

EMPIRICAL PAPER

Unlocking Human Capital Development through Technopreneurship Education: Evidence on the Moderating Influence of Entrepreneurial Mindset from Niger State, Nigeria

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Abstract

Purpose: Graduate unemployment remains a persistent challenge in Niger State, Nigeria, despite growing investments in entrepreneurial education. This study examines the moderating effect of entrepreneurial mindset (EMS) on the relationship between technopreneurship education and human capital development (HCD) among tertiary institution students.

Methodology: A quantitative research design was adopted using data from 500 students selected from a population of 9,135 students across tertiary institutions in Niger State through purposive sampling. The study assessed key dimensions of technopreneurship education—Business and Financial Literacy (BFL), Entrepreneurial Skills (ES), Innovation and Creativity (IC), and Technological Competence (TC). Data were analysed using Partial Least Squares Structural Equation Modelling (PLS-SEM), with EMS specified as a moderating variable.

Results: The findings indicate that BFL ($\beta = 0.194$, $p = 0.002$), ES ($\beta = 0.218$, $p = 0.001$), IC ($\beta = 0.146$, $p = 0.004$), and TC ($\beta = 0.224$, $p = 0.000$) exert significant positive effects on HCD. Although EMS shows only a marginal direct effect on HCD ($\beta = 0.092$, $p = 0.054$), it significantly strengthens the relationships between TC and HCD ($p = 0.000$) and between BFL and HCD ($p = 0.006$).

Novelty and contribution: The study advances technopreneurship literature by demonstrating that entrepreneurial mindset enhances the effectiveness of specific technopreneurial competencies in driving human capital development.

Practical and social implications: The study recommends integrating entrepreneurial mindset training into technopreneurship curricula, supported by mentorship and experiential learning initiatives, to improve graduate employability and foster sustainable human capital development in tertiary institutions.

Keywords: entrepreneurial mindset, human capital development, innovation and creativity, technopreneurship education, technological competence

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1 Introduction

Human capital development is a critical driver of sustainable economic growth, particularly in developing economies with rapidly expanding youth populations. It encompasses the enhancement of individuals' skills, knowledge, and competencies required to contribute effectively to national productivity and innovation (Nwachukwu et al., 2024). In Nigeria, and specifically in Niger State, the growing youth demographic, coupled with persistent unemployment challenges, underscores the urgency of developing educational systems that not only impart theoretical knowledge but also build practical, innovation-driven capabilities (Choi et al., 2024). The integration of technology and entrepreneurship, commonly referred to as technopreneurship education, has emerged as a strategic avenue for nurturing such competencies. According to Mulyany et al. (2023), technopreneurship education provides students with essential skills to thrive in a technology-driven economy, enabling them to become both job creators and innovators. This approach fosters a dynamic learning environment where creativity, innovation, and technological proficiency converge to enhance students' capacity for meaningful participation in the digital economy.

However, while technopreneurship education provides a strong foundation for fostering innovation and entrepreneurial potential, its effectiveness in promoting human capital development may largely depend on individual psychological attributes, particularly the entrepreneurial mindset (EMS) (Maitlo et al., 2020). Entrepreneurial mindset reflects a student's belief in their capability to successfully perform entrepreneurial tasks, influencing how they translate educational experiences into practical outcomes (Ndace et al., 2025). Abbasi et al. (2024) emphasised that students with high EMS are more likely to apply classroom knowledge in real-world entrepreneurial settings, thereby amplifying the impact of technopreneurship education on human capital development. Similarly, Kwapisz et al. (2024) noted that EMS strengthens the relationship between entrepreneurship education and students' inclination toward innovative ventures. Consequently, embedding EMS within technopreneurship education is vital for maximising its contribution to human capital development in tertiary institutions in Niger State. The specific objectives are:

- i. To examine the impact of technological competence on human capacity development among students of tertiary institutions in Niger State
- ii. To determine the impact of entrepreneurial skills on human capacity development among students of tertiary institutions in Niger State
- iii. To assess the impact of business and financial literacy on human capacity development among students of tertiary institutions in Niger State
- iv. To examine the impact of innovation and creativity on human capacity development among students of tertiary institutions in Niger State
- v. To determine the moderating role of entrepreneurial mindset on the impact of technopreneurship education on human capital development among Students of tertiary institutions in Niger State.

2 Conceptual Review

Technopreneurship education has emerged as a vital interdisciplinary field that merges technological innovation with entrepreneurial training to equip learners for a digital, knowledge-based economy (Ndace & Tsado 2021). In contrast to conventional entrepreneurship education, which often overlooks technical competencies, technopreneurship education responds to the demands of the Fourth Industrial Revolution by equipping individuals with both entrepreneurial and technological skills (Mulyany et al., 2023). Its goal is to equip individuals with knowledge, competencies and entrepreneurial mindset required to recognise opportunities, develop innovative technology-driven solutions, and transform them into sustainable enterprises (Majid et al., 2024). This approach positions technology not merely as a supporting tool but as a driver of new business models, ecosystems, and societal transformation (Choi et al., 2024).

At its core, technopreneurship education emphasises experiential and interdisciplinary learning by integrating principles from computer science, engineering, business management, design thinking, and innovation studies. Through problem-based projects, collaborative ventures, and digital simulations, learners gain hands-on exposure to opportunity recognition, product development, venture financing, and intellectual property management (Sutrisno, 2023). This practical orientation enhances their ability to navigate the realities of modern business environments while promoting creativity, innovation, and adaptability. Importantly, in developing countries, the integration of

technopreneurship education into higher education and vocational training has been strategically recognised as a means of addressing unemployment, reducing youth restiveness, and fostering inclusive economic growth (Mulyany et al., 2023). This nurtures job creators who can contribute to national development rather than relying solely on existing labour markets. From a theoretical perspective, technopreneurship education draws on human capital theory, innovation diffusion theory, constructivist learning, and experiential learning frameworks, which emphasise capability development and active knowledge construction (Sutrisno, 2023). Beyond economic benefits, it is also aligned with global agendas such as the United Nations Sustainable Development Goals (SDGs), as it encourages learners to engage in ethical, socially responsible, and sustainable innovation (Ogwuche et al., 2024). By embedding values of environmental stewardship, digital inclusion, and global citizenship, technopreneurship education prepares learners not only as business innovators but also as agents of social and environmental transformation in an increasingly digitalised world.

2.1 Conceptual Framework

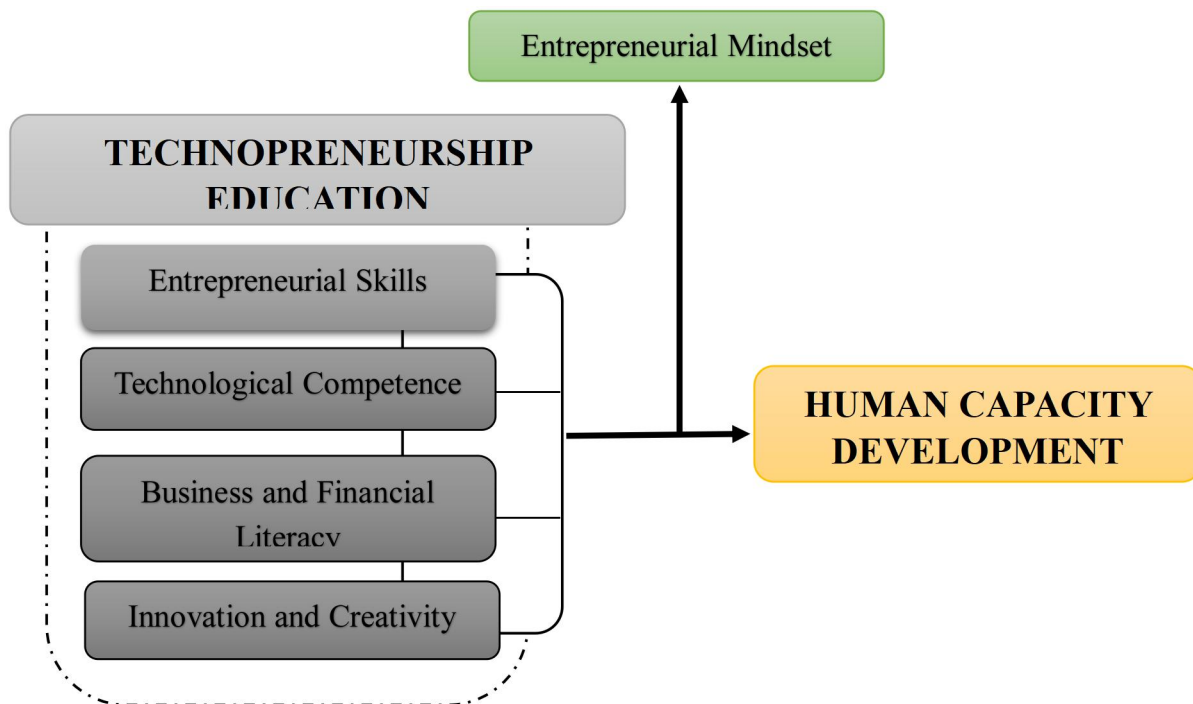


Figure 1 Conceptual Framework

The conceptual framework of the study is summarised in Figure 1. It concludes the subsection by clarifying the study's variables' concepts: Technopreneurship Education, Human Capital Development and Entrepreneurial mind-set as the moderating variable. The conceptual framework also depicts the study's primary goal, which is to unlock human capital through technopreneurship education: evidence on the moderating influence of entrepreneurial mindset from Niger State, Nigeria.

2.2 Hypothesis Development

Technological competence and human capital development

Technological competence (TC) is a crucial aspect of technopreneurship education, particularly in higher education, as there is a growing demand for skilled graduates. TC goes beyond basic digital literacy and encompasses expertise in advanced tools like programming, artificial intelligence, data analytics, mobile application development, and cloud computing (Omoniyi et al., 2025). It improves learners' ability to solve problems, increase productivity, and drive

creativity by teaching them how to understand and manage these technologies. TC transforms students from passive consumers to creators of technological solutions, placing them as active participants in a digital and innovation-driven economy.

TC transforms the learning experience by fostering problem-solving skills, resilience, and innovation. Educational practices like coding projects, simulations, and real-world problem-solving tasks stimulate critical thinking and enhance technical proficiency (Jan, 2024). This experiential learning approach equips students to adapt to the dynamic demands of knowledge-intensive industries and cultivates agility, continuous learning, and a proactive mindset (Ogwuche, 2024). TC positions graduates for employability and leadership roles in innovation ecosystems. It enhances graduates' market value, aligns their skills with evolving industry demands, and enables them to pursue entrepreneurial ventures in technology-based sectors. This supports national goals such as economic diversification, job creation, and poverty alleviation, making TC a strategic driver of inclusive growth (Guzmán-Coutiño et al., 2024). With this review, the first hypothesis is therefore drawn;

Ho₁ Technological competence has no significant impact on the human capital development among students of tertiary institutions

Entrepreneurial skills and mindset and human capital development

Entrepreneurial skills and mindset (ESM) are crucial for human capital development, especially in tertiary education. These skills include creativity, resilience, opportunity recognition, leadership, and strategic thinking, which enable graduates to start entrepreneurial businesses and actively contribute in various organisational contexts (Oluwasina et al., 2024). Experiential learning tools such as simulations, project-based learning, and real-world problem-solving help students navigate uncertainty and create change. Entrepreneurship education improves employability and the ability to create innovation and social impact in various sectors by providing learners with adaptive skills (Jan, 2024).

In higher education institutions, entrepreneurship education shapes students' perspectives and fosters a culture of initiative, innovation, and value creation. Various universities and colleges integrate entrepreneurship into curricula through mentorship programs, entrepreneurial ecosystems, and hands-on learning experiences (Jose & Kushwaha, 2024). This pedagogical shift helps students build confidence, self-efficacy, and envision and execute entrepreneurial opportunities. It encourages learners to see themselves as job creators and problem-solvers, broadening career outlooks and strengthening national innovation systems (Okolie et al., 2020). Employee education also develops interpersonal and leadership skills, including communication, negotiation, and teamwork, essential for success in modern, interconnected economies. The Human Capital Theory provides a strong foundation for understanding the role of entrepreneurial skills in human capital development, positing that education and skill acquisition are investments that enhance individual productivity, employability, and economic value (Bambi & Pea-Assounga, 2025). Based on the review above, the following hypothesis is proposed:

Ho₂ Entrepreneurial skills and mindset has no significant impact on the human capital development among students of tertiary institutions

Business and financial literacy and human capital development

Business and financial literacy (BFL) is a core competency in technopreneurship education, providing students with the information and skills needed to manage the financial and operational challenges of new companies. BFL, which covers topics such as business models, budgeting, cost management, and investment methods, helps students to progress from idea development to the creation of viable businesses (Imjai et al., 2025). Graduates who understand how to successfully organise, manage, and sustain resources are better equipped to lessen dependency on external funding and develop self-sufficiency in their entrepreneurial endeavours. This assures that technopreneurship education not only produces creative thinkers, but also financially capable decision-makers who can prosper in competitive contexts (Boldureanu et al., 2020). When incorporated into tertiary education, BFL fosters the development of well-rounded graduates who can interpret financial data, assess risks, and respond strategically to shifting market conditions. It prepares students to plan effectively, allocate resources wisely, and comply with regulatory and business demands, thereby enhancing their adaptability in dynamic economies (Pricopoaia et al., 2024). These competencies also mitigate the risks of financial mismanagement while cultivating resilience, innovation

and long-term growth. Furthermore, when paired with transferable skills like communication, leadership, and strategic thinking, BFL nurtures professionals who are versatile, confident and capable of making meaningful contributions across diverse sectors.

The Human Capital Theory provides a strong lens for understanding the link between BFL and broader human capital development. As an investment in education and skills, BFL directly boosts individual productivity, employability, and long-term economic value (Nwachukwu, 2024). Research highlights that financial literacy positively shapes students' attitudes, behaviours, and decision-making (Loza et al., 2023), positioning it as a key driver of professional and societal advancement. By embedding BFL into tertiary education, institutions contribute to inclusive growth, enabling students from diverse backgrounds to become self-reliant, innovative, and financially competent citizens (Nandini & Latif, 2024). This makes BFL not only essential for personal success but also for achieving broader national development objectives. The study therefore presents the hypothesis below:

Ho3 Business and financial literacy has no significant impact on the human capital development among students of tertiary institutions

Innovation and creativity and human capital development

Innovation and creativity (IC) are essential for preparing a future-ready workforce, especially in tertiary education where technopreneurship is emphasised. Innovation involves the application of new ideas, products, and services to create value, while creativity provides the imaginative foundation for this process (Javed, 2025). Within higher education, these competencies extend beyond product development to include rethinking business models, redesigning customer engagement, and reshaping organisational practices (Mulyany et al., 2023; Silas et al., 2024). Pedagogical strategies such as design thinking, interdisciplinary projects, and real-life simulations are increasingly adopted to cultivate these skills. By fostering IC, universities help shape students into value creators who can challenge conventional approaches and drive meaningful change in diverse industries (Rosyidah et al., 2024).

The cultivation of IC also strengthens broader human capital development in the context of rapidly evolving knowledge economies. As technological disruptions continue to reshape societies, graduates require the ability to think divergently, solve complex problems, and adapt to new challenges (Hamed et al., 2024). Universities serve as hubs of innovation by providing access to research platforms, collaborative environments, and mentorship that guide students through iterative problem-solving processes (Kayyali, 2023). This exposure transforms learners into proactive, lifelong innovators. Beyond individual benefits, IC enhances societal progress by supporting start-ups, generating employment, and fostering solutions to global challenges, thereby positioning graduates as key contributors to sustainable development (Reimers, 2024). The Resource-Based View (RBV) Theory provides a strong conceptual framework to explain the role of IC in human capital development. RBV underscores that competitive advantage stems from internal resources, particularly knowledge and innovative capacity. Innovation functions as a bridge between human capital and organisational performance, demonstrating how creativity translates into economic and social value (Rosyidah et al., 2024). Human capital comprising creativity, knowledge, and skills therefore becomes a critical driver of national competitiveness in a digital economy (Reimers, 2024). By embedding IC in education, tertiary institutions cultivate a workforce capable of sustaining innovation, adaptability, and leadership in dynamic environments. From this review, the fourth hypothesis is formulated as follows;

Ho4 Innovation and creativity has no significant impact on the human capital development among students of tertiary institutions.

Moderating Role of Entrepreneurial mindset

Technopreneurship education is pivotal for human capital development in higher education, imparting essential entrepreneurial skills (Kwapisz et al., 2024). The success of this education is often contingent upon EMS, indicating one's confidence in performing entrepreneurial tasks (Maitlo et al., 2020). Studies demonstrate that individuals with elevated EMS are more adept at translating technopreneurship training into entrepreneurial actions, thereby fostering employment and national progress (Ghouse et al., 2024). EMS plays a crucial moderating role in the variability of student responses to technopreneurship training. Students with low self-efficacy may exhibit disengagement or suboptimal performance, in contrast to those with high EMS who engage more effectively (Kehinde, 2023). Research

indicates that EMS significantly enhances the correlation between entrepreneurial learning and technopreneurial intentions, particularly within ICT education (Putri & Budiman, 2024). Additionally, Abbasi et al. (2024) found that EMS fortifies the relationship between entrepreneurial competencies and intentions in academia, thus serving as a critical facilitator for transforming knowledge into innovation and tangible entrepreneurial results.

EMS's function can be elucidated through Bandura's Social Cognitive Theory, which posits mindset as a fundamental influence on cognition, motivation, and behaviour (Bandura, 1999). Within this framework, EMS connects entrepreneurship education to entrepreneurial intention, influencing how students internalise and apply their learning (Kwapisz et al., 2024). Utilising this theoretical perspective, educators can develop technopreneurship curricula that consider psychological preparedness, thereby empowering students to translate acquired knowledge into viable entrepreneurial enterprises and enduring human capital enhancement. Based on this theoretical and empirical grounding, the following hypothesis is formulated:

Ho5 Entrepreneurial mindset does not significantly moderate the impact of Technopreneurship on the human capital development among students of tertiary institutions.

3 Methodology

The research adopted a quantitative research design. It was conducted as an empirical study that examines the moderating effect of entrepreneurial mindset on the relationship between technopreneurship education and human capital development among students of tertiary institutions in Niger State. The study's target population comprised 9,135 respondents. Using Slovin's formula, a sample size of 384 was initially determined from the population. However, to cater for non-response bias, a 30% (116 respondents) addition was made, resulting in a final sample size of 500 respondents. The 30% increase was added to the sample size, as recommended by Wright (2015), to address potential non-response bias and ensure sufficient valid responses for reliable and generalisable study results. The respondents were purposively selected from six tertiary institutions in Niger State, representing diverse educational environments: one federal university, one state university, one private university, one polytechnic, one college of education, and one institute.

Structured survey questionnaire, adapted from Abbasi et al. (2024), Ndace et al. (2025) and Omoniyi et al. (2025), was used to collect data from students in the selected institutions. Data was collected on respondents' demographics as well as the study's three variables (entrepreneurial education, human capital development and entrepreneurial mindset), with 26 Statement items. The questionnaire includes both closed-ended and Likert-scale questions (1 = Strongly Disagree to 5 = Strongly Agree), allowing for quantifiable data on students' perceptions and experiences. The instrument was pre-tested for reliability as well as face and content validity through a pilot study involving 50 students drawn from a similar population. The pilot study results revealed that all variables tested met the Cronbach's alpha threshold of ≥ 0.70 (BFL 0.801; ES 0.901; HCD 0.760; IC 0.803; TC 0.788; EMS 0.847), indicating that the instrument was valid and suitable for the study. To ensure a robust and representative sample, the sample size was calculated using a 95% confidence level and a 5% margin of error. Data collected were analysed using Partial Least Squares Structural Equation Modelling (PLS SEM). This advanced statistical tool enabled the researcher to examine the relationships between the dimensions of technopreneurship and human capital development.

4 Results

4.1 Measurement Model Assessment

Standard reflective indicators, including Cronbach's alpha, composite reliability (CR), average variance extracted (AVE), and indicator loadings, were used to assess the measurement model and establish its validity and reliability (see Figure 2). The findings showed that every construct either satisfied or exceeded the accepted criteria for convergent validity and internal consistency.

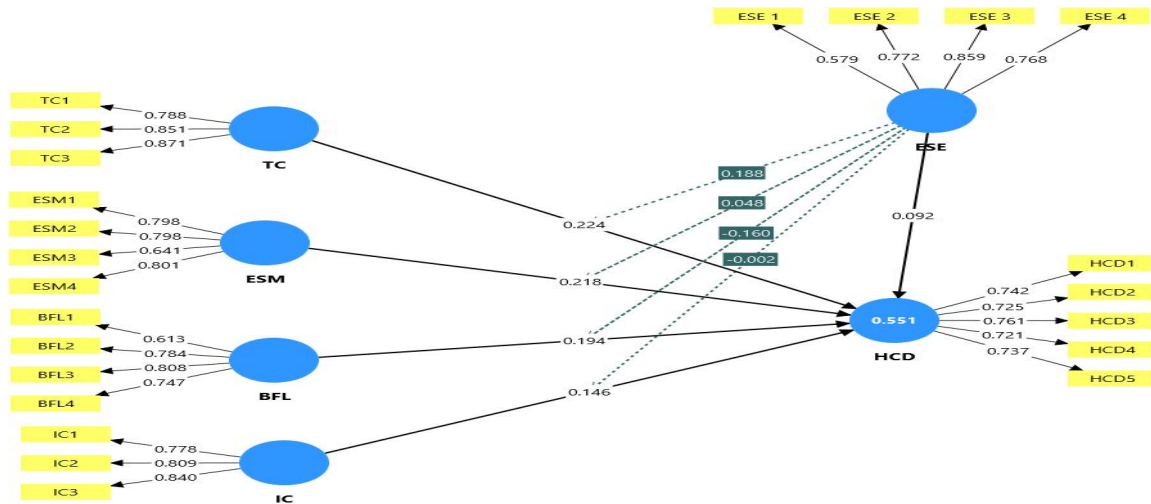


Figure 2 Indicator Loading

With the exception of EMS1, which had a loading of 0.579 and was kept because of its contribution to the model, all indicator loadings were higher than the threshold tolerable value of 0.6 (Nikraftar et al., 2022). The range of the indicator loadings is 0.579 to 0.871. This implies that there was a strong correlation between each indicator and its corresponding construct.

Table 1 Internal Consistency Table for the Constructs

Variables	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
BFL	0.727	0.747	0.829	0.550
EMS	0.745	0.783	0.836	0.565
ES	0.759	0.775	0.846	0.581
HCD	0.790	0.791	0.856	0.544
IC	0.737	0.740	0.851	0.655
TC	0.788	0.803	0.876	0.701

Source Researcher’s SEM PLS Output, 2025

All the latent variables' Cronbach's alpha values in Table 1 were above the acceptable threshold of 0.7 suggesting adequate internal consistency. Additionally, each construct's composite reliability values (ranging from 0.740 to 0.803) were significantly above 0.7, which is thought to be a more accurate indicator of reliability in PLS-SEM (Hu et al., 2017). The average variance index was used to evaluate the divergent validity. Accordingly, the variance between one construct and the other ought to be lower than the AVE (Haji-Othman and Yusuff, 2022). In other words, the correlation between one variable and the others in the model had a larger square root of the mean of the absolute extracted variance. These results validate the adequacy of the measurement model and support the structural model assessment.

4.2 Structural Model Results

The structural model aimed to test the relationships between TC, IC, ESM and BFL on HCD, both directly and through the moderating influence of EMS. Figure 2 and Table 2 summarise the path coefficients, t-statistics, and p-values.

Table 2 Path Coefficient

Variables	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (O/STDEV)	P values
BFL -> HCD	0.194	0.194	0.061	3.165	0.002
EMS -> HCD	0.092	0.096	0.048	1.923	0.054
EMS x BFL -> HCD	-0.160	-0.159	0.058	2.750	0.006
EMS x ES -> HCD	0.048	0.048	0.058	0.831	0.406
EMS x IC -> HCD	-0.002	0.002	0.053	0.042	0.966
EMS x TC -> HCD	0.188	0.190	0.049	3.801	0.000
ES -> HCD	0.218	0.216	0.063	3.437	0.001
IC -> HCD	0.146	0.150	0.051	2.866	0.004
TC -> HCD	0.224	0.221	0.055	4.054	0.000

Source Researcher's SEM PLS Output, 2025

With the measurement model's strong reliability and validity, the structural model yielded significant results. Most of the path coefficients for direct effects were statistically significant, as reflected in their high t-values and p-values lower than 0.05. The R^2 value for HCD is 0.551, indicating that only 55.1% of the variance in HCD is explained by the independent variables, a relatively moderate explanatory power.

5 Discussion of Findings

The research result indicates that Business and Financial Literacy (BFL) has a positive and statistically significant impact on Human Capacity Development (HCD), with a standardised coefficient (β) of 0.194 and a p-value of 0.002. This means that an increase in BFL is associated with a moderate increase in HCD, and the relationship is unlikely to have occurred by chance. In practical terms, individuals or communities with higher business and financial literacy are more likely to develop essential skills, knowledge, and competencies that enhance their overall capacity and productivity. This finding supports the importance of promoting financial and business education as a means of strengthening human development outcomes. This aligns with the study of Jumady et al. (2024), which found that financial literacy education significantly improves a composite financial-health score through increased confidence, better debt management, and stronger decision-making.

The research finding shows that Entrepreneurial mindset (EMS) has a positive but weak influence on HCD among students of tertiary institutions in Niger State, with a standardised coefficient (β) of 0.092. However, the p-value of 0.054 indicates that this relationship is not statistically significant at 0.05 level. This suggests that while there is a slight positive trend implying that students who are more confident in their entrepreneurial abilities may experience better capacity development, the evidence is not strong enough to conclusively support this effect. Therefore, EMS alone may not be a reliable predictor of HCD in this context, and other factors might play a more substantial role. This result is consistent with previous studies by Bambi and Pea-Assounga (2025) and Ndace et al. (2025), who reported that entrepreneurial self-efficacy has a positive but weak influence on human capacity development among students of tertiary institutions. In contrast, Putri and Budiman (2024) found that entrepreneurial self-efficacy significantly and positively predicts entrepreneurial intention among Nigerian university students, suggesting a stronger and statistically significant role for EMS. This suggests that, unlike in the current study, the effect of EMS on HCD in these studies was weak and marginally non-significant.

The result further reveals that Entrepreneurial Skills (ES) has a positive and statistically significant effect on HCD, with a standardised coefficient (β) of 0.218 and a p-value of 0.001. This means that an increase in ES is associated with a moderate increase in HCD, and the relationship is highly significant, showing strong evidence that the effect is not due to chance. In practical terms, this suggests that students who possess strong entrepreneurial skills and a growth-oriented mindset are more likely to enhance their knowledge, abilities, and overall capacity to contribute

meaningfully to society or the economy. This finding agrees with the previous studies of Ndace et al. (2025) and Aboobaker (2020), who reported that students who possess strong entrepreneurial skills and a growth-oriented mindset are more likely to enhance their knowledge, abilities, and overall capacity to contribute meaningfully to society or the economy. Therefore, fostering entrepreneurial thinking and skills can be an effective strategy for advancing human capacity development, particularly among students in tertiary institutions. Supportive studies by Jiatong et al. (2021) and Ndace and Tsado (2021) found that an entrepreneurial mindset positively and significantly influences entrepreneurial intention among university students. This aligns with the finding of this current study that ES strongly predicts HCD.

Additionally, the result confirms that Innovation and Creativity (IC) has a positive and statistically significant impact on HCD, with a standardised coefficient (β) of 0.146 and a p-value of 0.004. This indicates that higher levels of innovation and creative thinking are moderately associated with increased development of human capacity, and the relationship is unlikely to have occurred by chance. In practical terms, this means that fostering innovation and creativity among individuals, particularly students, can contribute meaningfully to building their skills, adaptability, and overall potential. The finding underscores the importance of encouraging creative problem-solving and innovative thinking as part of efforts to enhance human capacity development. This result aligns with the studies of Jan et al. (2024) and Omoniyi et al. (2025), which emphasise that integrating creativity and innovation into educational curricula cultivates essential skills and competencies in learners, reinforcing the finding of this study that IC positively and significantly enhances HCD.

Ultimately, the research finding indicates that Technological Competence (TC) has a positive and highly significant effect on Human Capacity Development (HCD), with a standardised coefficient (β) of 0.224 and a p-value of 0.000. This suggests that as individuals, particularly students, improve their technological skills and ability to use digital tools effectively, their overall human capacity such as problem-solving, productivity, and adaptability also increases. The strength and significance of this relationship highlight the crucial role of technological competence in developing the knowledge, skills, and capabilities needed to thrive in today's innovation-driven and digital world. This is in support of the results of Passaro et al. (2018) and Song et al., (2025) who also demonstrated that undergraduate students' digital competence including problem solving, content creation, and collaboration had a significant positive impact on academic achievement, reinforcing the finding of this current study that TC strongly promotes HCD.

5.1 Moderating Effects

Out of the four interaction terms, only EMS x TC \rightarrow HCD and EMS x BFL \rightarrow HCD showed statistically significant moderation effects with P-value of 0.00 and 0.006 respectively. Specifically, the result indicates that EMS significantly weakens the positive effect of TC on HCD, suggesting that higher EMS reduces the reliance on TC for enhancing HCD among students. Previous studies by Ndace and Tsado (2021); Mutohari et al. (2023); Ogwuche, (2024) and Guzmán-Coutiño et al. (2024) reported that technological competencies significantly moderated the impact of entrepreneurial personality on entrepreneurial intention suggesting that the strength of technology-based skills can alter how personal traits influence outcomes. Conversely, the result shows that EMS significantly and negatively moderates the relationship between BFL and HCD, meaning higher EMS reduces BFL's positive impact on HCD among students. This aligns with the results of Asdar and Hasbiah (2024), who found that EMS did not strengthen the influence of financial literacy on entrepreneurial behaviour among students. In fact, it failed to enhance the relationship.

6 Conclusion and Recommendations

This study explored how entrepreneurial mindset moderates the effect of technopreneurship education on human capital development. It concluded that technopreneurship education components, such as Business and Financial Literacy (BFL), Entrepreneurial Skills (ES), Innovation and Creativity (IC), and Technological Competence (TC), significantly contribute to Human Capacity Development (HCD) among students of tertiary institutions in Niger State. However, entrepreneurial mindset (EMS), while slightly positive, was not a strong direct predictor of HCD. More importantly, EMS exhibited a negative moderating effect on the relationships of both TC and BFL with HCD, indicating that higher EMS may reduce students' dependence on these competencies for capacity development. These findings highlight the complex role of self-belief in entrepreneurial contexts.

Based on the results, it is recommended that technopreneurship education programmes balance the development of entrepreneurial confidence with the reinforcement of practical competencies essential for human capital growth. Institutions should integrate experiential learning methods that develop both technical skills and realistic entrepreneurial mindset. Educators and policymakers should also consider designing targeted interventions that support students with high EMS to apply their confidence constructively alongside technological and financial competencies, ensuring a well-rounded approach to capacity development.

Social and Practical Implications of the Study

The findings of this study hold significant social and practical value for policymakers, educators, and society at large. The demonstrated influence of technopreneurship education specifically in the areas of Business and Financial Literacy (BFL), Entrepreneurial Skills (ES), Innovation and Creativity (IC), and Technological Competence (TC) on Human Capital Development (HCD) underscores the critical role of higher education institutions in equipping students with the capabilities needed to thrive in an innovation-driven economy.

Practically, these results suggest that tertiary institutions in Niger state and beyond should prioritise entrepreneurial curriculum reforms that blend traditional academic learning with experiential, technology-based, and problem-solving activities. By embedding entrepreneurial mindset (EMS) training into technopreneurship programs, universities can nurture students' self-efficacy, resilience, and creativity qualities essential for self-employment, innovation, and job creation. From a social standpoint, the research offers a pathway to reducing graduate unemployment by shifting students from job seekers to job creators. This transformation can strengthen local economies, reduce poverty, and enhance societal productivity. Moreover, mentorship programs and policy initiatives that integrate both skill-building and mindset development could lead to a more empowered youth population, fostering sustainable community development and technological advancement in the region.

Implications for Theory Development in Entrepreneurship

This study contributes meaningfully to entrepreneurship theory, particularly in the area of human capital and entrepreneurial mindset development. It extends existing theoretical frameworks such as the Human Capital Theory (Becker, 1993) and Entrepreneurial Event Theory (Shapero & Sokol, 1982) by empirically validating how technopreneurship education dimensions interact with entrepreneurial mindset to enhance students' human capital outcomes.

The moderating role of EMS highlights that mindset is not merely a personal trait but a contextual enhancer amplifying the impact of educational inputs like technological competence and financial literacy on HCD. This underscores the need to integrate psychological and cognitive factors into models of entrepreneurial learning and capability development. In theoretical terms, the study suggests that entrepreneurial mindset functions as a dynamic moderator within the relationship between education and entrepreneurial outcomes. Future models of entrepreneurship education theory should, therefore, recognise mindset as a core construct linking technological education, innovation capacity, and human capital formation, particularly within developing economies.

Limitations and Suggestions for Further Studies

While the study provides valuable insights, several limitations warrant consideration. First, employing a quantitative cross-sectional design constrains the ability to infer causal relationships among the variables. Longitudinal studies could better capture how technopreneurship education and entrepreneurial mindset evolve over time and their sustained impact on HCD. Second, the research was limited to students in tertiary institutions within Niger State, which may constrain the generalisability of the findings to other regions or educational contexts. Future studies could employ comparative or multi-state analyses to explore contextual variations across different socio-economic and institutional environments.

Third, the study relied on self-reported data, which can introduce response bias. Incorporating mixed-method approaches including interviews, focus groups, and observational data would provide deeper insights into students' attitudes, behavioural changes, and real-world entrepreneurial engagement. Lastly, future research should explore additional moderating or mediating variables, such as institutional support, access to technology infrastructure,

gender dynamics, and cultural orientation, to gain a more comprehensive understanding of how technopreneurship education translates into tangible human capital and economic outcomes.

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Data Availability Statement

The datasets generated and analysed during the current study are available from the corresponding author upon reasonable request.

Conflict Of Interest

The authors declare that there are no actual or potential conflicts of interest associated with this study.

Declaration Of Generative Ai Use

Generative artificial intelligence tools were utilised exclusively for linguistic refinement, including grammar, clarity, and formatting. No AI tools were employed in the research design, data collection, data analysis, interpretation of results, or in the formulation of conclusions. The authors retain full responsibility for the accuracy, originality, and integrity of the content of this manuscript.

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