Supporting Underprepared Students Through Technology and Inclusive Pedagogical Strategies

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Abstract. South Africa's higher education system faces significant challenges, including low academic performance and unsatisfactory throughput rates. These issues cannot be fully understood without considering the impact of the apartheid era, which left a legacy of pronounced educational inequality and fragmentation. Although the current government has made efforts to address these historical disadvantages and improve access to quality education, various contemporary challenges persist. Many South African students enter higher education underprepared, as evidenced by their low academic performance and throughput rates. This indicates that current responses to the teaching and learning needs of these students are insufficient. At some universities, particularly within the Extended Curriculum Program (ECP) where many underprepared students are enrolled, much of the problem lies in the teaching strategies employed. The aim of this article is to explore the use of inclusive pedagogical strategies focussing on scaffolding, inorder to address some of the challenges faced by underprepared students in a university of technology (UoT) in South Africa. Various emerging technologies are reviewed that can complement these scaffolding strategies. Vygotsky's Cultural Historical Activity Theory (CHAT) was used as a framework to gain a deeper understanding of the problem and the driving contradictions within the system.

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1 Introduction and Rationale

A significant number of students in South Africa enter universities ill equipped and underprepared for the rigorous academic programme that often characterises university learning (Tanga and Maphosa, 2018). This under preparedness is a direct reflection of the current state of schooling in South Africa, which Mohamed (2020) from Amnesty International describes as broken and unequal. The crisis in South African education is well documented, with teacher's journals, academic papers and newspapers revealing alarming statistics on poor academic performance, undertrained teachers and teacher absenteeism (Spaull, 2013; Maddock and Maroun, 2018; Somer, 2023). It is also important to note that while the current government shoulders a lot of responsibility for the lack of transformation and improvement, much of the problem is a legacy of the previous dispensation prior to 1994 (Megbowon et al., 2023). Prior to 1994, education in South Africa was divided along racial lines, favouring white communities.

The Extended Curriculum Programme (ECP) is an academic foundation initiative established and supported by South Africa's Department of Higher Education and Training (Baas, 2011). It provides an accessible and supportive environment for educationally disadvantaged, underprepared and at risk students to succeed in higher education (Megbowon et al., 2023). It is meant to be a holistic approach to education that extends beyond remedial course work to encampus different in and out of class activities (Brower et al., 2021). Students are provided with further academic support to improve pass rates by addressing different literacies like computer literacy, improving English language communication, Mathematics and others (Megbowon et al., 2023). Several gaps exist within the implementation of the ECP programme, but one that has received little attention is the traditional uniform teaching approaches that ignore the diversity in ECP classrooms. Lecturers apply the same pedagogical strategies in the ECP classrooms as with the rest of their classes. Pedagogies of access (Keates, 2015), diversity (Burke et al., 2016) and inclusion (Stentiford and Koutsouris, 2021) would be

much more appropriate in ECP classrooms rather than the one size fits all currently being employed. It would be beneficial to explore approaches like differentiated learning (Morgan, 2014), scaffolding (Van Der Stuyf, 2002) and suitable technologies (McMahon and Walker, 2019) to address this challenge. Failure to accommodate diversity and address preparedness disparities can negatively impact student learning outcomes. Students who feel unsupported or alienated by the teaching methods may disengage from the learning process, leading to lower academic achievement, decreased motivation, and higher dropout rates (Milner, 2021). Additionally, without tailored support and interventions, underprepared students may fall further behind, exacerbating educational inequalities. The aim of this article is to explore the use of inclusive pedagogical strategies, specifically focusing on scaffolding, to address the challenges faced by underprepared students in the South African higher education context. Additionally, the study reviews various emerging technologies that can complement these scaffolding strategies.

1.1 Context and Background

Mangosuthu University of Technology (MUT) is among the South African universities that offer ECP programs. The institution accommodates a diverse student body hailing from various regions, ranging from rural areas in Eastern Cape and KwaZulu Natal to townships like KwaMashu and Umlazi. Additionally, it welcomes students from countries such as eSwatini, Lesotho, and other parts of Africa. These students come from varied geographic locations, religions, cultures, ethnicities, languages, educational backgrounds, socio-economic status and work experience contributing towards a more complex classroom landscape (Awang-Hashim et al., 2019). On the one hand, this should be commended because it speaks to the growing access that students from all walks of life now enjoy in a democratic country. The problem, however, is that the teaching environment has not created a responsive learning environment for diverse learners to optimize their potential. This responsive classroom environment is particularly important within the ECP classrooms that largely cater to underprepared students (Slabbert and Friedrich-Nel, 2015).

Teaching approaches inside the ECP classrooms receive very little attention (Garraway and Bozalek, 2019). The Teaching and Learning Development Centre (TLDC) at MUT hosts a number of trainings and workshops for ECP lecturers, however these are on a volunteer basis and are poorly attended to make any meaningful contribution. Another issue that compounds this problem is MUT's unique recruitment approach. Historically, MUT has taken a distinctive approach to lecturer recruitment, favouring professionals from various industries over the more conventional practice of hiring predominantly from research-oriented academic backgrounds, whether internally or externally sourced (Tshibangu and Sikosana, 2023). This approach offers several advantages. Foremost among them is the infusion of real-world expertise and practical examples into the teaching curriculum (Gentelli, 2015). This enhances its relevance and applicability to contemporary challenges. However, despite these advantages, challenges have also been identified with this recruitment approach. These lecturers are ill equipped to respond to the issues of underprepared students from a pedagogical standpoint (Lin et al., 2019. This leads them to adopt a one size fits all approach, rather than student centred approaches that are effective in teaching such students. Pedagogical strategies that are more inclusive and supported using emerging technologies could play a big role in filling these gaps.

1.2 Cultural Historic Activity Theory

The main aim of this article is to explore inclusive pedagogical strategies (focusing on scaffolding) that can be applied to the ECP classes at MUT. Cultural Historical Activity Theory (CHAT) is a useful framework in trying to understand the change required in the ECP program including the interactions of the different components of the classroom as an activity system together with arising contradictions (Garraway and Bozalek, 2019). Cultural Historical Activity Theory (CHAT) is a good foundation for understanding change as culturally and historically informed (Lee, 2011), which is extremely relevant in the South African education system.

The primary conceptual aim of the socio-cultural perspective was to bridge the gap between the human mind, culture and society (Edwards, 2016). Unlike most psychological frameworks of that era, this perspective viewed culture and society as generative forces responsible for the creation of the human mind, rather than as external factors that merely influence the mind's functioning without altering its fundamental nature (Kaptelinin, 2014). Lev Vygotsky in the 1920s and beginning 1930s initiated CHAT. His colleague and disciple Alexei Leont'ev then further developed CHAT into the second generation (Engestrom, 2001). Vygostky conceptualized the first generation of CHAT around the idea of mediation. He proposed that human learning, the development of uniquely human higher cognitive functions, requires the appropriation of cultural tools through a process of mediation (Hardman and Amory, 2014). This idea is commonly depicted as a triad (figure 1) of subject, object, and mediating artifact (see Engestrom (2001) for more details).

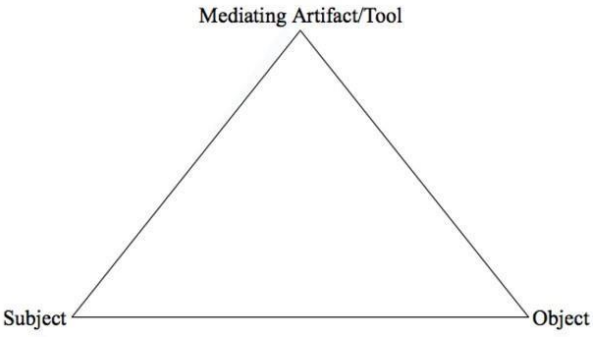

Figure 1: Vygotsky's reformulated model of mediated action (Engestrom, 2001).

The second generation of activity theory, centered around Alexei Leont'ev. He expanded on Vygotsky's ideas by focusing on collective activity systems. Leont'ev highlighted the difference between individual actions and collective activities, emphasizing the importance of group dynamics in understanding human behavior. The unit of analysis in this generation shifted from an individual focus to collective activity systems, where actions were embedded within a broader context of interactions.

Leont'ev's work introduced the concept of object-oriented actions within a collective system (figure 2), emphasizing the complexity of human interactions and the role of cultural artifacts in shaping behavior (Engestrom, 2001).

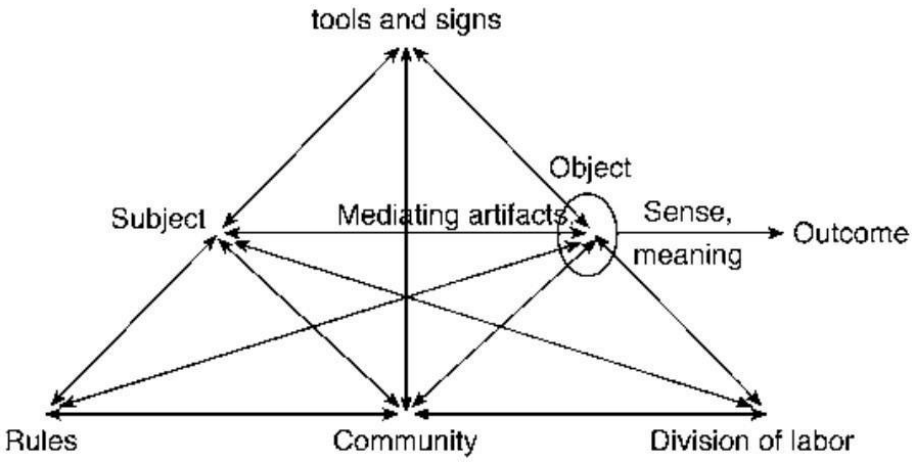

Figure 2: The structure of a human activity system (Engestrom, 2001).

The third generation of activity theory builds on the second generation by focusing on at least two interacting activity systems as the minimal unit of analysis (figure 3). It emphasizes the challenges and possibilities of inter-organizational learning, moving beyond individual or single-system analyses. This generation addresses issues of cultural diversity, dialogue between different perspectives, and the need for collaboration across various traditions. The theory of expansive learning in the third generation highlights the dynamic nature of activity systems, where multiple voices, shifting agency, and historical contexts play crucial roles in shaping learning processes (Engestrom, 2001). It places great emphasis on contradictions, which arise when there is misalignment between the goals, objects, or tools within an activity system, leading to inefficiencies or challenges. The presence of contradictions in activity systems leads to the emergence of new challenges and possibilities for learning. Contradictions are seen as a driving force of change in activity systems. The analysis of contradictions plays

a crucial role in expansive learning, as it helps in identifying and defining problems that need to be addressed for transformative change (Engestrom, 2001).

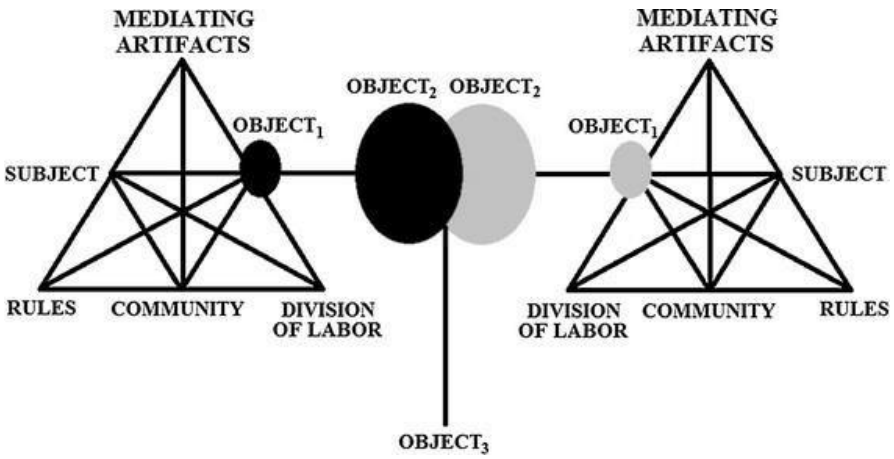

Figure 3: Two interacting activity systems as minimal model for the third generation of activity theory (Engestrom, 2001).

In the case of underprepared students in the ECP program the activity system can be understood as follows; The object is underprepared first year university students in the ECP program. The subject is the lecturer needing to address pedagogical challenges that are not responsive to underprepared students in the ECP program. The tools/artifacts would be the teaching strategies like scaffolding, the technology that can be used together with other educational resources that are utilized. The community includes the students, other lecturers in the ECP program, TLDC, university community and the broader educational context. The rules include the university rules for things like assessments, class attendants and pass marks. The rules also involve the rules set by the teacher and the students with regards to specific modules. The division of labor is the roles and responsibilities of the students, lecturers, and support staff. The outcome of this activity system is to improve the pedagogical strategy in the ECP program to respond to underprepared students.

Several contradictions can be identified in this activity system. The first is the mismatch between the teaching method and student's preparedness. This can be addressed by providing scaffolded learning experiences that build on students existing knowledge. Another contradiction relating to the above could be that the teachers are not equipped with skills to teach diverse student's. This can be addressed by professional development. Other contradictions that arise in this system are the rigid university rules around duration of modules and type of assessment. The Department of Higher Education and Training provides most of the provisions that govern the ECP programs in most South African institutions (Shay et al., 2016; Ogude and Rollnick, 2022). This can be viewed as a contradiction given that it can limit the responsiveness of institutions to unique needs arising from different contexts. Another contradiction with this activity system is that these programs take too long to be reviewed, delaying the identification of what works and what needs to be improved. An example of this is the study by Sibiya and Mahlanze (2018).

The historical contradiction in the South African education system stems from the legacy of apartheid. Before 1994, South Africa's education system was racially divided, with significant disparities in learning materials, assessment methods, and funding that favoured the minority white community. This inequality was entrenched by the Bantu Education Act of 1953 (Megbowon et al., 2023). The legacy of apartheid, characterized by racially segregated schools and under-resourced institutions for black students, persists today. This is evident in the substantial educational differentials between white and black students, particularly in terms of educational quality. Although race remains the primary factor influencing education quality and quantity, race and class are increasingly intertwined, even with growing socio-economic disparities within the black population (Van der Berg, 2007).

2 Literature Review

2.1 Scaffolding

The concept of scaffolding entails a series of activities provided by an educator or a more skilled peer to assist the learner. Over time, this support is gradually withdrawn, similar to scaffolding in construction, enabling the learner to accomplish tasks independently. The removal of the scaffolds is guided by the development of more advanced cognitive systems (Van Der Stuyf, 2002). It is important to note that, Vygotsky never actually used the term "scaffolding" in his work. The term was coined by researchers Wood, Bruner, and Ross in their 1976 paper, "The Role of Tutoring in Problem Solving," yet it remains closely linked to Vygotsky's theory (Verenikina, 2003). Several studies (Dixon-Krause et al., 2003; Sidek, 2011; Wass et al., 2011; Gonulal and Loewen, 2018) connect scaffolding to Vygotsky's Zone of Proximal Development (ZPD). Belland et al. (2013) indicates that linking the ZPD and scaffolding introduces challenges in translation. Xi and Lantolf (2021) call it a problematic relationship. They believe that it is a common misconception that Wood et al. (1976) based their definition of scaffolding on Vygotsky's theory of the ZPD.
Further evidence of this is the fact that Vygotsky's work was not cited in Wood et al. (1976). Due to the aforementioned reasons, scaffolding will be considered independently of the ZPD for the remainder of this review. The review will focus on scaffolding as describe in its inception in order to preserve and extend the vitality of the identified issues in its initial conceptualization.

Wood, Bruner, and Ross conceptualised scaffolding on the back of two factors, motivation and cognition. These are represented by the original scaffolding strategies. Three of the six original strategies are motivational (direction, maintenance, recruitment, and frustration control), while the other three are cognitive (marking critical features, reduction in degrees of freedom, and demonstration). Therefore, scaffolding, in its original context, provided equal parts motivational and cognitive support (Acosta-Gonzaga and Ramirez-Arellano, 2022). It is therefore important that a good scaffold design has both motivational and cognitive support.

Belland et al. (2013) suggest that what began as an intervention equally balanced between motivational and cognitive support soon evolved into one perceived primarily as cognitive support. Their opinion is based on a review of scaffolding frameworks published over the years. They conclude that there has not been sufficient systematic work to develop scaffolds that support both motivation and cognition. They argue that researchers often assume students will be motivated simply by participating in design activities, without creating scaffolds specifically aimed at enhancing motivation. While a detailed analysis of motivational scaffolding is not the focus of this review it generally involves enlisting student interest, promoting mastery goals, establishing task value, promoting belonging, promoting expectancy for success, promoting emotion regulation, and promoting autonomy (Tuckman, 2007; Mackiewicz and Thompson, 2013; Michalsky, 2021). Ideally a balanced scaffold should therefore aim to:

- Enlist students interest in educational activities
- Make activities more manageable and achievable
- Provide clear direction and instructions
- Indicate the differences between the students work and the desired outcomes
- Eliminate as much as it is possible frustrations
- Model and clearly communicate expectations (Van Der Stuyf, 2002)

McKenzie (2000) expands on these aims by explaining that clear direction and the reduction of student confusion are achieved when an educator can anticipate potential challenges and develop organized instructions that clarify expectations. Properly implemented scaffolding helps students understand the significance of their work and its purpose, connecting broader concepts beyond any single activity. Scaffolds also provide structure and safety nets. While students are given space to explore and make decisions, these guidelines ensure they remain on the intended path. Open communication channels, and the timing of this communication, are also crucial. At the start of activities, it is important to communicate marking rubrics, expectations, standards of excellence, and provide feedback. Another important characteristic of scaffolding in learning is its role in guiding the learning process. This involves a clear

distinction between situations where students receive additional support as necessary and a gradual reduction in support as they become more proficient and independent. This process ensures that students receive the assistance they need precisely when they need it, fostering their development while gradually promoting autonomy and selfreliance in their learning journey (Amerian and Mehri, 2014; Maksic and Josic 2021).

The next section of this article will delve into the learning theories that underpin scaffolding strategies and explore their significance in addressing the challenges encountered by underprepared students in higher education settings. Understanding learning theories is essential in developing effective teaching and learning strategies because they provide a theoretical framework for understanding how students learn and how instruction can be tailored to facilitate this process.

2.2 Scaffolding and Learning Theories

As indicated above, three (marking critical features, reduction in degrees of freedom, and demonstration) of the six original scaffolding approaches are based on cognitive functions (Acosta-Gonzaga and Ramirez-Arellano, 2022). Cognitivism posits that learning involves the processing of information, and that the cognitive load on the learners working memory should be managed effectively (Selwyn, 2011). By reducing the degrees of freedom, an instructor simplifies tasks to decrease cognitive load, allowing learners to focus their mental resources on key aspects of the task without becoming overwhelmed. This strategy helps in chunking information into smaller. More digestible units, which is consistent with the cognitive approach to managing working memory capacity. Scaffolding directly supports these mental processes by providing external assistance that helps learners organize and process information effectively. This support is tailored to the learner's current level of cognitive development. It is also the advancement in cognitive skills that allows for the scaffolds to be gradually withdrawn (Chaiklin, 2003). Cognitivism also highlights the importance of processes by which

knowledge is accumulated, such as perceiving, recognizing, conceiving and reasoning in the learning process (Armstrong, 2004). By marking critical features, instructors draw learner's attention to the most important elements of a task or concept, enhancing their ability to perceive and process relevant information. This selective attention is crucial for effective cognitive processing, as it helps learner's identify and focus on the key components that are essential for understanding and mastering the task. This approach aligns with cognitivism because it recognises that learning is more efficient when learner's can discern which information is most pertinent (Benko, 2012).

Cognitivism also asserts that learning involves the acquisition and organization of knowledge. Demonstration as a scaffolding strategy provides a concrete example of how to perform a task or solve a problem, which aids in the construction of mental models and schemas. Schemas or schemata are personalized organizational structures (Michela, 2022). By observing a demonstration, learners can visualize the steps and processes involved, facilitating their understanding and retention of the information. Demonstrations also support observational learning, a concept rooted in cognitive theories, where learners gain insights by watching others perform tasks, thus enhancing their own cognitive processes through imitation and practice (Clark, 2018).

During the latter half of the twentieth century, cognitivism primarily concentrated on the individual mind in isolation, emphasizing context-free problem-solving, mental representations, and reasoning (Tenenberga and Knobelsdorf, 2014). Over the last twenty years studies have emerged that have begun to incorporate recent research that extends, elaborates, and occasionally challenge cognitivism. These studies, collectively known as sociocultural cognition theories, view the mind as a cultural product, biologically evolved to be enhanced by tools, social interaction and embodied interaction with the world. From this perspective, learning is seen as tool-mediated participation in the ongoing practices of cultural communities (Lantolf, 2000; Villamil and de Guerrero, 2006; Davidson, 2010; Scott and Palincsar, 2013). One of the most important tools in modern education is technology. As a mediating tool, technology

facilitates the learning process by providing interactive, engaging and adaptive experiences. This is discussed further in the section below.

2.3 Scaffolding in Higher Education Institutions in South Africa

In the South African context underprepared and marginalised students have increased in numbers over time with the increase in access to these institutions, brought by the democratic dispensation (Brussow, 2007). Several studies have been done to determine the nature of unpreparedness (Yeld, 2010; Bradbury and Miller 2011; Bozalek and Boughey, 2012; Smit, 2012; Woldegiorgis and Chiramba, 2024), together with interventions needed to support these students. Scaffolding has also been tested as a strategy to address the problems. A brief look into three of these studies is given below, to highlight the previous and current practice of scaffolding of underprepared students within the South African higher education context.

Study 1. A study was conducted by Bertram et al. (2022), implementing scaffolded academic literacy practices with first-year biology students, biochemistry honours students, and master's in education students. The key problem the study aimed to address was the literacy crisis in South Africa, particularly evident at both schooling and university levels. The study focused on the low academic literacy levels among South African students, as highlighted by data and different reports. Many interventions have been made by South African universities including the establishment of academic development units or writing centres to support academic literacy. The article argues against the autonomous model of literacy, which understands literacy development as the mastery of a set of decontextualised generic skills required for interpreting printed text. Where stand-alone academic literacy modules and writing canter's are the main drivers, believing that competencies learned in one context can be applied in a range of disciples. It instead proposes that academic literacies are socially constructed practices that are best learned within specific disciplines due to their unique ways of engaging with texts and understanding.

The scaffolding used in the study involved students engaged in activities like rewriting scientific paragraphs in their own words to enhance understanding and engagement. The scaffolded approach focused on both reading and writing in the discipline, addressing plagiarism by modelling meaningful paraphrasing of academic text. The scaffolding aimed to support learner engagement and help academics develop language knowledge and clear methodologies for adaptation across disciplines and academic levels. The study showed significant gains in academic writing using scaffolded academic literacy practices within the classroom. This approach is supported by other studies like Cartens (2016) and Sosibo (2015), who focussed on

scaffolding in discipline specific interventions. Mdodana-Zwide and Mafugu (2023) recommend collaborations between lecturers and writing centers that are lead and initiated by the teachers to optimally support students.

Study 2. Booi and Van Staden (2016) conducted a study to investigate how Life Sciences lecturers used scaffolding to address knowledge gaps in the practical skills of first-year Life Sciences pre-service teachers. The study applied community of practice theory to understand how scaffolding processes and group dynamics facilitated information sharing among peers. All first-year pre-service teachers enrolled in Natural Sciences were selected as subjects. The researchers assigned three tasks: two involving microscopy and one a practical investigation on the rates of chemical reactions. The first task, which was not assessed, focused on operating microscopes and was designed to allow students to practice and teach each other. This task aimed to orient those who had never used a microscope and upskill them with the help of competent peers. The researchers grouped students with strong practical skills with those from disadvantaged schooling backgrounds, using a community of practice strategy. Despite all students having passed matric Life Sciences with at least 50%, the study found varying levels of experience due to different educational backgrounds. The study confirmed significant gaps in practical skills among the cohort. It concluded that peer learning activities, structured through scaffolding, could effectively help bridge these gaps. Similar studies using peer learning in scaffolding include Thondhlana and Belluigi (2014).

Study 3. De Jager (2013) investigated the impact of scaffold-lecturing methods on the academic performance of first-year Science student-teachers in South Africa who are non-native English speakers. The study aimed to determine if scaffold lectures could enhance students' understanding of academic content and improve their English communication skills. The investigation involved dividing the student-teachers into two classes: Class A received scaffold lectures, while Class B did not receive any additional support. Scaffold lectures included techniques such as visual aids, drawing activities, and encouraging the use of the mother tongue to explain concepts. Data was collected through open-ended questionnaires, analysis of assessment results, and comparisons between Class A and Class B. The results indicated that students in Class A demonstrated clear academic progress, better coursework performance, and improved active class participation compared to Class B. Class A outperformed Class B in all three assignments and the test, highlighting the effectiveness of scaffold lectures in enhancing academic performance and English proficiency.

A consistent theme in these studies and others is the focus on improving academic literacies, as success in higher education has been intrinsically tied to academic literacy skills (Fernsten & Reda, 2011; Maher, 2011; Pineteh, 2014; Khumalo and Reddy, 2021). Recent advancements in technology have significantly impacted education and can be leveraged to address some of the challenges faced by underprepared students. These emerging technologies offer innovative solutions to improve academic literacies, thereby supporting students in achieving better academic outcomes.

2.4 Technology Enhanced Scaffolding

Contemporary learning environments often include various support mechanisms and typically feature one teacher overseeing multiple students. Given the temporal and contextual demands, technology can be integrated into scaffolding strategies to assist learners as they engage in specific tasks (Sharma and Hannafin, 2007). Restricting

scaffolding to what is provided by the teacher may result in students in a typical classroom receiving minimal support (Belland, 2014).

Technology can take on routine support tasks, enabling the teacher to offer more dynamic assistance. Technological tools can enhance scaffolding interactions by providing unique representational opportunities and diverse methods for exploring ideas and concepts. By offloading extraneous cognitive tasks to computers, both the teacher and the student are freed to focus on higher-order reasoning (Acosta-Gonzaga & Ramirez-Arellano, 2022).

Technology mediated scaffolds are intended to complement, rather than substitute, teacher scaffolds (Tammets et al., 2022). Employing both teacher and technologybased support allows students to leverage the advantages of each type, the responsive quality of teacher supports and the constant availability and reproducibility of technology. Essentially, the incorporation of both teacher and technology support is essential, as students require the combined assistance to thrive within the modern educational context (Pea, 2004). In their critical review and assessment of the use of technology in learning environments, Kirkwood and Price (2014) suggest that information must be clear and detailed about the design of teaching and learning interactions associated with technology interventions. This is to avoid talking about technology enhancing learning in very abstract terms that are difficult to ascertain. The article discusses three main concepts of enhancement in technology enhanced learning (TEL), operational improvement, quantitative change in learning, and qualitative change in learning. Operational improvement focuses on providing greater flexibility for students and making resources more accessible to enhance the learning experience. Quantitative change in learning refers to measurable changes such as increased engagement, more time spent on tasks, and better grades. Qualitative change in learning involves promoting reflection on learning and practice, greater engagement with the material, and a better understanding of the content being taught. These concepts help categorize the different forms of enhancement observed in TEL interventions, providing insights into how

technology can impact learning experiences in higher education. Consequently, the use of technology in scaffolding must be intentional, with a clear and comprehensive understanding of the scaffolding objectives and the educational content being scaffolded (Kirkwood and Price, 2014)

It is also important to mention that focusing on using technology to enhance learning can often oversimplify technology's role in educational approaches. This oversimplification neglects the complex interactions between technology, teachers, and students in education. Jandric and Knox (2022) emphasize the need to move beyond determinist and instrumentalist views and recognize the co-constitutive relationships between technology and educational practices. They argue that technologies do not just enhance educational activities but actively shape and change how we communicate, learn, and experience education. Furthermore, they suggest that technology is inherently political and intertwined with human assumptions and worldviews. Their paper calls for a post-determinist and post-instrumentalist understanding of education and educational research through the lens of post digital theory, advocating for a more nuanced approach to technology's role in education. Shelton (2019) emphasizes the interconnectedness of relationships, roles, activities, and settings, highlighting the importance of the microsystem in shaping individual experiences. Recognizing the diverse interactions of learners within the classroom microsystem is essential, as a one-size-fits-all approach is inadequate. Consequently, individual experiences with educational technologies are varied, and educators need to be aware of this spectrum of interactions rather than assuming uniformly positive outcomes.

A few technologies can be used to aid scaffolding in the classroom environment. These include technologies that encourage channels of communication between the teacher and students (Zachos et al., 2018). This is important in scaffolding as it gives the teacher information about the current state of proficiency of the students and also serve to timeously clarify confusions so they do not lead to frustrations. Most learning management systems (LMS) used by institutions of higher learning will at this point

have options to create polls for feedback or other accessible forms of feedback like Google sheets, Wooclap, and WhatsApp. Students coming from different backgrounds might find it difficult to ask questions and engage in synchronous physical classrooms (Price, 2022). These tools can be used to keep the lines of communication open even outside of the classroom during study at home or the library, these quick responses go a very long way in providing clarity and fostering a safe learning environment (Wahyuni, 2018).

Utilizing WhatsApp offers several advantages, particularly for first-year university students. As reported by Business Insider (Goodwin, 2023), it is the most widely used messaging app in South Africa, making it a familiar platform for many individuals. Its widespread adoption for staying connected with distant family and friends enhances its familiarity among students. Moreover, WhatsApp's user-friendly interface makes it less daunting for students who may be using similar tools for the first time. Another advantage is its reliance on Wi-Fi connectivity, which is readily available on campus and in both internal and external residences. The only potential interruption occurs when students are in transit between these locations, ensuring continuous access to the platform for most users. Only a minority of students who reside off-campus may need to purchase data to use the tool if they lack Wi-Fi access at home.

One drawback of this tool is that students may struggle to differentiate between its social and academic applications. It can easily become a platform for sharing campus updates unrelated to the module, thus diverting attention from the primary learning objectives. Moreover, depending on the number of students accessing the tool from home, there may be associated costs if access to Wi-Fi is limited. Many students utilize WhatsApp on their mobile devices, which may lack sufficient storage capacity for storing academic materials, especially for those without access to cloud services or laptops for transferring notes. Additionally, WhatsApp is primarily a social tool used for maintaining personal connections with friends and family (Allil et al., 2024). Therefore, integrating it into an

academic environment may lead to increased distractions and interruptions, as students must continually navigate between academic and social interactions.

As indicated above, emerging technologies have the potential to significantly enhance academic literacy skills. Research has shown that students with limited English proficiency face challenges in South African universities where English is the language of instruction (Mphasha et al., 2022). These students often spend excessive time on reading materials and writing exercises, which hinders their ability to keep up with the curriculum, ultimately affecting their motivation and confidence. Emerging technologies for improving academic literacy skills can be categorised into those that assist with reading and summarising text. These tools often include different features to enhance user experience, like interactive questions and answers to help understand the material. An example is Scispace (Giglio and Costa, 2023). The are also tools that assist users in the writing process like Grammarly (Karyuatry, 2018). This tool corrects grammar, spelling and coherence among other things. There are also tools that can be used to edit written text through paraphrasing and rewording sentences, an example is Quillbot (Fitria, 2021). Currently, tools that generate text, such as ChatGPT, have received significant attention and have had a substantial impact on education (Meyer et al., 2023).

Recent studies have explored the efficacy of these technologies, particularly for second language or foreign language learners (Schmohl et al., 2020; Dong, 2023; Assidiq, 2024). The findings suggest that these technologies are effective in improving students literacy skills. Benefits include providing timely feedback that promotes engagement (Dong, 2023), greater participation (Schmohl et al., 2020; Song and Song, 2023), and enhanced understanding of grammatical rules, vocabulary acquisition and coherence (Tran, 2023; Zulfa et al., 2023).

However, there are ethical concerns around the use of these technologies, especially generative AI like ChatGPT. Issues include potential over-reliance on these tools by

students and the risk of passing generated text as their own work (Derga et al., 2023). Additional concerns include the integration of incorrect or biased information that can deceive users. Large language models (LLMs) like ChatGPT are trained on an extensive corpus of text, the lack of transparency in the training data raises concerns about biases and inaccuracies (Meyer et al., 2023). Despite these challenges the authors believe that most of these concerns can be addressed through institutional policies and guidelines on the use of these technologies, ensuring accountability for responsible use.

3 CONCLUSION

In addressing the persistent challenges faced by South Africa's higher education system, particularly for underprepared students, it is evident that traditional pedagogical strategies of the teacher talking, and the student listening are insufficient. The analysis of Mangosuthu University of Technology's Extended Curriculum Program (ECP) reveals that more inclusive teaching approaches are crucial for improving student outcomes. Scaffolding, as an inclusive pedagogical strategy, has the potential to provide both cognitive and motivational support necessary for underprepared students to thrive. Moreover, integrating technology can further enhance these scaffolding efforts, making learning more accessible and engaging which will ultimately lead to improved academic performance and throughput rates that have been largely elusive thus far.

The application of Vygotsky's Cultural Historical Activity Theory (CHAT) has provided a robust framework to understand the complexities and contradictions within the current system. The historical context of apartheid has left a legacy of inequality that continues to impact the educational experiences of many students. By recognizing and addressing these contradictions, such as the mismatch between teaching methods and student preparedness, and the lack of pedagogical training among industry recruited lecturers, institutions can begin to implement more effective teaching strategies.

For the ECP at Mangosuthu University of Technology, adopting scaffolding techniques tailored to the diverse needs of students, supported by technology, can bridge the gap between underprepared students and academic success. This approach requires a commitment to professional development for lecturers and a systemic shift towards more flexible and responsive teaching methods. By fostering an inclusive learning environment, embracing emerging technologies, through clear policies governing its use and application, we can better support underprepared students. Ultimately, we can improve academic performance and throughput rates, and contribute to the broader goal of educational equity in South Africa.

4 REFERENCES

Acosta-Gonzaga, E., & Ramirez-Arellano, A. (2022). Scaffolding matters? Investigating its role in motivation, engagement and learning achievements in higher education. *Sustainability*, *14*(20), 13419.

Amerian, M., & Mehri, E. (2014). Scaffolding in sociocultural theory: Definition, steps, features, conditions, tools, and effective considerations. *Scientific Journal of Review*, *3*(7), 756-765.

Armstrong, D. M. (2004). In defense of the cognitivist theory of perception. *The Harvard Review of Philosophy*, *12*(1), 19-26.

Assidiq, I. (2024). Academic Writing Acceleration: Investigating the Impact of Artificial Intelligence (AI) Applications on Academic Writing Efficiency. In *International Conference of Business, Education, Health, and Scien-Tech* (Vol. 1, No. 1, pp. 256-270).

Awang-Hashim, R., Kaur, A., & Valdez, N. P. (2019). Strategizing inclusivity in teaching diverse learners in higher education. *Malaysian Journal of Learning and Instruction*, *16*(1), 105-128.

Bass, G. H. (2011). Social and academic integration in an extended curriculum programme. *The Journal of Independent Teaching and Learning*, *6*(1), 45-54.

Belland, B. R. (2014). Scaffolding: Definition, current debates, and future directions. In J. M. Spector, M. D. Merrill, J. Elen, & M. J. Bishop (Eds.), Handbook of research on educational communications and technology (4th ed., pp. 505–518). New York, NY: Springer.

Belland, B. R., Kim, C., & Hannafin, M. J. (2013). A framework for designing scaffolds that improve motivation and cognition. *Educational psychologist*, *48*(4), 243-270.

Benko, S. L. (2012). Scaffolding: An ongoing process to support adolescent writing development. *Journal of adolescent & adult Literacy*, *56*(4), 291-300.

Bertram, C., Johnson, K., & Goldring, J. D. (2022). Using scaffolding academic literacy practices in tertiary classrooms: A South African case study. *Critical Studies in Teaching and Learning*, *10*(1), 165-185.

Booi, K., & Van Staden, V. (2016). Knowledge gaps in first year life sciences laboratories: "scaffolding" under prepared students through peer interaction. ISTE International Conference on Mathematics, Science and Technology Education. 23-28 October 2016. Mopani Camp in Kruger National Park, Limpopo, South Africa. http://hdl.handle.net/11189/6581

Bozalek, V., & Boughey, C. (2012). (Mis) framing higher education in South Africa. *Social Policy & Administration*, *46*(6), 688-703.

Bradbury, J., & Miller, R. (2011). A failure by any other name: The phenomenon of underpreparedness. *South African Journal of Science*, *107*(3), 1-8.

Brower, R. L., Nix, A. N., Daniels, H., Hu, X., Jones, T. B., & Hu, S. (2021). A pedagogy of preparation: Helping underprepared students succeed in college-level coursework in community colleges. *Innovative Higher Education*, *46*, 153-170.

Brussow, S. (2007). A learning facilitation framework to enhance academic skills development among underprepared learners in South African higher education (Doctoral dissertation, University of the Free State).

Burke, P. J., Crozier, G., & Misiaszek, L. (2016). *Changing pedagogical spaces in higher education: Diversity, inequalities and misrecognition*. Routledge.

Carstens, A. (2016). Designing linguistically flexible scaffolding for subject-specific academic literacy interventions. *Per Linguam: A Journal of Language Learning= Per Linguam: Tydskrif vir Taalaanleer*, *32*(3), 1-12.

Chaiklin, S. (2003). The zone of proximal development in Vygotsky's analysis of learning and instruction. *Vygotsky's educational theory in cultural context*, *1*(2), 39-64.

Clark, K. R. (2018). Learning theories: cognitivism. *Radiologic technology*, *90*(2), 176-179.

Davidson, K. (2010). The integration of cognitive and sociocultural theories of literacy development: Why? How?. *Alberta Journal of Educational Research*, *56*(3).

Dergaa, I., Chamari, K., Zmijewski, P., & Saad, H. B. (2023). From human writing to artificial intelligence generated text: examining the prospects and potential threats of ChatGPT in academic writing. *Biology of sport*, *40*(2), 615-622.

Dixon-Krauss, L. A. (2003). Does Action Research Count as Scientifically-Based Research? A Vygotskian Mediational Response. Annual Meeting of the American Educational Research Association, Chicago, Illinois.

Dong, Y. (2023). Revolutionizing academic English writing through AI-powered pedagogy: practical exploration of teaching process and assessment. *Journal of Higher Education Research*, *4*(2), 52.

Edwards, A. (2016). Cultural-historical approaches to teaching and learning in higher education: Teaching to support student agency. In *Theorising learning to teach in higher education* (pp. 146-160). Routledge.

Engestrom, Y. (2001). Expansive learning at work: Toward an activity theoretical reconceptualization. *Journal of education and work*, *14*(1), 133-156.

Fernsten, L. A., & Reda, M. (2011). Helping students meet the challenges of academic writing. *Teaching in Higher Education*, *16*(2), 171-182.

Fitria, T. N. (2021). QuillBot as an online tool: Students' alternative in paraphrasing and rewriting of English writing. *Englisia: Journal of Language, Education, and Humanities*, *9*(1), 183-196.

Garraway, J., & Bozalek, V. (2019). Theoretical Frameworks and the Extended Curriculum Programme. *Alternation*, *26*(2).

Gentelli, L. (2015). Using industry professionals in undergraduate teaching: Effects on student learning. *Journal of University Teaching & Learning Practice*, *12*(4), 4.

Giglio, A. D., & Costa, M. U. P. D. (2023). The use of artificial intelligence to improve the scientific writing of non-native english speakers. *Revista da Associação Médica Brasileira*, *69*(9), e20230560.

Gonulal, T., & Loewen, S. (2018). Scaffolding technique. *The TESOL encyclopedia of English language teaching*, 1-5.

Hardman, J., & Amory, A. (2014). Introduction to cultural-historical activity theory and tool mediation. In *Activity Theory, Authentic Learning and Emerging Technologies* (pp. 9-21). Routledge.

Kaptelinin, V. (2014). Activity Theory. Interaction Design Foundation - IxDF. https://www.interaction-design.org/literature/book/the-encyclopedia-of-humancomputer-interaction-2nd-ed/activittheory.

Karyuatry, L. (2018). Grammarly as a tool to improve students' writing quality: Free online-proofreader across the boundaries. *JSSH (Jurnal Sains Sosial dan Humaniora)*, *2*(1), 83-89.

Keates, S. (2015). A pedagogical example of teaching Universal Access. *Universal Access in the Information Society*, *14*(1), 97-110.

Khumalo, N. P., & Reddy, S. (2021). Cross-disciplinary synergy: First-year students' experiences of learning academic writing through integrated writing support at a University of Technology. *The Journal for Transdisciplinary Research in Southern Africa; Vol. 17, Issue 1*.

Lantolf, J. P. (2000). Introducing sociocultural theory. *Sociocultural theory and second language learning*, *1*, 1-26.

Lasmawan, I. W., & Budiarta, I. W. (2020). Vygotsky's zone of proximal development and the students' progress in learning (A heutagogcal bibliographical review). *JPI (Jurnal Pendidikan Indonesia)*, *9*(4), 545-552.

Lee, Y. J. (2011). More than just story-telling: cultural–historical activity theory as an under-utilized methodology for educational change research. *Journal of Curriculum Studies*, *43*(3), 403-424.

Lin, M. T., Chen, X. W., Huang, L. P., & Chen, J. H. (2019). Investigating the advantages and disadvantages of Taiwan's industrial design education from department evaluation Data. In *IOP Conference Series: Materials Science and Engineering* (Vol. 573, No. 1, p. 012048). IOP Publishing.

Mackiewicz, J., & Thompson, I. (2013). Motivational scaffolding, politeness, and writing center tutoring. *The Writing Center Journal*, *33*(1), 38-73.

Maddock, L., & Maroun, W. (2018). Exploring the present state of South African education: Challenges and recommendations. *South African Journal of Higher Education*, *32*(2), 192-214.

Maher, C. (2011). *Academic writing ability and performance of first year university students in South Africa* (Doctoral dissertation).

Maksic, S., & Josic, S. (2021). Scaffolding the development of creativity from the students' perspective. *Thinking Skills and Creativity*, *41*, 100835.

McKenzie, J. (2000). *Beyond Technology: Questioning, Research and the Information Literate School*. FNO Press, 500 15th St., Bellingham, WA 98225.

McMahon, D. D., & Walker, Z. (2019). Leveraging emerging technology to design an inclusive future with universal design for learning. *CEPS Journal*, *9*(3), 75-93.

Megbowon, F. K., Palesa, M. K., Bongiwe, K., & Sipokazi, M. (2023). Challenges of first-year extended curriculum Programme students at a University in South Africa. *International Journal of Learning, Teaching and Educational Research*, *22*(4), 178-194.

Meyer, J. G., Urbanowicz, R. J., Martin, P. C., O'Connor, K., Li, R., Peng, P. C., ... & Moore, J. H. (2023). ChatGPT and large language models in academia: opportunities and challenges. *BioData Mining*, *16*(1), 20.

Michalsky, T. (2021). When to scaffold motivational self-regulation strategies for high school students' science text comprehension. *Frontiers in Psychology*, *12*, 658027.

Michela, E. (2022). Cognitivism. R. Kimmons (Ed.), The students' guide to learning design and research, EdTech Books. https://edtechbooks.org/studentguide/cognitivism

Milner, H. R. (2021). *Start where you are, but don't stay there: Understanding diversity, opportunity gaps, and teaching in today's classrooms*. Harvard Education Press.

Mohamed, S. (2020). South Africa: Broken and unequal education perpetuating poverty and inequality. Amnesty International.

Morgan, H. (2014). Maximizing student success with differentiated learning. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas*, *87*(1), 34-38.

Mphasha, L. E., Nkuna, K. J., & Sebata, M. B. (2022). The impact of English language as medium of instruction versus South African indigenous languages offered as modules on academic progress of first year higher education students: A case study of the University of Venda, Limpopo Province, South Africa. *Gender and Behaviour*, *20*(1), 19251-19265.

Ogude, N. A., & Rollnick, M. (2022). Ideological positioning of Extended Curriculum Programmes–a case study of a large South African research university. *South African Journal of Higher Education*, *36*(2), 222-238.

Pineteh, E. A. (2014). The academic writing challenges of undergraduate students: A South African case study. *International Journal of Higher Education*, *3*(1), 12-22.

Price, T. J. (2022). Real-time polling to help corral university-learners' wandering minds. *Journal of Research in Innovative Teaching & Learning*, *15*(1), 98-109.

Schmohl, T., Watanabe, A., Fröhlich, N., & Herzberg, D. (2020). How can artificial intelligence improve the academic writing of students?. In *Conference proceedings. International conference* (pp. 168-171).

Scott, S., & Palincsar, A. (2013). Sociocultural theory. Education.com

Selwyn, N. (2011). Does technology improve learning? In Selwyn, N. *Education and Technology: Key issues and debates*. (pp. 64-91). New York. Continuum International Publishing Group.

Shay, S., Wolff, K., & Clarence-Fincham, J. (2016). New generation extended curriculum programmes: Report to the DHET. *Cape Town: University of Cape Town*.

Sibiya, M. N., & Mahlanze, H. T. (2018). Experiences of facilitators regarding the extended curriculum programme offered at a higher education institution in the province of KwaZulu-Natal in South Africa. *Curationis*, *41*(1), 1-6.

Sidek, H. M. (2011). ZPD, scaffolding and syntax development. *International Journal of Humanities and Social Science*, *1*(6), 23-34.

Slabbert, R., & Friedrich-Nel, H. (2015). Extended curriculum programme evolution: a road map to academic success?. *South African Journal of Higher Education*, *29*(1), 45-59.

Smit, R. (2012). Towards a clearer understanding of student disadvantage in higher education: Problematising deficit thinking. *Higher education research & development*, *31*(3), 369-380.

Somer, R. (2023). South African children's grim prospects in a failing education system. Mail & Gardian.

Song, C., & Song, Y. (2023). Enhancing academic writing skills and motivation: assessing the efficacy of ChatGPT in AI-assisted language learning for EFL students. *Frontiers in Psychology*, *14*, 1260843.

Sosibo, Z. (2015). Support strategies for scaffolding students' acquisition of academic literacy skills: Experiences at a University of Technology. *Alternation Journal: Interdisciplinary Journal for the study of the Arts and Humanities in Southern Africa*.

Spaull, N. (2013). South Africa's education crisis: The quality of education in South Africa 1994-2011. *Johannesburg: Centre for Development and Enterprise*, *21*(1), 1-65.

Stentiford, L., & Koutsouris, G. (2021). What are inclusive pedagogies in higher education? A systematic scoping review. *Studies in Higher Education*, *46*(11), 22452261.

Tammets, K., Khulbe, M., Sillat, L. H., & Ley, T. (2022). A digital learning ecosystem to scaffold teachers' learning. *IEEE Transactions on Learning technologies*, *15*(5), 620-633.

Tanga, M., & Maphosa, C. (2018). Academic Hurdles Facing Undergraduate Students at One South African University. *Research in Higher Education Journal*, *35*.

Tenenberg, J., & Knobelsdorf, M. (2014). Out of our minds: a review of sociocultural cognition theory. *Computer Science Education*, *24*(1), 1-24.

Thondhlana, G., & Belluigi, D. Z. (2014). Group work as terrains of learning for students in South African higher education. *Perspectives in Education*, *32*(4), 40-55.

Tran, T. T. H. (2023). AI tools in teaching and learning English academic writing skills. In *Proceedings of the AsiaCALL International Conference* (Vol. 4, pp. 170187).

Tshibangu, R., & Sikosana, P. Y. (2023, November). Investigating the experience of lecturers who transitioned from industry to academia at Mangosuthu University of Technology. In *The 10th Focus Conference (TFC 2023)* (pp. 78-93). Atlantis Press.

Tuckman, B. W. (2007). The effect of motivational scaffolding on procrastinators' distance learning outcomes. *Computers & Education*, *49*(2), 414-422.

Van der Berg, S., Burger, R., Burger, R., Louw, M., & Yu, D. (2007). *A series of national accounts-consistent estimates of poverty and inequality in South Africa* (No. 09/2007).

Van Der Stuyf, R. R. (2002). Scaffolding as a teaching strategy. *Adolescent learning and development*, *52*(3), 5-18.

Verenikina, I. (2003). Understanding scaffolding and the ZPD in educational research. https://ro.uow.edu.au/edupapers/381

Villamil, O. S., & de Guerrero, M. C. (2006). Sociocultural theory: A framework for understanding the social-cognitive dimensions of peer feedback. *Feedback in second language writing: Contexts and issues*, 23-41.

Wass, R., Harland, T., & Mercer, A. (2011). Scaffolding critical thinking in the zone of proximal development. *Higher Education Research & Development*, *30*(3), 317328.

Woldegiorgis, E. T., & Chiramba, O. (2024). Access and success in higher education: fostering resilience in historically disadvantaged students in South Africa. *Journal of Applied Research in Higher Education*.

Xi, J., & Lantolf, J. P. (2021). Scaffolding and the zone of proximal development: A problematic relationship. *Journal for the Theory of Social Behaviour*, *51*(1), 25-48.

Yeld, N. (2010). Some challenges and responses: higher education in South Africa. *Discourse*, *38*(1), 24-36.

Zachos, G., Paraskevopoulou-Kollia, E. A., & Anagnostopoulos, I. (2018). Social media use in higher education: A review. *Education Sciences*, *8*(4), 194.

Zulfa, S., Dewi, R. S., Hidayat, D. N., Hamid, F., & Defianty, M. (2023). The use of AI and technology tools in developing students' English academic writing skills. In *International Conference on Education* (pp. 47-63).