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Exploring Synchronicity and Flexibility: Bichronous Learning as a Model for Inclusive Higher Education in South Africa

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Abstract

This paper investigates the comparative potential of synchronous, asynchronous, and bichronous learning models in addressing persistent inequalities in South African higher education. Situated within a constructivist theoretical framework, the study explores how bichronous learning, blending real-time engagement with self-paced study, offers a flexible and inclusive pedagogical model capable of supporting diverse student needs, particularly in contexts characterised by digital divides and infrastructural disparities. Adopting a qualitative desktop review methodology, the study critically synthesises findings from 72 peer-reviewed articles selected using PRISMA guidelines. These articles were thematically analysed using the Critical Appraisal Skills Programme (CASP) checklist with Braun and Clarke's six-step framework. The results reveal that while synchronous and asynchronous approaches have distinct strengths, bichronous learning offers a more adaptable and resilient approach to promoting academic success, engagement, and graduate employability. The paper recommends a structured implementation framework for bichronous learning in South African higher education. It highlights avenues for further research into its long-term impact on inclusivity and workforce readiness. Beyond its pedagogical implications, the study contributes to scholarship on inclusive and flexible higher education by advancing an evidence-based framework for implementing bichronous learning in digitally unequal contexts such as South Africa. It concludes by highlighting avenues for future research into the long-term effects of bichronous learning on equity and workforce readiness.

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Introduction

Higher education in South Africa (SA) continues to grapple with the lingering effects of historical inequalities that systematically restricted access for the majority of its population (Council on Higher Education in South Africa (CHE), 2021). Despite significant policy reforms post-1994, disparities in infrastructure, digital connectivity, and technological access remain pervasive, particularly across rural and low-income communities (World Bank, 2021). The COVID-19 pandemic further exposed and deepened these divides, highlighting the urgent need for more flexible and resilient educational delivery models to accommodate diverse student contexts (SAQA, 2023). In this environment, there is a growing imperative for South African higher education institutions to adopt pedagogical strategies that ensure academic continuity and promote inclusive participation for historically marginalised students.

Online learning has evolved primarily into two pedagogical modes: synchronous learning, which involves real-time interaction between instructors and students, and asynchronous learning, in which students engage with course content independently at flexible schedules (Martin et al., 2020). Each model presents distinct advantages and challenges: synchronous approaches foster immediate interaction but depend heavily on stable connectivity, while asynchronous models offer flexibility but can lead to feelings of isolation and disengagement (Bao, 2020; Adedoyin & Soykan, 2023). More recently, bichronous learning, a deliberate integration of synchronous and asynchronous strategies, has been proposed as a promising hybrid approach that aims to balance immediacy with autonomy, potentially mitigating the shortcomings inherent in each mode when used independently (Alqabbani et al., 2021; Suwastini et al., 2024). Thus, there is a pressing need to critically investigate whether bichronous learning can serve as a viable and sustainable model to support inclusive education, improve student engagement, and enhance graduate readiness in the South African higher education landscape.

While globally, bichronous learning is increasingly recognised for its potential to foster flexibility and student autonomy (Martin, Polly & Ritzhaupt, 2020; Adedoyin & Soykan, 2023; Varkey et al., 2023), South Africa faces unique contextual challenges that amplify the urgency of adopting such inclusive learning models. The rapid digital transition prompted by COVID-19 exposed systemic inequalities in access to technology, connectivity, and institutional readiness, particularly between historically advantaged and disadvantaged universities (Faloye & Ajayi, 2022; CHE, 2021). These disparities mirror broader socio-economic divides that continue to shape higher-education participation and outcomes. Limited digital infrastructure, inconsistent staff preparedness, and unequal student access to reliable devices or data hinder equitable engagement in online learning (World Bank, 2021; SAQA, 2023). Consequently, while global institutions have leveraged synchronous and asynchronous modalities to enhance autonomy and flexibility (Adnan & Anwar, 2020; Baber, 2022), South African universities must simultaneously address digital inequality and inclusivity imperatives. This makes the exploration of bichronous learning not merely pedagogically relevant but an urgent strategy for advancing equity and resilience within the national higher-education landscape. This study contributes to scholarship by expanding constructivist approaches to include bichronous pedagogical design in contexts of digital inequality, thereby advancing both theoretical and practical understandings of inclusive online learning in the Global South.

The primary aim of this study is to investigate which online learning model, synchronous, asynchronous, or bichronous, offers the most inclusive and adaptable solution for South African higher education, given the infrastructural, digital, and socio-economic challenges present. By examining how these models align with the principles of equitable access, student engagement, and academic resilience, the study aims to contribute to the development of contextually responsive pedagogical frameworks that advance educational inclusivity and promote graduate readiness in a digitally mediated future.

Research Objectives

- To analyse the strengths and limitations of synchronous, asynchronous, and bichronous learning models within digitally unequal educational contexts.

- To assess the potential of bichronous learning in promoting inclusive participation and academic success among diverse student populations in SA.
- To propose a conceptual implementation framework for integrating bichronous learning into South African higher education.

Literature Review

The rapid evolution of digital technologies and the global shift toward online education have catalysed the exploration of diverse learning models in higher education. In digitally unequal contexts such as SA, where infrastructural disparities persist, the choice of learning modality significantly influences educational inclusivity, student engagement, and academic success (Adedoyin & Soykan, 2023). This literature review critically examines three primary online learning models, synchronous, asynchronous, and bichronous, to evaluate their respective potentials and limitations in supporting inclusive higher education. This section establishes the foundation for assessing bichronous learning as a viable pedagogical model to address SA's complex educational challenges by interrogating current research findings and identifying gaps.

Synchronous Learning in Higher Education

Synchronous learning refers to online education formats in which instructors and students interact in real time via video conferencing, live discussions, and virtual classrooms (Suwastini et al., 2024). Real-time communication fosters immediacy, social presence, and peer collaboration, aiming to replicate key elements of face-to-face interaction within a digital environment (Adnan & Anwar, 2020; Rasheed et al., 2020). Several recent studies highlight the pedagogical advantages of synchronous learning. Rasheed et al. (2020) argue synchronous environments enhance student motivation by facilitating immediate feedback and dynamic engagement. Similarly, Suwastini et al. (2024) found that synchronous sessions fostered a sense of academic community, promoting deeper cognitive engagement and interaction among geographically dispersed students. In disciplines where collaboration, rapid feedback, and dialogic learning are central, such as education and healthcare, synchronous modalities have been associated with higher student satisfaction and stronger knowledge construction (Martin et al., 2020).

However, the limitations of synchronous learning are particularly pronounced in contexts marked by infrastructural and socio-economic disparities. Adnan and Anwar (2020) note that synchronous delivery models disproportionately disadvantage students lacking reliable internet access, personal devices, or conducive study environments, conditions acutely prevalent in SA's rural and peri-urban areas. Further, synchronous participation requires fixed scheduling, which may conflict with students' work and caregiving responsibilities and with inconsistent electricity supply (Faloye & Ajayi, 2022). Consequently, while synchronous learning fosters active engagement for well-resourced students, it risks exacerbating inequalities for underserved populations. Thus, although synchronous learning offers pedagogical strengths in fostering immediacy and interaction, its successful implementation remains heavily contingent on infrastructural readiness, digital equity, and student support mechanisms. In contexts like SA, exclusive reliance on synchronous modalities may deepen existing educational divides, underscoring the need for hybrid models that combine structure with flexibility.

Asynchronous Learning in Higher Education

Asynchronous learning refers to educational models in which students access course materials, engage in activities, and communicate with instructors and peers at their own pace, without real-time interaction (Martin et al., 2020; Rasheed et al., 2020). Common asynchronous elements include recorded lectures, discussion forums, self-paced assignments, and digital resource libraries. This learning mode offers significant flexibility, enabling students to control the timing, pace, and sequencing of their engagement with academic content (Varkey et al., 2023). The advantages of asynchronous learning have been widely documented, particularly in contexts that require adaptable educational solutions. Asynchronous environments accommodate diverse learning styles, allowing students to review materials multiple times and engage more deeply with complex content

(Varkey et al., 2023). Furthermore, asynchronous learning significantly reduces dependence on real-time internet stability, which is particularly beneficial in digitally unequal environments such as SA (Faloye & Ajayi, 2022). Students managing employment, caregiving, or other life responsibilities also benefit from the scheduling flexibility afforded by asynchronous modalities, promoting broader access to higher education.

However, asynchronous learning is not without limitations. One of the most commonly cited challenges is the potential for feelings of isolation and detachment, as the absence of immediate interaction can lead to reduced motivation and weaker peer connections (Adarkwah, 2021; Rasheed et al., 2020). Without real-time feedback and spontaneous discussion, students may struggle with confusion or misinterpretation of content, potentially impeding their academic progress. Asynchronous learning also demands a high degree of student autonomy, time management skills, and intrinsic motivation, competencies that not all students possess equally, particularly first-generation or underprepared students (Varkey et al., 2023). In digitally unequal contexts, asynchronous learning represents a critical access strategy but must be supported by strong pedagogical scaffolding, frequent instructor communication, and opportunities for optional synchronous engagement. Without these supports, the flexibility that makes asynchronous learning attractive can inadvertently undermine educational quality and student persistence, particularly among vulnerable populations.

Bichronous Learning: Bridging the Divide

Bichronous learning represents a deliberate integration of synchronous and asynchronous modalities, designed to combine the immediacy and social engagement of real-time interaction with the flexibility and autonomy of self-paced study (Martin et al., 2020; Martin et al., 2023). In bichronous environments, students participate in scheduled live sessions while engaging with asynchronous content such as recorded lectures, online discussions, and independent assignments. This approach seeks to harness the respective strengths of each modality while mitigating their limitations, offering a more holistic and adaptable learning experience. The pedagogical benefits of bichronous learning are increasingly recognised in recent scholarship. Martin et al. (2020) highlight that bichronous models promote greater student autonomy while maintaining peer interaction and instructor presence, which are critical for motivation and engagement. Furthermore, Martin et al. (2023) found that bichronous frameworks enhance cognitive presence by allowing students to reflect deeply on asynchronous materials before participating in synchronous discussions, thereby fostering richer, more meaningful engagement. Bichronous learning also supports inclusive practices by offering students multiple entry points into the learning environment, accommodating varied schedules, access constraints, and learning preferences (Wang, 2023).

Critically, bichronous learning offers significant advantages for digitally unequal contexts such as SA. Faloye and Ajayi (2022) argue that students with intermittent connectivity benefit from asynchronous access to course materials, while scheduled synchronous sessions, carefully timed and optionally recorded, provide opportunities for direct engagement without imposing rigid participation demands. Infrastructural challenges, such as load-shedding or bandwidth instability, can thus be partially mitigated by the flexible design of bichronous learning environments. Nonetheless, implementing bichronous learning is not without its challenges. Effective bichronous course design demands careful coordination to ensure that synchronous and asynchronous components are pedagogically aligned rather than disjointed (Alqabbani et al., 2021; Suwastini et al., 2024). Without intentional integration, students may experience cognitive overload or confusion regarding expectations. Moreover, faculty development and institutional support are crucial to equipping academics with digital pedagogical skills and redesigning curricula that meaningfully incorporate both modalities (Baber, 2022). Overall, bichronous learning emerges as a promising and contextually responsive model capable of bridging the digital and pedagogical divides that constrain inclusive education. Its capacity to offer both flexibility and engagement positions it as a strong

candidate for promoting equitable participation and success in South African higher education.

Gaps in the Literature

While considerable research has examined synchronous and asynchronous online learning models, there remains a notable gap in the literature regarding bichronous learning, particularly in digitally unequal environments such as SA. Existing studies on bichronous approaches (e.g., Martin et al., 2020; Martin et al., 2023) are predominantly based in well-resourced settings in North America and Europe, where stable internet access, device availability, and digital literacy can largely be assumed. As a result, the applicability of bichronous learning to under-resourced, infrastructurally challenged contexts has been insufficiently explored. Few studies explicitly interrogate the relationship between learning modality choice and broader issues of educational equity, historical exclusion, and graduate employability in the Global South. Research focuses on immediate academic outcomes, such as student satisfaction and course completion rates (Rasheed et al., 2020), without adequately considering the long-term implications for inclusive educational transformation and socio-economic mobility. This narrow focus leaves critical questions unanswered about how hybrid models, such as bichronous learning, can support national goals for widening participation and skills development in emerging economies (Faloye & Ajayi, 2022).

There is a paucity of practical implementation frameworks guiding higher education institutions in the design, delivery, and support of bichronous learning environments. Most existing recommendations are theoretical rather than operational, offering limited guidance on issues such as curriculum alignment, faculty development, technological infrastructure, and student support strategies tailored to diverse access realities (Baber, 2022; Wang, 2023). Given these gaps, this study addresses an essential need by critically examining bichronous learning as a model for enhancing educational inclusivity within the specific socio-economic, infrastructural, and historical context of South African higher education. By synthesising existing scholarship and proposing a conceptual framework for implementation, the study seeks to contribute to more equitable and contextually responsive digital education practices.

Theoretical Framework

Building on the critical evaluation of synchronous, asynchronous, and bichronous learning models, it becomes necessary to ground the analysis within an appropriate theoretical lens. Constructivist learning theory, emphasising active, socially mediated knowledge construction, provides a relevant framework for examining how online modalities support or inhibit student engagement and educational inclusivity. The following section applies constructivist principles to critically assess the pedagogical affordances of bichronous learning in digitally unequal higher education contexts.

Constructivism posits that students actively construct knowledge through interaction with their environment, rather than passively absorbing information (Piaget, 1973; Vygotsky & Cole, 1978). Central to constructivist pedagogy is the notion that meaningful learning occurs when students engage collaboratively, reflect critically, and build new understandings based on prior knowledge and experience (Jonassen, 2013). In the context of online education, constructivism emphasises active engagement, dialogue, and scaffolded support to facilitate profound, transformative learning experiences. Synchronous learning environments align with constructivist principles by facilitating real-time dialogue, social negotiation of meaning, and immediate feedback. Live discussions, collaborative projects, and interactive webinars create opportunities for students to co-construct knowledge, mirroring Vygotsky and Cole's (1978) concept of the Zone of Proximal Development (ZPD), where learning is maximised through guided interaction with more knowledgeable peers or instructors. However, in contexts where digital divides limit synchronous participation, these benefits become unevenly distributed, risking the exclusion of students who cannot consistently access real-time engagements (Faloye & Ajayi, 2022).

Asynchronous learning also embodies constructivist ideals by supporting reflective engagement, self-paced exploration, and differentiated learning

pathways (Varkey et al., 2023). Through discussion forums, recorded lectures, and scaffolded assignments, asynchronous modalities allow students to revisit complex materials, formulate independent interpretations, and contribute thoughtfully to knowledge-building activities. However, without intentional community-building strategies, asynchronous environments risk isolating students and undermining the socially situated learning processes that constructivism advocates (Adarkwah, 2021).

Bichronous learning offers a pedagogical model that synthesises the strengths of both synchronous and asynchronous approaches, aligning closely with constructivist ideals. By enabling students to engage reflectively with asynchronous content and then apply and extend their understanding through synchronous dialogue, bichronous learning scaffolds both autonomous and collaborative meaning-making processes (Martin et al., 2020; Martin et al., 2023). This hybrid approach acknowledges that students construct knowledge individually but are socially mediated by timely interactions with peers and instructors, thereby optimally activating the ZPD even in contexts of infrastructural constraint. Furthermore, bichronous learning supports differentiated scaffolding by offering multiple modes of access, feedback, and engagement tailored to students' varying needs and circumstances, a critical consideration in digitally unequal higher education systems such as SA's (Faloye & Ajayi, 2022). By blending real-time social interaction with flexible, self-directed study, bichronous learning operationalises constructivist pedagogy to promote inclusivity, engagement, and deeper learning outcomes. Thus, constructivist learning theory not only frames the analysis of bichronous learning but also underscores its transformative potential for redressing structural inequities in digitally unequal higher-education systems.

Methodology

This study adopted a qualitative desktop literature review to critically explore the comparative potential of synchronous, asynchronous, and bichronous learning models for enhancing educational inclusivity in South African higher education. Given the emerging nature of bichronous learning and the limited availability of primary empirical studies in SA, a desktop review enabled the synthesis of existing research across global and local scholarship (Snyder, 2019). The search and selection process followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure transparency, replicability, and methodological rigour. This approach enabled a comprehensive, contextually grounded examination of online learning models aligned with the realities of the Global South. This approach enabled a comprehensive, contextually grounded examination of online learning models aligned with the realities of the Global South.

Search Strategy

A systematic search was conducted across three academic databases: Google Scholar, EBSCOhost, and ResearchGate, following the PRISMA flow structure of identification, screening, eligibility, and inclusion.. Search terms included various combinations of keywords and Boolean operators, such as: "Synchronous learning" AND "higher education", "Asynchronous learning" AND "digital equity", "Bichronous learning" OR "hybrid flexible learning", "Online learning models" AND "South Africa", "Inclusive education" AND "graduate employability"

The search focused on peer-reviewed journal articles published between 2018 and 2024 to capture the most recent developments, particularly those accelerated by the COVID-19 pandemic. Grey literature, opinion pieces, conference abstracts, and studies unrelated to higher education were excluded. Only articles written in English were considered. An initial pool of 215 articles was retrieved. After title and abstract screening, 102 articles were selected for full-text review. Following a critical appraisal using the CASP checklist (CASP, 2018), the final thematic synthesis included 72 articles that met the quality threshold.

Inclusion and Exclusion Criteria

Articles were included if they addressed the implementation, evaluation, or theoretical development of synchronous, asynchronous, or bichronous learning models in higher education settings; focused on issues related to digital equity, inclusivity, flexible learning design, or graduate employability and were published

in peer-reviewed journals between 2018 and 2024. Articles were excluded if they focused solely on primary or secondary education contexts, did not address issues of access, flexibility, or equity, and were not available in English or lacked peer-review status. The PRISMA flow process ensured transparency at each stage, with detailed records of article identification, screening, and exclusion, ultimately resulting in the inclusion of 72 studies for synthesis.

Critical Appraisal and Quality Assurance

Each selected article was critically assessed using the Critical Appraisal Skills Programme (CASP) Qualitative Checklist. Studies scoring at least 8 out of 10 on the CASP tool were included to ensure methodological rigour, transparency, and credibility. This appraisal process evaluated aspects such as clarity of research aims, methodological appropriateness, ethical considerations, and validity of findings.

Data Analysis

Thematic analysis was conducted following the six-phase framework developed by Braun and Clarke (2006). This rigorous analytical approach ensured that the findings were systematically derived, offering a robust foundation for evaluating online learning models against SA's educational landscape.

Limitations

As a qualitative desktop review, this study may be limited by potential publication bias, the exclusion of grey literature, and the focus on English-language sources. Furthermore, while the review captures a broad range of peer-reviewed scholarship, it may not fully represent emerging practices in under-documented or innovative localised contexts. Future empirical research, including primary data collection from South African higher education, would be valuable in triangulating and deepening these findings.

Findings

The thematic analysis of the selected literature identified several recurring, interrelated themes regarding the implementation and effectiveness of synchronous, asynchronous, and bichronous learning models in digitally unequal higher education contexts. Each theme highlights these modalities' comparative advantages and limitations relative to infrastructural realities, student engagement, pedagogical quality, and employability outcomes. The findings are organised thematically to provide a critical synthesis of how these models operate within the SA context, foregrounding the unique potential of bichronous learning to bridge systemic gaps.

Theme 1: Infrastructure Access and Technological Readiness

Infrastructure access and technological readiness emerged as critical determinants of students' ability to participate effectively in online learning environments. While fostering immediate interaction and community-building, synchronous learning was heavily dependent on stable internet connectivity, uninterrupted electricity supply, and access to appropriate devices (Adnan & Anwar, 2020; Faloye & Ajayi, 2022). In the South African context, where digital infrastructure remains unevenly distributed across urban and rural areas, reliance on synchronous learning disproportionately disadvantages students from historically marginalised communities (Uleanya & Alex, 2021).

Conversely, asynchronous learning models demonstrate greater adaptability to infrastructural constraints. Asynchronous approaches mitigate some of the barriers associated with unstable connectivity by allowing students to engage with course content flexibly, including offline when necessary (Varkey et al., 2023). However, the lack of real-time interaction can lead to disconnection from the learning community, which, over time, may negatively affect motivation and academic persistence, particularly among students who require additional academic support (Adarkwah, 2021). Bichronous learning offers a strategic response to infrastructural disparities by combining the flexibility of asynchronous access with strategically scheduled synchronous engagements (Martin et al., 2020; Martin et al., 2023). In bichronous models, students who face connectivity challenges can benefit from asynchronous materials at their convenience, while still participating in synchronous sessions when feasible, either live or through recorded formats. This blended approach ensures that engagement opportunities are maximised without

a rigid reliance on stable real-time connectivity, thereby offering a more inclusive framework for South African higher education grappling with digital inequality (Faloye & Ajayi, 2022).

Theme 2: Student Engagement and Motivation

Student engagement and motivation emerged as critical themes influencing the effectiveness of online learning modalities. Engagement, defined as the degree of attention, curiosity, and commitment students bring to learning, is essential for academic success, particularly in online environments where physical presence is absent (Martin et al., 2020). Synchronous learning models have consistently been associated with higher immediate engagement due to their interactive nature. Real-time lectures, group discussions, and collaborative activities foster social presence and immediacy, factors known to enhance student motivation (Suwastini et al., 2024; Rasheed et al., 2020). Immediate feedback from instructors and peers during synchronous sessions helps clarify doubts, sustain cognitive investment, and build a sense of academic community (Martin et al., 2023). However, in contexts where synchronous participation is inconsistent due to infrastructural barriers, the benefits of engagement are not equitably distributed among all students, potentially deepening educational inequalities.

Asynchronous learning gives students the autonomy to engage with content on their terms, which can empower students with strong self-regulation skills (Varkey et al., 2023). However, the absence of real-time interaction can lead to decreased motivation, especially among students who struggle with self-discipline or feel isolated in their learning experience (Adarkwah, 2021). The delayed nature of feedback in asynchronous environments may further contribute to disengagement if students perceive a lack of instructor presence or timely support (Baber, 2022; Mustapha & Kurt, 2021).

Bichronous learning offers a hybrid solution by intentionally combining the engagement benefits of synchronous interaction with the flexibility of asynchronous access. Research by Martin et al. (2020) and Martin et al. (2023) suggests that bichronous models enhance both cognitive and emotional engagement by allowing students to reflect independently on content asynchronously before collaboratively applying their knowledge during synchronous sessions. Scheduled live discussions provide structured opportunities for peer interaction and immediate feedback, while asynchronous activities allow for deep, reflective engagement at the student's own pace. In digitally diverse environments such as SA, bichronous learning allows for differentiated engagement strategies, ensuring that students with varying access levels and learning needs are not excluded from meaningful academic participation (Faloye & Ajayi, 2022). Thus, bichronous learning offers a more inclusive and motivating framework for sustaining student engagement over time, particularly in educational contexts where flexibility, access, and social presence must be carefully balanced.

Theme 3: Pedagogical Quality and Skill Development

The ability of online learning models to support deep learning, critical thinking, and the development of graduate employability skills emerged as a significant theme across the reviewed literature. Beyond basic content delivery, effective higher education requires pedagogical models that cultivate analytical skills, creativity, collaboration, and adaptability, capabilities critical for success in a rapidly changing, knowledge-driven economy (Martin et al., 2020; Faloye & Ajayi, 2022).

Synchronous learning environments facilitate the real-time co-construction of knowledge through live debates, case study discussions, and group projects. These activities align with constructivist pedagogical approaches, emphasising dialogue, immediate feedback, and collaborative meaning-making (Martin et al., 2023; Rasheed et al., 2020). Synchronous modalities are particularly effective for developing communication skills, teamwork, and quick problem-solving abilities. However, as noted by Faloye and Ajayi (2022), in South African contexts where access to synchronous participation is inequitable, these pedagogical benefits are often confined to more privileged students, thereby reproducing existing inequalities in skill acquisition. Asynchronous learning environments offer different pedagogical affordances. They provide

opportunities for students to engage in deeper critical reflection, self-paced research, and iterative revision of their work (Varkey et al., 2023). Discussion forums, reflective journals, and independent projects are common asynchronous strategies that foster metacognitive skills, written communication abilities, and long-term development of critical thinking. Yet, without real-time interaction, opportunities for spontaneous debate, real-world simulation, and adaptive feedback loops are limited, which can impede the holistic development of collaborative and dynamic problem-solving skills (Baber, 2022).

Bichronous learning presents a promising synthesis of these pedagogical strengths. By deliberately integrating synchronous opportunities for real-time collaboration with asynchronous spaces for deeper individual reflection, bichronous models enable multidimensional skill development (Martin et al., 2020). Research indicates that students engaged in bichronous courses are better positioned to develop critical thinking, autonomy, teamwork, and communication skills (Martin et al., 2023). In resource-constrained environments, such as SA, bichronous learning allows for differentiated instructional strategies. It ensures that students who cannot consistently attend live sessions can still access skill-building opportunities asynchronously, while those with better connectivity can benefit from richer real-time interactions (Faloye & Ajayi, 2022). Thus, from a pedagogical perspective, bichronous learning offers a balanced model that supports the development of independent critical skills and collaborative knowledge construction, positioning it as a highly adaptable framework for developing graduate employability across diverse educational contexts.

Discussion

This study critically evaluated synchronous, asynchronous, and bichronous learning models concerning educational inclusivity, student engagement, and skill development within the digitally unequal context of South African higher education. The findings reveal that synchronous and asynchronous modalities offer distinct advantages but pose significant limitations when used independently. Bichronous learning, by strategically integrating the strengths of both models, emerges as a pedagogically robust and contextually responsive framework capable of addressing persistent infrastructural disparities and fostering graduate readiness. The thematic analysis demonstrated that synchronous learning fosters immediacy, collaboration, and real-time cognitive engagement, aligning closely with constructivist principles of social negotiation and knowledge co-construction (Vygotsky & Cole, 1978; Martin et al., 2023). However, infrastructural barriers such as unstable internet access and electricity supply undermine the equitable effectiveness of synchronous modalities, particularly in rural and low-income settings (Faloye & Ajayi, 2022). Asynchronous learning addresses access barriers by enabling flexible, self-paced engagement that promotes independent and critical reflection consistent with constructivist principles of student autonomy (Varkey et al., 2023). Nevertheless, without intentional social scaffolding, asynchronous models risk fostering isolation and disengagement, which contradicts the collaborative imperatives of constructivism.

Bichronous learning bridges these gaps by offering a dynamic interplay between asynchronous reflection and synchronous social engagement, thus fully operationalising constructivist pedagogy. Through this hybrid model, students can engage deeply with content independently while benefiting from real-time feedback and peer interaction when conditions permit (Martin et al., 2020; Martin et al., 2023). The dual modality approach enhances cognitive presence and skill development and ensures differentiated access pathways, making it particularly suited to SA's infrastructurally diverse educational landscape.

This study contributes to the growing body of literature on digital learning modalities by situating bichronous learning within the specific socio-economic and infrastructural realities of SA, an area underrepresented in current scholarship. Furthermore, by developing a structured intervention plan aligned with the identified risks and opportunities, the study moves beyond theoretical analysis to offer a practical roadmap for institutional implementation. However, certain limitations must be acknowledged. As a desktop literature review, the study relies on secondary data, which may not fully capture emergent local innovations or unpublished

initiatives in South African higher education. The findings are primarily based on academic discourse rather than direct experiential data from students or staff, which may limit the granularity of insights into the lived experiences of online learning challenges and opportunities. Future research should prioritise empirical investigations into implementing bichronous learning models within South African institutions, particularly longitudinal studies tracking student outcomes, retention rates, and graduate employability.

Furthermore, exploring the experiences of diverse student cohorts, including first-generation students, rural students, and students with disabilities, would offer deeper insights into the inclusivity impacts of bichronous approaches. Therefore, this study highlights that bichronous learning provides a compelling, context-sensitive solution to the complex challenges of digital education in SA. Through strategic design, stakeholder collaboration, and ongoing evaluation, bichronous models can be pivotal in advancing equitable, future-ready higher education systems.

These findings reaffirm constructivist theory's emphasis on socially mediated knowledge construction by showing that bichronous learning can sustain interactional engagement even amid infrastructural limitations. In the South African context, this illustrates how constructivist principles can be operationalised to bridge access divides and enhance student agency within flexible digital ecosystems.

Emergent Conceptual Framework for Implementing Bichronous Learning in South African Higher Education

The conceptual framework presented in Figure 1 emerged from the synthesis of themes identified through the qualitative desktop review. It integrates the key dimensions of synchronous and asynchronous learning into a cohesive bichronous model that directly responds to the infrastructural, engagement, and pedagogical challenges facing South African higher education. By combining the immediacy of real-time interaction with the flexibility of self-paced study, bichronous learning enables more equitable access, sustained student engagement, and the cultivation of graduate-ready skills. The model thus positions bichronous learning as a contextually responsive and constructivist-aligned strategy for advancing inclusive, future-ready academic environments in digitally unequal settings.

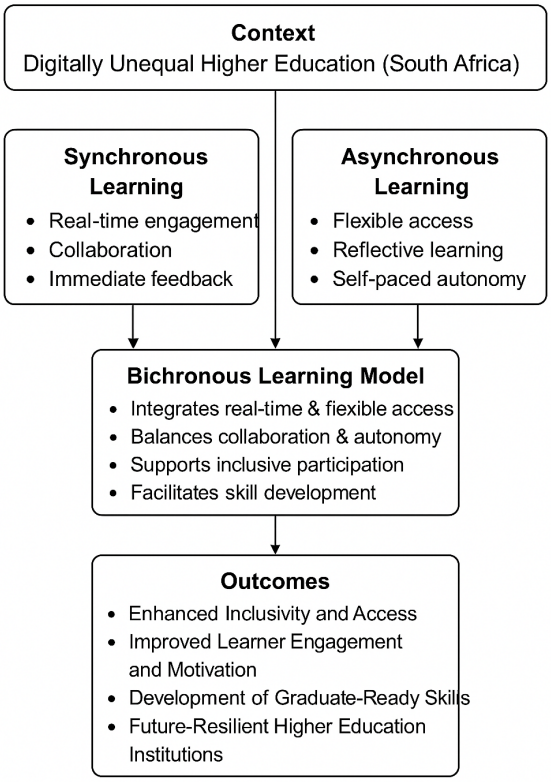

Fig. 1: Emergent Conceptual Framework for Implementing Bichronous Learning in South African Higher Education

The conceptual framework illustrates the interdependence of four core components, synchronicity, flexibility, inclusivity, and digital readiness, that together underpin effective bichronous learning in the South African higher-education context. At its centre lies the bichronous learning model, an integrative mechanism that combines the immediacy of synchronous engagement with the autonomy of asynchronous study.

Synchronicity represents real-time interaction that fosters social presence, immediacy, and collaborative knowledge construction, resonating with constructivist principles of co-learning (Vygotsky & Cole, 1978). Flexibility encompasses learner agency

and temporal adaptability, allowing students to access and process content at their own pace while accommodating infrastructural constraints such as limited connectivity (Faloye & Ajayi, 2022; World Bank, 2021**).** Inclusivity operates as the mediating construct, ensuring that both synchronous and asynchronous modalities are intentionally designed to address diverse learning needs, promote equity, and support meaningful participation (Adarkwah, 2021; SAQA, 2023). Digital readiness functions as an enabling foundation reflecting institutional capacity, staff competence, and technological infrastructure that sustain the bichronous environment (Adedoyin & Soykan, 2023).

The arrows connecting these elements indicate a cyclical, mutually reinforcing process: improvements in digital readiness expand opportunities for flexible learning; enhanced flexibility increases inclusivity; and inclusive pedagogical design strengthens engagement in synchronous spaces. Together, these interactions create a constructivist, future-oriented ecosystem that supports equitable access, deep learning, and graduate employability within South Africa's digitally uneven higher-education landscape.

Recommendations

Building on the critical synthesis of learning modalities and the unique infrastructural and socio-economic challenges facing South African higher education, several strategic recommendations are proposed to guide the effective adoption of bichronous learning models. These recommendations focus on enhancing infrastructural accessibility, developing academic staff capacity, designing inclusive and flexible curricula, and ensuring ethical governance of digital learning environments. Recognising that successful bichronous learning requires coordinated efforts across multiple stakeholder groups, an intervention plan has been developed to outline specific actions, responsible parties, timelines, and monitoring indicators. This plan aims to operationalise the transition toward more inclusive, resilient, and future-ready higher education systems in SA.

The successful implementation of bichronous learning models requires more than technological adaptation; it demands a holistic, systemic transformation across curriculum design, staff development, infrastructural investment, and governance frameworks. The proposed intervention plan offers a roadmap for addressing identified risks through coordinated stakeholder action, realistic timelines, and measurable outcomes. By operationalising these strategies, South African higher education can move toward more inclusive, flexible, and resilient learning environments that not only respond to current digital divides but also future-proof graduates for the evolving demands of the knowledge economy.

Implementation Risks and Mitigation Strategies

The integration of bichronous learning into South African higher education carries both transformative potential and structural vulnerability. While the model promotes inclusivity through flexible engagement, its success depends on the sector's capacity to anticipate and mitigate contextual risks that may hinder equitable adoption. Table 1 outlines the primary risks identified through the literature review and thematic synthesis, alongside proposed interventions, responsible stakeholders, timelines, and indicators for monitoring progress. This section provides a narrative interpretation of those strategies.

A central and persistent risk is digital inequality, which continues to limit equitable participation in synchronous sessions. Despite progress in expanding online access since the COVID-19 pandemic, disparities in connectivity, device ownership, and affordability of bandwidth remain deeply entrenched (Faloye & Ajayi, 2022; World Bank, 2021). The proposed interventions, such as subsidised data bundles, institutional device-loan programmes, and the development of mobile-compatible asynchronous platforms, address this constraint by recognising that inclusivity depends on technological accessibility. These actions require collaboration among universities, the Department of Higher Education and Training and telecommunications providers to ensure systemic rather than piecemeal solutions.

A second critical risk involves academic staff preparedness. Many lecturers continue to replicate traditional face-to-face pedagogies in virtual environments, limiting interaction and flexibility

Table 1: Risk Intervention

Identified Risk	Recommended Action	Responsible Stakeholders	Timeline	Monitoring Indicators
Persistent digital inequality is limiting synchronous participation.	Provide subsidised data bundles, expand device loan programmes, and develop mobile-compatible asynchronous platforms	University ICT Departments, DHET, Telecommunications Providers	Short term (6–12 months)	Increase in student device ownership; improvement in course access analytics
Academic staff are unprepared for designing bichronous learning environments	Deliver digital pedagogy training programmes focusing on synchronous–asynchronous integration and inclusive design	Academic Development Units, Centre for Innovation in Learning and Teaching (CILT), Deans of Faculties	Immediate to medium term (6–18 months)	Number of staff trained; improvement in online student engagement scores
Student disengagement in asynchronous components	Embed interactive asynchronous activities, use micro-synchronous sessions strategically, and apply gamification techniques	Course Coordinators, Learning Designers, Faculty Teaching and Learning Committees	Ongoing	Discussion forum participation rates; assignment completion rates
Misalignment between synchronous and asynchronous components	Redesign curriculum frameworks to map learning outcomes across both modalities with clear assessment alignment	Senate Curriculum Committees, Programme Review Panels	Medium term (12–24 months)	Completion of curriculum review cycles; internal moderation reports
Data privacy, cybersecurity, and ethical risks with digital platforms	Develop and implement institutional AI ethics, data privacy, and digital governance policies aligned with POPIA compliance	Legal Departments, ICT Governance Boards, Academic Registrars	Short to medium term (12–18 months)	Number of policies adopted; cybersecurity incident reports; student consent rates
Limited student support structures for bichronous learning	Establish online academic advising, virtual peer mentoring programmes, and asynchronous academic support services	Student Success Units, e-Learning Support Services, Student Representative Councils	Short term (6–12 months)	Utilisation rates of online support services; student satisfaction surveys

(Adedoyin & Soykan, 2023; Martin et al., 2023). Capacity-building through structured digital-pedagogy training, coordinated by Academic Development Units and centres such as CILT, is essential for embedding synchronous–asynchronous integration and inclusive design principles. Institutional commitment to professional learning is therefore not ancillary but foundational to bichronous adoption.

Closely related is the risk of student disengagement in asynchronous components, which threatens course completion and learning coherence. Interactive design strategies such as gamification, micro-synchronous check-ins, and scaffolded peer discussion help sustain motivation and cognitive presence (Baber, 2022). These pedagogical innovations must be supported through continual evaluation of learning analytics, ensuring that engagement gaps are identified early and addressed responsively.

Furthermore, misalignment between synchronous and asynchronous components can compromise the coherence of curriculum delivery. Curriculum review processes should explicitly map learning outcomes, assessment criteria, and pedagogical activities across both modalities to achieve constructive alignment (Rasheed et al., 2020; Orhan, 2022). Senate curriculum committees and programme review panels play a pivotal role in embedding this integration within institutional quality-assurance frameworks.

The expansion of digital ecosystems also introduces ethical and data privacy risks. As universities adopt cloud-based tools and artificial-intelligence-enabled platforms, compliance with national data-protection legislation such as POPIA becomes imperative (SAQA, 2023). Developing AI ethics and digital governance policies under institutional legal and ICT governance oversight will safeguard students and staff while reinforcing public trust in digital education.

Finally, limited student-support structures may exacerbate inequities in bichronous environments. Establishing asynchronous academic advising, online peer-mentoring, and virtual tutoring services can extend support to students who cannot attend synchronous sessions due to socio-economic or geographic constraints (CHE, 2021). These services should be continuously monitored using utilisation analytics and student satisfaction data to ensure they remain responsive to diverse student needs.

Collectively, these mitigation strategies highlight that the sustainable implementation of bichronous learning requires coordinated, multi-stakeholder engagement that spans pedagogical, infrastructural, and governance domains. By addressing these risks proactively, higher-education institutions can transform bichronous learning from an adaptive response to crisis into a deliberate strategy for equity, resilience, and systemic transformation within South Africa's digital higher-education landscape.

Limitations and Future Research

While this study synthesises a broad range of peer-reviewed evidence, its reliance on secondary data limits the depth of contextual insight into students' and staff's lived experiences. Future research should employ mixed-methods approaches, including surveys and focus groups, to examine how bichronous learning affects engagement, performance, and inclusion across diverse South African institutions. Longitudinal analysis would also help determine the sustainability of bichronous learning's inclusivity outcomes over time.

Conclusion

This study critically examined synchronous, asynchronous, and bichronous learning models to determine which approach best supports inclusive, flexible, and future-oriented higher education in the context of SA's enduring infrastructural and digital divides. Grounded in constructivist learning theory, the study found that while synchronous models promote real-time collaboration and asynchronous models support flexible, reflective learning, both approaches present limitations when implemented independently in digitally unequal environments.

Bichronous learning emerged as the most adaptable and contextually responsive model, combining the immediacy of synchronous interaction with the accessibility of asynchronous engagement. By offering differentiated access pathways, fostering deeper cognitive engagement, and facilitating holistic skill development, bichronous learning closely aligns with the goals of widening participation, promoting educational equity, and enhancing graduate employability in SA's evolving higher education landscape.

Beyond theoretical analysis, this study proposed a structured intervention plan addressing critical risks associated with digital inequality, staff preparedness, curriculum integration, and ethical governance. By identifying actionable strategies, assigning stakeholder responsibilities, and proposing monitoring indicators, the intervention plan offers a practical roadmap for institutional adoption of bichronous learning frameworks.

While the desktop review methodology provided comprehensive insights from global and South African scholarship, future empirical research is necessary to validate these findings through direct engagement with student and staff experiences. Longitudinal studies assessing the impact of bichronous models on academic success, retention, and employability outcomes would further enrich understanding and guide policy development.

In an era where flexibility, resilience, and inclusivity are imperative for higher education systems, bichronous learning offers a promising pathway toward a more equitable and future-ready academic environment. By strategically investing in infrastructure, staff development, curriculum innovation, and digital ethics, South African higher education can leverage bichronous learning to bridge historical divides and empower a new generation of graduates equipped for the demands of an interconnected, knowledge-driven world. This research extends the current theoretical discourse by situating bichronous learning within a constructivist, equity-driven framework, thereby contributing to a more nuanced understanding of inclusive digital pedagogy in emerging economies.

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