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Regular Article

Cultural and technological Synergy: A new Pathway to learners success in development studies in Lesotho secondary schools

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ABSTRACT

Efforts to improve learners' achievement in Development Studies (DS) have been ongoing, yet the chief examiners' reports from 2018 to 2023 show no significant improvement. This persistent issue may be linked to the use of inappropriate pedagogical practices. There is a notable lack of research exploring the Culturo-Techno-Contextual Approach (CTCA) in Southern Africa; hence, we investigated how CTCA can enhance learners' achievement in DS classrooms. Grounded in socio-constructivism, practice architecture, and meaningful verbal learning theory, a quasi-experimental design involving grade 11 intact classes was employed to generate quantitative data. We employed an Analysis of covariance (ANCOVA) to assess the impact of CTCA on learners' achievement and mean ranks were calculated to determine the difficulty levels of DS topics. The results indicate that the most challenging topic was theories of development (M = 4.72), followed by Population and Development (M = 3.71). More importantly, learners exposed to CTCA significantly outperformed their peers in the comparison group, as evidenced by [F (1,47) = 4.579; $p < 0.05$] n2 = .89 (p = 0.038). These results suggest that CTCA positively impacts learners' achievement, particularly in Population and Development. Continuous assistance and active participation were associated with higher scores and better comprehension. We conclude that incorporating CTCA in DS teaching can improve learner outcomes. These results underscore the need for adopting innovative pedagogical approaches like CTCA to enhance educational practices and learner achievement in DS.

1. Introduction

The Lesotho educational system aims to equip learners with the skills and competencies required for personal and social growth. The Lesotho Curriculum and Assessment Policy (MoET, 2009) defines national goals and identifies worthwhile learning areas. Specifically, Development Studies (DS), as part of personal, spiritual, and social learning, is considered one of the important areas that emphasize the notion of learning by doing. Development Studies first came to Lesotho in the form of education for self-reliance. Over the years, several attempts have been made to improve learners' performance in DS through various interventions and initiatives. Despite numerous efforts and government concerns, such as the Ministry of Education and Training (MoET, 2008), learners' achievements in DS have remained persistently poor. Reports from teachers and end-of-year examination results since 2018 indicate that performance in DS is very poor. For instance, in 2018, the average performance of learners in DS was approximately 45%, dropping to 40% in 2019, and further declining to 35% in 2020 (Ecol, 2022). Specifically, the overall Performance Examination Sheet of LGCSE 2021–2022 revealed that 18.53% and 16.15% of learners received an F symbol, while only .18% and 2.71% obtained an A symbol in DS for 2021–2022. These statistics highlight the concerning state of learners' achievement in DS (Ecol, 2022).

The literature suggests that this persistent problem is partly due to a lack of inclusivity in curriculum reforms, where teachers are not involved in making curriculum adjustments. As a result, they struggle to sequence and present the content in an accessible manner using relatable and local examples (Chere-Masopha et al., 2021). Moreover, the use of foreign examples in teaching DS topics, which learners find difficult to understand, contributes to poor grades. Effective pedagogical practices aligned with the content being delivered are essential for learners' comprehension of concepts. Lekhanya and Raselimo (2022) emphasize that there is often a misalignment between teachers' pedagogical practices and the teaching and learning of DS. This misalignment, coupled

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with inadequate teacher training, significantly contributes to learners' poor achievement. In addition to pedagogical issues, inequalities and unequal access to educational resources also impact learners' achievement. Onyedikachi (2021) highlights that unequal treatment and allocation of learning materials between male and female students can hinder performance. Similarly, Michubu (2016) points out that the socio-economic status (SES) of students can adversely affect their performance due to their home environments. These factors underscore the need to improve DS teaching to foster a democratic learning environment where every learner has equal epistemological access.

To address the poor achievement of learners, there is a growing need for a decolonized pedagogy that can help eliminate colonial narratives in teaching and learning (Ndlovu, 2017). In Western African countries, a new approach called the Culturo-Techno-Contextual Approach (CTCA) has been used to address perceived difficult subjects in science, technology, engineering, and mathematics (STEM) education. According to Adam et al. (2025) and Oladejo and Sanni (2023), CTCA is a teaching approach designed to facilitate understanding of difficult topics in STEM subjects in Africa. It promotes meaningful learning by integrating locational context, cultural knowledge, and technology. This approach is deemed suitable for creating a democratic learning environment where learners can relate to the content being taught. Previous studies have demonstrated that CTCA effectively promotes equality in the teaching and learning of science subjects, with the treatment group showing significant improvements.

In light of these challenges, this study aims to explore the effectiveness of CTCA on learners' achievement in Development Studies in Lesotho secondary schools. Specifically, the study seeks to address the following research questions: (i) What is the effect of the Culturo-Techno-Contextual Approach (CTCA) on learners' academic achievement in Development Studies? (ii) How does CTCA influence inclusivity and equity in the teaching of Development Studies? We structure the paper as follows: First, we delve into the background and rationale for exploring the potency of CTCA in DS. This is followed by a review of related literature and underpinning theories. Next, we outline the methodology and treatment package used, followed by data analysis and results. We then discuss the results, highlight the study's practical implications, and conclude with a summary of findings, limitations, and suggestions for future research.

2. Literature review

2.1. Theoretical framework

This study is based on three foundational theories: social constructivism (Vygotsky, 1978), meaningful verbal learning (Ausubel, 1968), and practice architecture theory (Kemmis, 2017). These theories collectively inform the implementation of the Culturo-Techno-Contextual Approach (CTCA) (see Fig. 1) to enhance learners' achievement in Development Studies (DS) classrooms. CTCA, conceptualized as a tripod consisting of culture, technology, and context, facilitates teaching and learning by integrating these three critical elements to improve learner outcomes. Social constructivism, developed by Vygotsky (1978), emphasizes that learning occurs through scaffolding, social interaction, semiotic mediation, and assistance from a More Knowledgeable Other (MKO). According to Davis (2017), Vygotsky believed that learning begins in social and cultural contexts, where novice learners gain understanding through interactions with peers or adults. This interaction shapes learners' cognitive structures, leading to meaningful learning.

In implementing CTCA to enhance learners' achievement in DS, the first step involves learners engaging with MKOs—parents, guardians, or older individuals—to gather indigenous cultural knowledge relevant to their assignments (Mcleod, 2023). Additionally, learners watch educational videos on platforms like YouTube or use social media such as WhatsApp and Facebook to explore the assigned topics. Akpan (2020) supports this by asserting that social constructivism considers community, parents, and peers essential in the meaning-making process in education, equipping learners with cultural and contextual knowledge. Thus, culture plays a significant role in facilitating meaningful learning within the CTCA framework. Furthermore, a classless classroom environment that encourages group interactions allows learning to occur through social interaction, as Vygotsky highlighted. Adewusi et al. (2021) emphasizes that the second step of CTCA involves grouping learners of mixed genders and abilities to share ideas gathered from their MKOs. Social constructivism supports this by advocating for cooperative and collaborative learning, where students work in diverse groups to share experiences and build new knowledge (Macleod, 2023). As the lesson progresses, CTCA's subsequent steps involve continuous assistance and clarification of difficult concepts by the teacher. Kapur (2018) explains that scaffolding, as described by Brunner (1961) and Vygotsky (1978), involves assisting novice learners to perform tasks beyond their current understanding within their Zone of Proximal Development (ZDP). Vygotsky (1978) defines ZDP as the gap between what learners can achieve independently and what they can achieve with assistance. This process helps break down learning barriers and address epistemological injustices in the DS classroom, enhancing learners' attainment through continuous support and clarification.

Furthermore, the meaningful verbal learning theory, proposed by Ausubel (1968), emphasizes the use of advance organizers to facilitate meaningful learning. Ausubel agreed with Brunner (1961) that cognitive processes are crucial in instructional planning and sought to address

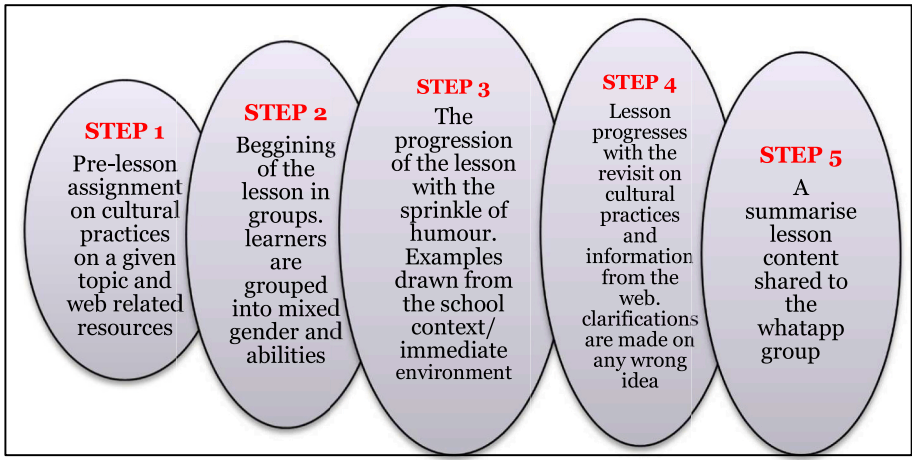

Fig. 1. *Steps in the implementation of CTCA,* Adopted from (Oladejo et al., 2022).

teaching, learning, and curriculum issues (Chen, 2014). This theory helps shape classroom activities to be more meaningful and effective. To accelerate learners' achievement in DS through CTCA, learners visit websites like YouTube and Google to search for lesson-related information and consult their parents for cultural insights. This approach aligns with Ausubel's (1968) concept of advance organizers, which are introductory materials that prepare learners' cognitive structures for new learning experiences. Sunasuan and Songsem (2021) state that advance organizers help learners integrate new information with existing knowledge, facilitating meaningful learning. Chen (2014) adds that advance organizers link students' prior knowledge with new concepts, promoting active participation and rejecting rote learning, which CTCA also opposes. A learning environment that values all learners' locational contexts is conducive to learning, as CTCA promotes equal access to resources regardless of socioeconomic status. This is where the third theory, practice architecture theory by Kemmis (2017), comes into play. Practice architecture consists of doings, sayings, and relating that enable or constrain educational practices (Mockler, 2017). This theory is suitable for transforming education practices that cause suffering and injustice (Mahon, 2017).

The CTCA aims to decolonize teaching methods and effect meaningful change in Development Studies (DS) classrooms by making learning concepts relevant to learners' immediate environments. Decolonized pedagogy, as embodied in CTCA, extends beyond merely removing Eurocentric content from curricula. It seeks to incorporate diverse perspectives rooted in local cultures, histories, and experiences into teaching and learning processes. This approach emphasizes inclusivity, critical thinking, and the contextual relevance of knowledge, which are essential for fostering meaningful and equitable learning experiences. Decolonized pedagogy centers Indigenous knowledge systems and local cultural practices while recognizing the contributions of non-Western scholars and traditions. It encourages critical examination of dominant narratives and their implications for learners, ensuring epistemological justice. CTCA operationalizes these principles by integrating cultural knowledge, technology, and contextual realities into education, making learning more relatable. For instance, CTCA's "sayings" emphasize using language in the classroom that all learners understand, thereby promoting inclusivity regardless of socioeconomic status. Schatzki (2021) further identifies "doings" as the activities undertaken during learning, such as using videos and internet resources to gather information before lessons, which enhances learners' access to diverse sources of knowledge. "Relating," on the other hand, focuses on the interactions between teachers and learners and among learners themselves, fostering collaboration and dialogue in the classroom. These elements ensure that CTCA moves beyond surface-level changes by embedding local knowledge systems and lived experiences into the curriculum.

In addition to CTCA, scholars have proposed other approaches to address Eurocentrism in education. Afrocentric education, for example, places African history, values, and philosophies such as Ubuntu at the center of the curriculum, providing ethical and social frameworks rooted in African contexts. Problem-posing education, inspired by Paulo Freire, emphasizes dialogue, critical inquiry, and learner agency, empowering learners to question power dynamics and societal structures. Decolonized content creation, another alternative, actively involves educators, students, and communities in co-creating curricula, ensuring the inclusion of diverse voices through tools like oral histories, folklore, and local case studies. While these approaches present viable alternatives, they face challenges such as institutional resistance, resource constraints, and the need to balance global standards with local relevance. Minor adjustments, such as integrating culturally familiar examples, serve as incremental yet important steps toward achieving a more inclusive pedagogy. CTCA's implementation aligns with these broader goals of decolonized pedagogy. By involving mixed-gender and ability groups, CTCA promotes practice architectures that enhance learner performance through appropriate tools and resources. It rejects epistemological violence by integrating cultural context and technology into learning, thereby creating a democratic environment where learners can connect with the content. Furthermore, CTCA is supported by key educational theories, including social constructivism, practice architecture, and meaningful verbal learning theories. Social constructivism emphasizes active learner participation and continuous assistance, while practice architecture and meaningful verbal learning theories advocate for emancipation in education by fostering inclusivity and critical engagement.

2.2. Incorporation of technology in learning

Despite its drawbacks, technology is the most effective tool for enhancing learners' comprehension. Based on the study conducted by Shah (2022) on teachers' perceptions about the incorporation of technology in the classroom, it was found to be more effective than traditional teaching. The results of this study support the idea that technology-based learning helps build learners' confidence in expressing ideas and thoughts. Further, Shah (2022) found that web-based sources help learners think more creatively, thus understanding concepts better. This suggests that incorporating technology in teaching and learning is important, as it helps contribute to a comprehensive and productive earning environment. Moreover, a study by Harris et al. (2019) examined the effects of technology on students' academic performance and their motivation to attend school. This study's results asserted that technology positively impacted students' performance, as the implementation group achieved better than the placebo group. Raja and Nagasubramani (2018) affirmed that using technology in teaching and learning is important, as it helps learners solve their academic problems. Equally important, Yosupov et al. (2022) added that different websites help learners access up-to-date information, which helps them be more active in the classroom. Furthermore, in his study, Muniz (2019) found that culture helps situate teaching and learning content in learners' everyday experiences. In addition, it was revealed that culture helps break barriers to meaningful learning. Arson (2016) highlighted that; students learn new information perfectly when linked to their prior knowledge. Then again, Muniz (2019) found that culture is a powerful tool for facing colonial narratives in teaching and learning. It can be seen that a culturally responsive learning classroom situation aids learners' comprehension and improves their achievement. This is because culture allows room for examples drawn from an immediate learning context. In essence, Pusey (2018) asserts that a lesson linked to indigenous knowledge and cultural values helps learners feel that they belong, as that allows for the use of understandable language. In addition, learners' home situation has an impact on their learning. Notably, Michubu (2016) stipulated that parental immersion in their children's education is important, as they assist in any assigned homework. Moreover, parents who are considerate about their children's schoolwork aid their achievement, as they know their learning needs. Jennifer (2018) conducted a study on the effects of SES on learners' performance. It has been revealed that learners with high SES score better than those with low SES. This is because those from SES have more access to learning resources than those from low SES.

2.3. Previous studies on CTCA

Several studies have investigated the effectiveness of CTCA as an intervention strategy in teaching and learning. Onowugbeda et al. (2022) stated that CTCA has been used in several studies as an intervention strategy in teaching and learning. In a study that tested the effectiveness of CTCA on learners' performance and attitudes towards networking, the results revealed a positive change. Certainly, there was a significant difference between those who received treatment and those who did not Ikpah (2022). The mean scores were as follows: traditional method ($m = 11.84$) and CTCA ($m = 19.62$). Most importantly, the discussions highlighted that CTCA leads to meaningful learning in which

learners can participate actively. This implies that CTCA helps advance learners' performance and aids their comprehension. Moreover, Adam and Okebukolas' (2020) study explored CTCA in relation to the achievement and attitudes of students towards mutation and variation. Their study revealed a positive impact of CTCA on learners' attitudes and achievement. Okebukola (2016) reported that technology-based learning plays a vital role in learners' comprehension and, hence, has a positive effect on the results. The active involvement of learners in giving opinions on their cultural activities about mutation and variation helped learners perform better than those treated with the traditional method. It is important to consider technology and culture as useful tools in teaching and learning, as they help enhance learners' understanding of concepts. Of the two studies conducted by Oladejo (2022–2023), one focused on physics learning, while the other focused on chemistry learning. The findings reveal that CTCA can potentially eliminate obstacles during the learning process. The results from both studies were the conclusions drawn from previous studies. Their discussions stated that learners' performance improved because of the incorporation of culture and technology in teaching and learning. Four studies found that CTCA has the potential to contribute to comprehensive learning. This is because learning blended with technology seems to evoke learners' interests, thus helping them pay attention and actively engage in their work. Again, as CTCA consists of cultural aspects, it helps learners relate the lesson content to their everyday experiences, thereby helping them to have a great understanding of the lesson content. However, Adolo (2020) found different results. His study reported no impact of CTCA on the experimental and control groups. It can be seen that even though CTCA is considered by many authors to impact a positive change in learners' achievement in their learning, some studies like that of Adolo (2020) found it to have similar capabilities as traditional teaching methods.

3. Methodology

3.1. Context, participants, and research design

This study was conducted in secondary schools located in Lesotho and specifically targeted Grade 11 learners enrolled in Development Studies. The Lesotho educational system aims to equip learners with essential skills and competencies for personal and social development. Development Studies is a critical curriculum component that emphasizes personal, spiritual, and social learning. Despite its importance, there has been a persistent issue of poor performance in DS, which necessitates innovative approaches like the CTCA to enhance student engagement and achievement. We conducted the study with a sample size of 50 Grade 11 learners from intact classes within ten secondary schools. These schools were purposively selected because they offered DS as an elective subject. We divided the sample into 25 learners in the experimental group and 25 in the control group. The experimental group consisted of 13 girls and 12 boys, while the control group included 14 girls and 11 boys. The average age of the subjects ranged from 15 to 18 years. This selection ensured a diverse representation of learners in terms of gender and age, allowing us to comprehensively understand the impact of the intervention across different demographic groups. Additionally, we employed a quasi-experimental pre-test, post-test, and control design to assess the impact of the CTCA on student achievement in Development Studies. The experimental group received the CTCA intervention, while the control group was taught using traditional teaching methods. This design enabled a comparison between the two groups, providing robust data on the effectiveness of the CTCA.

3.2. Treatment package

The experimental group was treated with the CTCA following the pre-test. The implementation of CTCA in the classroom followed the steps illustrated in Fig. 1, based on the ideas of Onowugbeda et al. (2022). These steps highlighted how culture, technology, and context could be used to enhance learners' engagement and comprehension. The treatment lasted for three weeks, with lessons conducted two days a week, each session lasting either 40 min.

Step 1: Pre-lesson preparation

Two days before the lesson, learners were informed about the topic to be studied, "Population and Development." They were assigned to search for information on this topic using web-based resources on their mobile phones or those of their parents. Learners were encouraged to watch YouTube videos or search Google for relevant information. As highlighted by Oladejo and Sanni (2023), visiting websites like YouTube provides learners with valuable background knowledge on the topic. Learners were also instructed to explain the concept of population and development to their guardians, older persons, or any more knowledgeable individuals, and to ask them about the cultural or indigenous knowledge related to the topic. This step emphasized the role of parents in shaping learners' cognitive structures through the mediation process, aligning with Vygotsky's social constructionism. Learners were informed that the information they gathered would be shared with their peers during the lesson.

Step 2: Group work and presentations

The lesson began with the introduction of the topic, and learners were divided into three groups based on mixed abilities and gender. Two groups consisted of eight members each, while the third group had nine members. Each group was tasked with preparing a short presentation on the information they gathered from different websites and their parents about population and development. They were given 5 min to prepare and 3 min to present their findings. During the presentations, learners highlighted various Sesotho cultural aspects related to population and development. Examples included statements like "re Basotho sechabana sa Moshoeshoe" (we are the Basotho nation of King Moshoeshoe, we are his population) and "mafu a seoa joalo ka lepera le phamokate a fokotsa sechaba" (pandemic diseases such as HIV/AIDS and leprosy cause a decrease in population). Additionally, Figs. 2 and 3 show how learners discussed the traditional ways in which the Basotho nation worked together to solve social problems, such as through the practice of "matsema."

Fig. 2. The Basotho Nation in traditional attire (Note: The Basotho are an ethnic group native to Lesotho, and their cultural practices). Source: https://patonbrands.com/tag/sesotho/.

Fig. 3. The Matsema in Basotho culture (Note: Matsema is a traditional communal labor practice of the Basotho people, where community members come together to help with social tasks). Source: https://southafrica.co.za/basotho-religion-and-beliefs.html.

Step 3: Integration and clarification

As the lesson progressed, the teacher shared the practical cultural activities related to population and development that the learners had discussed. Clarifications were provided for concepts that learners found difficult to understand. The teacher also drew examples from the school environment to make the population-related concepts more relatable and understandable.

Step 4: Reinforcement of cultural practices

During the teaching process, the importance of the cultural practices and indigenous knowledge presented by the learners was continually emphasized. The teacher related this content to the lesson to promote a better understanding of the concepts. Dewey (1938), as cited in Davis (2017), maintained that students learn better when content is connected to their everyday experiences. At this stage, students were encouraged to ask questions, and additional clarifications were provided to ensure comprehensive understanding.

Step 5: Summary and next steps

At the end of the lesson, the teacher asked one of the group leaders to send a summary of the lesson via WhatsApp (see figures 4a to c). Students were also informed about the topic of the next lesson and were advised to visit any website where they were comfortable searching for related information. Additionally, learners were asked to interact with their parents, caregivers, or siblings to reflect on cultural and indigenous knowledge related to the upcoming topic.

3.3. Instruments

We used two instruments to collect data for our study. Firstly, we created the Difficult Development Studies Concepts Questionnaire (DDSCQ) to assess learners' perceived difficulty with various DS concepts. This questionnaire was designed based on the DS Grade 11 syllabus to make it relevant to the learners curriculum. The DDSCQ asked learners to rate each concept on a three-point scale: very difficult, moderately difficult, and not difficult. This tool helped us identify the areas where learners struggled the most with understanding the subject material. Secondly, we administered the Development Studies Achievement Test at pre-test and post-test stages to measure learners' achievement. This test consisted of 20 multiple-choice questions based on the DS Grade 11 syllabus. Our goal was to evaluate how well learners understood and retained the material covered during the intervention period. Additionally, we took great care to ensure the validity and reliability of these instruments. To assess content validity, we sought expert reviews (that is, teachers teaching DS) to evaluate the relevance and comprehensiveness of the DDSCQ and the achievement test. Subject matter experts provided feedback, which we used to refine the items. The content validity index (CVI) was calculated for both instruments, resulting in a value of .77 for the DDSCQ and .85 for the achievement test. These CVI scores indicate that both instruments were relevant and covered the necessary content comprehensively. Regarding reliability, we used the test-retest method to ensure response consistency over time. We administered both the DDSCQ and the achievement test to a pilot group of learners' and then re-administered them after a two-week interval. The DDSCQ demonstrated a reliability coefficient of .720, while the achievement test showed a reliability coefficient of .830. These coefficients indicate good reliability and confirm that the instruments produced consistent results over repeated administrations.

3.4. Data collection procedure

The data collection procedure for our study was carefully planned and executed over four weeks to ensure the accuracy and reliability of our results. It consisted of three stages: preparation, intervention, and assessment.

Week one: We met with the administrators, teachers, learners, and their parents or guardians at the participating schools. The purpose of this meeting was to explain the objectives, procedures, and ethical considerations of our study. We made sure to obtain informed consent from all participants. At the end of the first week, we administered the pre-test to both the experimental and control groups. This test included the Development Studies Achievement Test, designed to assess the learners' baseline understanding of the DS concepts. Additionally, we administered the Difficult Development Studies Concepts Questionnaire (DDSCQ) to identify learners' perceived difficulty with various DS concepts.

Weeks 2–3: Intervention phase.

Week two: We implemented the Culturo-Techno-Contextual Approach (CTCA) with the experimental group, while the control group continued with traditional teaching methods. Traditional instruction for the control group was defined as conventional teaching methods that did not incorporate the innovative strategies used in the experimental group. This included teacher-centered approaches such as lectures, rote memorization, and minimal use of interactive or technology-driven tools. The instruction relied heavily on textbooks, handouts, and standard assessments, such as quizzes and tests, with limited opportunities for student engagement or inquiry-based learning activities. For the experimental group, we began with pre-lesson preparation to introduce the topic "Population and Development." Learners were informed about the topic and were assigned to gather information from web-based resources, as well as from their parents or community members. This step aimed to integrate cultural and contextual knowledge with the lesson content, making it more relatable and meaningful for the learners. By contrast, the control group engaged with the same topic through traditional instruction methods, focusing on teacher-led explanations and textbook-based learning, without the integration of external or interactive resources.

Week 3: We organized group work and facilitated class discussions for the experimental group. Learners were divided into mixed-gender and mixed-ability groups to prepare and present their findings on the topic. This collaborative approach encouraged peer learning and fostered a sense of inclusivity and equity in the classroom. The teacher guided discussions, incorporating students' cultural and contextual knowledge into the lesson content. We supplemented the lessons with digital resources such as YouTube videos and online articles. During this same two-week period, the control group received instruction through traditional teaching methods, allowing us to make a clear comparison

between the two groups.

Week 4: We administered the post-test to both the experimental and control groups. This test was identical to the pre-test, comprising the Development Studies Achievement Test and the DDSCQ. The post-test aimed to measure any changes in student understanding and retention of the DS concepts following the intervention. After administering the post-test, we collected all the completed pre-tests and post-tests from both groups. We also gathered additional feedback from teachers and students regarding their experiences during the intervention.

3.5. Method of data analysis

We conducted the data analysis for this study using the Statistical Package for Social Sciences (SPSS) software version 26.0. Both descriptive and inferential statistical techniques were employed to summarize the data and evaluate the impact of the CTCA on learners' achievement in DS. Descriptive statistics, such as means, standard deviations, and frequencies, were used to provide a clear understanding of the overall distribution of the data and to identify noticeable trends. This allowed us to comprehensively summarize learners' performance and highlight key patterns. Additionally, we calculated mean ranks to identify the perceived difficulty of various DS topics, offering valuable insights into the areas where learners faced the most challenges. More so, to determine the specific impact of the CTCA intervention on learners' achievement, we conducted an Analysis of Covariance (ANCOVA). This statistical approach enabled us to control for pre-test scores, isolating the effect of the CTCA on post-test performance. By accounting for initial differences between the experimental and control groups, ANCOVA allowed us to accurately evaluate the extent to which changes in learners' achievement could be attributed to the intervention. The sample consisted of 25 learners in the experimental group and 25 learners in the control group. Before running ANCOVA, we rigorously tested several key assumptions to ensure the validity and reliability of our analysis.

First, we tested for normality of residuals using the Shapiro-Wilk test. The results confirmed that the residuals of the dependent variable, post-test scores, were normally distributed for both the experimental group ($W = .967$, $p = 0.185$) and the control group ($W = .960$, $p = 0.125$), satisfying the assumption of normality. Next, we examined the homogeneity of variances through Levene's test for equality of error variances. The test result ($F(1, 48) = 1.456$, $p = 0.234$) indicated that the variances of post-test scores were equal across the two groups, fulfilling this assumption. We also assessed linearity by examining a scatterplot of the covariate (pre-test scores) and the dependent variable (post-test scores). The scatterplot revealed a linear relationship between pre-test and post-test scores for both groups. To ensure the homogeneity of regression slopes, we included the interaction term between the covariate and the independent variable (group) in the model. The interaction was not significant ($F(1, 46) = 1.892$, $p = 0.175$), indicating that the slopes of the regression lines were parallel, satisfying this assumption. Finally, we checked for the independence of errors using the Durbin-Watson statistic, which yielded a value of 1.857. This falls within the acceptable range of 1.5–2.5, confirming that the errors were independent. By employing these rigorous data analysis procedures, we ensured both transparency and reliability in evaluating the impact of the CTCA intervention.

3.6. Ethical considerations

We strictly adhered to ethical guidelines to safeguard the rights and well-being of the participants. Informed consent was obtained from both learners' and their parents or guardians. Participants were assured that their responses would remain confidential and anonymous, and their participation was completely voluntary. They were fully informed of the study's purpose and their right to withdraw at any time without any negative repercussions. These ethical considerations were of utmost importance in maintaining the integrity of the research and ensuring that it was conducted in a respectful manner that honored the rights of the participants. Additionally, we obtained ethical clearance from the Faculty of Education Ethical Review Board at the National University of Lesotho. The approval was granted on October 24, 2023, with the Ethical Clearance Number FED 2-2023-194. This approval confirmed that the study fully adhered to the ethical standards and guidelines for research involving human participants. The research was conducted in accordance with the Helsinki Declaration, which outlines ethical principles for research involving human subjects, ensuring that the study adhered to the highest standards of ethical practice throughout.

4. Results

To address our first research question, we calculated the mean of the difficult topics. Specifically, we summed the difficult scores for each concept and then divided this sum by the number of participants who completed the questionnaire. Table 1 presents the topics in the Development Studies Grade 11 syllabus (MoET, 2018), arranged chronologically based on their perceived difficulty. For each topic, we have provided the mean and mean rank to indicate which topics our learners perceived as the most difficult. This approach allowed us to identify the areas where our learners struggled the most, providing valuable insights for future instructional strategies and interventions. By understanding these difficulties, we can better tailor our teaching methods to address these challenging concepts and improve overall learner performance.

The results (see Table 1) indicated that the most perceived difficult topic in Development Studies is "Different development theories" with the mean ($M = 4.72$). Therefore, this topic was ranked first in Table 1. The topic "Impacts of population change on development" was ranked second with the mean ($M = 3.17$). In addition, the topics "Trade" and "Nature of the relationship between environment and development" have the same ranking as sixth. This suggests that the learners found the two topics to have the same level of difficulty. Another important idea is that "Indicators of development" were found to be the least difficult topic in Development Studies. The selection of the topics that were ranked was informed by the Grade 11 DS syllabus (MoET, 2018). Furthermore, Table 2 presents the results in response to the hypothesis. In essence, the study revealed that there is a significant impact of treatment on learners' achievement in Development Studies. In addition, no significant impact or interaction has been found on the moderating variables: gender and socio-economic status on learners' achievement.

5. Discussion

Our study's results reveal significant insights into the effectiveness of

Table 1
The ranking of perceived difficult topics in Development studies grade 11 ($n = 50$).

Development studies topics	Mean	Mean Rank
1 Different theories of development	4.72	1st
2 Impacts of population change on development	3.71	2nd
3 The role of women in poverty alleviation	3.47	3rd
4 Basic components of research	3.25	4th
5 Foreign aid and investment in development	3.06	5th
6 Trade	2.88	6th
7 Nature and the relationship between environment and development	2.88	6th
8 Growth and importance of agricultural products	2.47	8th
9 Forms of governance and their influence on development	2.17	9th
10 Industrialization and processes of production	1.70	10th
11 Types of education systems	1.44	11th
12 Pollution	1.33	12th
13 Indicators of development	1.16	13th

Table 2
ANCOVA summary of the differences in the groups.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	352.665a	8	44.083	1.882	.089	.269
Intercept	772.587	1	772.587	32.991	.000	.446
Pretest	57.244	1	57.244	2.444	.126	.056
Treatment	101.272	1	101.272	4.324	.038	.095
SES	18.271	1	18.271	.780	.382	.019
Gender	69.101	1	69.101	2.951	.093	.067
Treatment * SES	18.585	1	18.585	.794	.378	.019
Treatment * Gender	72.348	1	72.348	3.089	.086	.070
Treatment * SES * Gender	4.704	1	4.704	.201	.656	.005
Error	960.155	41	23.418			
Total	11197.000	50				
Corrected Total	1312.820	49				

a. R Squared = .269 (Adjusted R Squared = .126)

the Culturo-Techno-Contextual Approach (CTCA) in enhancing learners' achievement in Development Studies (DS) in Lesotho secondary schools. In this section, we discussed these results extensively, situating them within the broader context of existing research to provide a robust discussion.

RQ: Which topics do learners perceive as most difficult in Development Studies?

Learners' comprehension is often hindered in a classroom environment that does not allow for active participation. Table 1 adds to previous studies by highlighting the need for more responsive pedagogical practices in teaching and learning in Development Studies. Kemmis (2017) suggests that using relatable language and sayings in the classroom can make it easier for learners to understand. Lekhanya and Raselimo (2022) also found that the misalignment of teaching strategies in Development Studies impairs learners' comprehension. Therefore, this study incorporates CTCA to improve learners' comprehension of population and development.

H01There is no significant effect of treatment on learners' achievement in Development Studies

The results indicate a statistical difference between those taught using CTCA and those taught using the lecture method. The p-value in Table 2 indicates significance, with a value less than .05 indicating a significant effect and rejecting the null hypothesis. The specific results obtained were as follows: [$F(1, 41) = 101.272$; $p < 0.05$]. The study found that learners taught using CTCA outperformed those taught using traditional methods. This improvement aligns with previous studies highlighting the benefits of integrating cultural relevance, technology, and contextual understanding into teaching. Oladejo and Sanni (2023) demonstrated that CTCA promotes meaningful learning by making abstract concepts more relatable and easier to understand for students. Similarly, Adam and Okebukola (2020) found that culturally and contextually enriched teaching strategies significantly improved student performance in science subjects. These findings suggest that CTCA's holistic approach addresses the diverse learning needs of students, thereby enhancing their academic achievement. However, some studies have shown mixed results. Adolo (2020) reported no significant impact of CTCA on student performance in networking subjects. This discrepancy could be due to variations in the implementation of CTCA, the subject matter, or the context in which the study was conducted. It highlights the need for further research to explore the conditions under which CTCA is most effective.

H02There is no significant effect of gender on learners' achievement in Development Studies.

The results in Table 2 indicate that gender has no substantial effect on students' achievement in Development Studies [$F(1,41) = 69.101$; $p > 0.05$]. Specifically, the results show no difference in mean test scores between males and females taught using CTCA (Male: $M = 15.00$, Female: $M = 15.85$). However, in the control group, males outperformed females (Male: $M = 15.55$, Female: $M = 10.43$). Mohan (2017) suggested that collaboration among learners in a classroom is important for the theory of practice and architecture. Similarly, Macleod (2023) pointed out that social constructivism theory suggests learners should work in mixed-gender and mixed-ability groups for better cooperation, epistemological access, and collaboration. These findings align with those of Oladejo et al. (2023), who also found that CTCA can equalize performance between males and females. Thus, CTCA has the potential to bring about equality and social justice in the teaching and learning environment, facilitating more meaningful learning between males and females.

H03There is no significant effect of socioeconomic status on learners' achievement in Development Studies.

Table 2 provides insights into the effect of socioeconomic status (SES) on students' achievement in Development Studies (DS). The ANCOVA results indicate that SES does not significantly affect students' post-test scores in DS. The F-value for SES is .780 with a p-value of .382, which is greater than the .05 significance level. Therefore, the null hypothesis, which posits that SES does not have a significant impact on student achievement in DS, is accepted. This finding against the perspective presented by Jennifer (2018), who emphasized the importance of integrating educational aspects with culture and technology, especially when parents are involved. In our study, the high achievement of students with low SES can be attributed to the significant role of parental involvement. Parents provide cultural values and traditions that are crucial for the students' understanding and application of lesson content. This parental support compensates for any potential disadvantages that might arise from a lower socioeconomic status.

H04There is no significant interaction between treatment and gender on learners' achievement in Development Studies.

Based on the result presented in Table 2, the results support the null hypothesis: [$F(1, 41) = 72.348$; $p > 0.05$]. The p-value of .086, greater than .05, indicates no significant interaction of treatment and gender on learners' achievement in Development Studies. The lack of a significant interaction between treatment and gender in our study highlights the effectiveness of CTCA in promoting gender equity in the classroom. This finding is important as it suggests that the CTCA framework is inherently inclusive and does not favor one gender over the other. Both male and female students were able to engage with the cultural, technological, and contextual elements of the CTCA equally, resulting in similar academic gains. Furthermore, research by Macleod (2023) supports the idea that gender-inclusive teaching strategies can improve academic performance for all students. Macleod's study emphasized that when educational interventions are designed to be inclusive, they help mitigate traditional gender biases and ensure that both male and female students can thrive academically.

H05*There is no significant interaction between treatment and SES on learners' achievement in DS.*

Table 2 shows no significant interaction between treatment and SES on students' achievement in DS. The results indicate [$F(1, 41) = 18.585$; $p > 0.05$]. Specifically, the p-value of .378, greater than .05, suggests no interaction between treatment and SES on learners' achievement in DS. Okebukola (2016) supports the idea that technology is a powerful tool in teaching and learning, breaking down barriers to learning. The Ausubel theory, through the use of advanced organizers, helped students in the pre-assignment phase as they could utilize technology at home. This mitigated any potential impact SES could have on students' achievement. Therefore, CTCA is an effective tool for promoting equality in teaching and learning.

H06There is no significant interaction between treatment, gender, and SES on learners' achievement in DS.

Analyzing Table 2, we see that the null hypothesis has been accepted. The results show [$F(1, 41) = 4.704$; $p > 0.05$]. The p-value is .656. As noted by several authors such as Ikpah (2022), Adam and Okebukola (2020), and Oladejo (2022, 2023), CTCA is a transformative tool in teaching and learning, countering current practices that cause suffering and marginalization. This empowers students to engage in their learning process actively and enhances their understanding of the concepts. Similarly, Aronson (2016) and Muniz (2019) emphasize how culturally situated learning content fosters collaboration among students, irrespective of gender and SES. Furthermore, technology helps boost students' confidence in sharing their opinions with peers, giving them a deeper understanding of the course content (Raja & Nagasubramani, 2018). In conclusion, CTCA effectively addresses factors that can lead to learning inequalities related to gender and SES. Therefore, this study found no significant interactions among the variables.

6. Implications

The results of our study have practical implications for educators, policymakers, and curriculum developers who aim to improve students' achievement in Development Studies (DS) and other subjects. Firstly, integrating the CTCA into the curriculum can significantly enhance student comprehension and performance. By incorporating cultural relevance, technology, and contextual understanding into teaching methods, educators can make abstract concepts more relatable and engaging for students. This approach promotes a more inclusive and democratic classroom environment where all learners, regardless of gender or socioeconomic status (SES), can actively participate and achieve better academic outcomes. Secondly, teacher training programs should emphasize the importance of culturally responsive teaching and the effective use of technology in the classroom. Professional development workshops and ongoing training sessions can provide teachers with the necessary skills and knowledge to successfully implement CTCA. This will help address the identified misalignment of teaching strategies in DS and improve overall instructional quality. Thirdly, parental involvement plays a crucial role in supporting student learning. Schools should encourage parents to actively engage in their children's education by providing resources and guidance on integrating cultural knowledge and technology at home. This can help mitigate the potential disadvantages of low SES and enhance students' learning experiences. Lastly, policymakers should consider revising educational policies to support the widespread adoption of CTCA. This includes providing schools with the necessary technological infrastructure and resources to effectively implement this approach. By prioritizing equitable access to educational tools and culturally relevant materials, policymakers can help create a more inclusive and effective education system.

7. Conclusion

Our study provides compelling evidence of the effectiveness of the CTCA in enhancing learners' achievement in DS in Lesotho secondary schools. The results reveal that learners taught using CTCA significantly outperformed those taught using traditional methods, highlighting the benefits of integrating cultural relevance, technology, and contextual understanding into teaching. This approach addresses diverse learning needs, making abstract concepts more relatable and fostering meaningful learning. Despite initial concerns about the impact of gender and socioeconomic status (SES) on learners' achievement, our results indicate no significant effect of these factors when using CTCA. The approach promotes gender equity and social justice in the classroom, ensuring that both male and female students engage equally with the learning material. Additionally, the involvement of parents and the use of advanced organizers help mitigate potential disadvantages related to SES, providing all students with equal opportunities for success. The absence of significant interactions between treatment, gender, and SES further supports the inclusivity of CTCA. This framework effectively counters traditional biases and promotes a democratic learning environment where all students can thrive. The study underscores the importance of adopting innovative pedagogical approaches like CTCA to enhance educational practices and learner outcomes. Overall, the positive impact of CTCA on learners' achievement in DS suggests that this approach could be a valuable tool for improving educational outcomes in other subjects and contexts.

Despite the promising results, we acknowledge the limitations of this study. The first limitation is the study's reliance on quantitative data. While quantitative methods allowed us to measure the impact of CTCA on learner achievement, they did not capture the nuanced experiences and perceptions of learners and teachers involved in the intervention. Future research should incorporate qualitative methods, such as interviews and focus groups, to gain deeper insights into how CTCA is perceived and implemented in the classroom. This would provide a more comprehensive understanding of the approach's effectiveness and the challenges faced during its implementation. We also faced constraints related to the duration of the intervention. CTCA was implemented over a relatively short period of four weeks. While the results indicated a positive impact on learner achievement, longer-term studies are necessary to determine the sustained effects of CTCA on learning and retention. Future research should explore the long-term impact of CTCA by extending the duration of the intervention and conducting follow-up assessments to measure retention and continued academic performance. The study did not extensively explore the specific technological tools and resources used within the CTCA framework. Future studies should examine which technologies are most effective in enhancing learning outcomes and how they can be best integrated into the curriculum. This would help refine the CTCA approach and make it more adaptable and effective in various educational settings.

CRediT authorship contribution statement

Musa Adekunle Ayanwale: Writing – review & editing, Writing – original draft, Supervision, Investigation, Conceptualization, Data curation, Funding acquisition, Project administration. **Mathaha Puseletso:** Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Conceptualization.

Data availability statement

The data supporting the findings of this study are available from the first author upon reasonable request.

Declaration of the use of AI

We declare that no AI tools were used in the writing of this

manuscript.

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