018. The Fourth Industrial Revolution and Higher Education. In *Higher Education in the Era of the Fourth Industrial Revolution*. Singapore: Palgrave Macmillan.
- PWC. 15 October 2019. *Workforce of the Future: 2030 Global Trends Challenged by African Realities*. Available at: <https://www.pwc.co.za/en/publications/pwc-focus-on-education-series2.html> (Accessed on 02 April 2020.)
- Ramaphosa, C. 10 January 2020. A National Strategy for Harnessing the Fourth Industrial Revolution: The Case of South Africa. Brookings. Available at: <https://www.brookings.edu/blog/africa-in-focus/2020/01/10/a-national-strategy-for-harnessing-the-fourth-industrial-revolution-the-case-of-south-africa/> (Accessed on 24 April 2020.)
- Schmidt, D.A., E. Baran, A.D. Thompson, P. Mishra, M.J. Koehler & T.S. Shin 2009. Technological Pedagogical Content Knowledge (TPACK): The Development and Validation of an Assessment Instrument for Preservice

- Teachers. *Journal of Research on Technology in Education* 42,2: 123 – 149.
- Schwab, K. 2015. *The Fourth Industrial Revolution: What it Means, How to Respond*. Available at: <https://www.weforum.org/agenda/2016/01/the-fourth-industrial-revolution-what-itmeans-andhow-to-respond> (Accessed on 02 April 2020.)
- Susanti, H., V. Pratiwi & Han Tantri Hardini January 2020. The Readiness of Economy Education Students for the Employment Market of the 4th Industrial Revolution. In *International Conference on Research and Academic Community Services (ICRACOS 2019)*. Atlantis Press.
- Syaddad, H.N. 2020. February. Preparing the Preservice Teachers to be the Industrial Revolution Teacher 4.0 Era. In *3rd International Conference on Learning Innovation and Quality Education (ICLIQE 2019)*. 1165-1173. Atlantis Press.
- University of KwaZulu-Natal (UKZN) 2017. *Strategic Plan 2017-2021*. Available at: <https://strategicplan17-21.ukzn.ac.za/> (Accessed on 02 April 2020.)
- University of KwaZulu-Natal (UKZN) School of Education 2020. *Module Template for Remote Learning: Economics and Management Sciences Education 1*. Unpublished Document
- University of KwaZulu-Natal (UKZN) School of Education 2020. *Module Template for Remote Learning: Accounting Education 113*. Unpublished Document.
- Vithal, R. 2013. *UKZN Policy on Teaching and Learning*. Available at: <https://soe.ukzn.ac.za/teaching-learning-office/> (Accessed on 02 April 2020.)
- Webber-Youngman, R.C.W. 2017. Life Skills Needed for the 4th Industrial Revolution. *Journal of the Southern African Institute of Mining and Metallurgy* 117,4: iv – v.
- Wilson, C., P. Lennox, M. Brown & G. Hughes 2017. How to Develop Creative Capacity for the Fourth Industrial Revolution: Creativity and Employability in Higher Education. *International Conference on Knowledge, Innovation, and Enterprise (KIE 2017)*. Philadelphia, United States of America.
- World Economic Forum (WEF) January 2016. The Future of Jobs: Employment, Skills and Workforce Strategy for the Fourth Industrial Revolution. In *Global Challenge Insight Report, World Economic Forum*,

Geneva. Available at: http://www3.weforum.org/docs/WEF_Future_of_Jobs.pdf

(Accessed on 02 April 2020.)

World Economic Forum (WEF) 2017. The Future of Jobs and Skills in Africa Preparing the Region for the Fourth Industrial Revolution. Available at: http://www3.weforum.org/docs/WEF_EGW_FOJ_Africa.pdf
(Accessed on 02 April 2020.)

Xing, B. & T. Marwala 2017. Implications of the Fourth Industrial Age for Higher Education. *The Thinker* 73, Third Quarter 2017.

Yuhatriati, Jasmaniah, B. Azhari, A Ma'awiyah, Zulkifli, Syabuddin, M. Hamid, Hamidansyah, M. Ridhwan, Hambali, Ilyas & S. Bahri 2020. e-Learning as Connector among Education Institutions in the 4th Industrial Revolution. *Journal of Physical Sciences* 1471,1.
<https://doi.org/10.1088/1742-6596/1471/1/012024>
(Accessed 02 April 2020.)

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