



BRIDGING THE GAP: EXAMINING THE ROLE OF FUNDING ADEQUACY IN STEM PROGRAMME COMPLETION IN UGANDAN PUBLIC UNIVERSITIES

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Abstract:

The persistent under-enrolment of science, technology, engineering, and mathematics (STEM) graduates continues to impede Uganda's socio-economic development and technological advancement. Despite increased access to the university through programmes like the Higher Education Students Financing Board (HESFB), it is difficult not to wonder whether funding such programmes is sufficient to guarantee timely completion in STEM-based programmes. The study examined the effects of adequate loan financing on programme completion among undergraduate students studying

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STEM programmes in universities in Uganda. Based on surveys of 430 students and interviews with 12 staff members from four public universities, this research presents the views of students and staff on loan sufficiency, the impact of loans on academic performance, and significant financial issues. It is exposed that although 61.1% of the participants used loans, only 29% agreed that tuition fees and other education expenses were adequately funded ($M = 3.13$, $SD = 0.79$), whereas 78.9% did not believe that the loans were enough to meet non-academic costs such as accommodation and food ($M = 2.29$, $SD = 0.88$). In addition, only 45.2% of the students perceived that the loans had facilitated finance for unforeseen financial emergencies ($M = 2.87$, $SD = 0.74$). Regional cost differences supported inadequacy perceptions ($M = 3.01$, $SD = 0.71$). Linear regression analysis also identified programme completion as the most significant predictor, with funding adequacy ($\beta = 0.32$, $p < .001$), accounting for 36% of the variance (Adjusted $R^2 = 0.360$). These findings add pressure to policy revision that would increase loan amounts, improve flexibility, and address imbalances in location. This research contributes to the educational equity policy discourse and demonstrates how insufficient funding continues to hinder Uganda's efforts to build STEM capacity.

Keywords: students' loans, adequacy, STEM, completion, higher Education

1. Introduction

When a student from a rural district in Uganda gains admission to a public university to study engineering or computer science, it is not only a personal triumph but also a glimmer of hope for the community. Yet, the majority of such students are unable to pursue further studies, not due to a lack of talent, but because they eventually run out of money and must leave. This scenario is typical of a growing issue in Uganda as a whole: even with enhanced access to the tertiary level through government programmes like the Higher Education Students Financing Board (HESFB), actual graduation from Science, Technology, Engineering, and Mathematics (STEM) courses is always very low (Ministry of Education and Sports [MoES], 2021; UNESCO, 2022).

This persistent gap between access and graduation remains a significant threat to Uganda's vision of socio-economic transformation, as outlined in the National Development Plan III and Vision 2040 (National Planning Authority, 2020). These STEM programmes are expensive, with high investment in laboratory equipment, fieldwork, and technical infrastructure costs that exceed the tuition fees alone (World Bank, 2021; African Development Bank, 2023). Although the HESFB, launched in 2014, is intended to alleviate financial pressures, there is evidence that its coverage, timeliness, and adequacy are suboptimal for the special needs of STEM students (Sserubidde & Onen, 2025).

Several scholars have examined the barriers to higher education achievement in low-income contexts. Literature produced by UNESCO (2022) and the African Development Bank (2023) has indicated that STEM students experience imbalanced dropout rates due to insufficient funding. There is a considerable research gap in the link

between provision sufficiency, i.e., the quantity, timing, and predictability of provision, and completion rates in programmes, particularly in Uganda. Few existing studies have focused on enrollment rates or generic financial aid models, and there is a knowledge deficit regarding the actual effects of such interventions on STEM-specific pathways.

If these funding concerns are not addressed, Uganda risks graduating generations of half-trained scientists, engineers, and technologists, which would lock up innovation and undermine national aspirations in health, agriculture, and digitalisation. As the world economy becomes increasingly technology-driven, national competitiveness and success will increasingly depend not just on enrolling but also on graduating science, technology, engineering, and math talent. There is, therefore, an urgent need to understand how financial mechanisms need to shift to support both access and academic persistence.

This study examined the extent to which funding adequacy influences undergraduate STEM programme graduation rates in public universities in Uganda. Focusing on student attitudes, experiences, and organisational facts, the study intended to contribute implementable recommendations for fair and target-specific financing programmes. Specifically, this study was driven by the following research questions:

- 1) How sufficient do STEM students perceive the funding they receive?
- 2) How does the adequacy of funds influence completion rates in Ugandan public universities' STEM programmes?
- 3) What are the specific finance-related challenges faced by STEM students that influence their programme completion?
- 4) What are the potential interventions for improving funding adequacy and programme completion in STEM programmes?

2. Literature Review

2.1 Adequacy of Funding for STEM Students at Public Universities

Adequate funding remains a cornerstone in supporting access, retention, and completion of STEM classes at universities. Globally, research from programmes such as the NIH-funded BUILD programme in the United States reveals that full funding of tuition, stipends, and research supplies has a strong positive effect on persistence and STEM student identity formation (Arruda *et al.*, 2025). Thus, Van Antwerpen and Van Schalkwyk (2024) suggest that at varying income levels, ineffectively executed funding models can worsen experiential learning, which is required for performance in STEM. All of these studies indicate that not only the presence but also the nature and adequacy of the funding influence educational progress in the field of STEM.

Despite such evidence, much of the global literature overlooks the specific low-income contexts where systemic bottlenecks exacerbate the impact of underfunding. In Uganda, for example, the continuous underfunding of public universities limits the recruitment of qualified academics, the procurement of laboratory equipment, and the maintenance of infrastructure required for STEM learning (Sserubidde & Onen, 2025).

Furthermore, the Science Granting Councils Initiative Africa (2024) further emphasises that regional variations in the distribution of funds result in uneven learning environments, which are particularly problematic for socio-economically disadvantaged and rural students. The variations further emphasise the hardship that STEM students face in financing programme-related expenses, such as laboratory fees, materials, and field trip fees.

Furthermore, there are drastic methodological deficits in the literature. While meta-analyses, such as those by Nguyen *et al.* (2019), provide aggregated estimates on support and persistence among students, they rarely decompose STEM-specific findings or investigate long-term outcomes. Few have employed strong causal inference methods, such as regression discontinuity designs or longitudinal models, to assess the effect of support levels on STEM completion, especially in Sub-Saharan Africa. This study aims to overcome these limitations by integrating regression-based quantitative analysis and qualitative interviews to conduct a student-level, context-specific investigation of financial sufficiency in Ugandan public universities. Identity, belonging, and resilience focus will also define the institutional and regional borders that surround STEM student success.

2.2 Adequacy of Financing and Stem Programme Completion Rate Relationship

The relationship between programme completion and adequate funding has been widely reported across various settings. Židonė (2025) established that the connection between public finance and institutional priority goals, such as infrastructure and growth of student support services, has significantly improved Lithuanian university graduation rates. In a related study, Kelchen *et al.* (2024) reported that U.S. states that implemented performance-based funding based on student completion rates experienced enhanced retention and graduation, particularly when combined with institutional strategic planning. Despite these studies' affirmation of the salience of funding alignment, their reliance on aggregated institutional data limits inference regarding outcomes for individual STEM students.

There have been few studies in the Ugandan context that have explored systematically the impact of funding adequacy on undergraduate completion rates. Deboru and Etomaru (2024), mentioning but a few, unearthed tight funding limitations in Makerere University's postgraduate STEM programmes and cited late and incommensurate financial assistance as one of the causative factors for protracted study periods and non-completion. But their focus on postgraduates overlooks the broader and more diverse universe of undergraduate STEM students, in which completion problems are likely to be proportionately more acute. Additionally, the bulk of existing research does not examine how demographic factors, such as socio-economic status, gender, and rural and urban location, condition the variation and impacts of funding adequacy.

These empirical and methodological shortcomings can be overcome by using disaggregated data and multilevel analysis. This study will employ a combination of regression analysis and student interviews to investigate the impact of financing

adequacy on individual academic achievement. By placing analysis in local and institutional contexts, it will enable finer-grained observations of the degree to which financing terms may facilitate or restrict STEM graduation. The purpose is to provide practical recommendations to Ugandan education policymakers, funding agencies, and university administrators who aim to improve STEM completion levels and other national development objectives.

2.3 Financial Issues Facing STEM Students Concerning Programme Progress and Graduation

Financial issues remain the most prevalent issues affecting the academic progress of STEM students. Shortlidge *et al.* (2024) applied a propensity score-matched analysis of over 120,000 U.S. undergraduates to show that participation in compensated undergraduate research experiences significantly enhanced four-year graduation, especially for students from underrepresented groups. These findings demonstrate the impact of targeted funding interventions on pupil progress. However, the observational data in these studies limit the validity of causal inference. Similarly, Bennett *et al.* (2023) investigated the impact of COVID-19 fiscal stress on STEM students in the U.K. They concluded that pressures to achieve academically and reduced motivation levels were contributing factors to the reduced progress rates, but did not fully account for the longer-term institutional mediators.

Sub-Saharan Africa, and Uganda in general, suffers from persistent and pervasive economic distress. Nasr *et al.* (2024) set the standard, finding that 74% of the STEM students they interviewed at Lebanese universities experienced significant financial distress, which compromised their sleep quality, emotional stability, and academic concentration. These results are consistent with anecdotal and limited empirical accounts from Uganda. However, there is relatively limited work on the impacts of long-term financial constraints, apart from pandemics and crises, on the movement and completion of programmes in STEM areas. Additionally, short-term critical problems, such as laboratory fees, specialist reagents, travel to fieldwork locations, and housing, are not covered in existing research.

This study aims to fill this gap by employing causal methods, such as regression analysis, in the investigation of the direct effects of financial stress on academic disengagement among STEM undergraduate students. It will also draw on qualitative data to investigate students' daily lived experiences of economic stress, with a special focus on resilience factors and institutional changes. In the process, it aims to provide a comprehensive picture of the challenges that STEM students face and how targeted bursaries help prevent dropouts and increase completion rates in resource-constrained settings, such as Uganda.

2.4 Strategies That Maximise Funding Impact towards Improving STEM Completion Rates

Targeted funding assistance has played a crucial role in motivating persistence in STEM fields and graduation, particularly when accompanied by psychosocial support. Shortlidge *et al.* (2024) demonstrated that STEM Intervention Programmes (SIPs), which combine tuition support with community development, mentoring, and identity formation, effectively facilitate science identity, student motivation, and student retention rates. Similarly, Learning Assistant programmes embedded in high-attrition STEM gateway courses—funded by subsidising peer teachers—yielded a 9% increase in university-wide graduation rates and a 21% boost in underrepresented minority students at U.S. universities (National Academies of Sciences, Engineering, and Medicine, 2025).

Public-private partnerships are also a promising solution to improved funding effectiveness. The National Academies of Sciences, Engineering, and Medicine (2025) noted that industry and nongovernmental organisation collaborations offer complementary finance, mentorship, and professional development programmes—constitutive components of pan-stem education. Besides lowering the cost burden, they increase employment opportunities. These initiatives, however, are context-specific and have not been extensively pilot-tested for long-term scalability in impoverished public university systems, particularly in Sub-Saharan Africa.

To address these knowledge gaps, this study will examine the types of funding that are most effective in Uganda, taking into account demographic, geographic, and institutional differences. By applying both qualitative and quantitative methods simultaneously, this study will investigate how funding sources impact STEM graduation rates among student cohorts. By generating evidence that is both contextually nuanced and methodologically rigorous, the research aims to contribute to sustainable and replicable funding models that can be applied by other middle- and low-income countries in their efforts to enhance STEM outcomes.

3. Methodology

3.1 Research Design

Research employed a convergent parallel mixed methods design that combined quantitative and qualitative approaches to provide a rich interpretation of the funding adequacy effect on the success of STEM programmes in Ugandan public universities. The design enabled the researcher to collect and analyse quantitative and qualitative data separately, but to combine them at the point of interpretation to provide richer, corroborated findings (Creswell & Plano Clark, 2018). The motivation behind using curriculum mapping is to provide space for identifying measurable patterns and lived experiences, allowing for a better-informed understanding of the complex interrelationships between school funding and programme completion.

3.2 Study Population and Sampling

The research population consisted of undergraduate students pursuing STEM courses in four Ugandan public universities, who were enrolled under the Higher Education Students Financing Board (HESFB) loan programme, as well as other relevant university stakeholders responsible for academic management and student funding.

Stratified random sampling was employed in the selection of student respondents for the quantitative strand to achieve proportionality in representation by faculty, year of study, gender, and region. For the qualitative component, purposive sampling was employed to select key informants. These include bursars, deans, academic registrars, HESFB officials, and student leaders. They were chosen based on their experience and in-depth knowledge of institutional funding issues, loan disbursements, and student support systems.

3.3 Data Collection Methods and Instruments

Quantitative data were collected through a standardised survey questionnaire, distributed from October 2024 to March 2025, among STEM students. An effort towards inclusivity, especially for students with limited or no internet access, was made using a mixed-mode design (online and on-paper). The survey captured primary fields like perceived sufficiency of funding, unfunded budgetary needs, academic achievement, and graduation progress.

Qualitative data were gathered through focus group discussions (FGDs) among students and key informant interviews (KIIs) with university administrators, student leaders, and government officials at HESFB. In-depth probing through a semi-structured interview guide was informed by challenges such as the disbursement of funds procedures, perceived policy loopholes, and institutional reactions to financial difficulties. Interviews and FGDs were audio-recorded following participants' consent and transcribed for analysis.

3.4 Data Analysis

The quantitative data were coded and processed using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics, including percentages, frequencies, and means, were used to summarise the students' responses, and inferential statistical analyses, such as regression and correlation analysis, were used to determine the direction and strength of the relationship between funding adequacy and completion of the STEM programme.

Data from qualitative interviews and focus groups were coded thematically using a content thematic analysis approach. Hand coding of transcripts was employed to initiate the process of generating emergent themes related to issues of funding inadequacy, barriers to programme completion, institutional practices, and coping strategies of students. Qualitative and quantitative data were integrated at the level of interpretation, allowing the research to present a triangulated whole regarding the influence of financial assistance on persistence among STEM students.

3.5 Validity and Reliability

To pilot-test the instruments, the interview guide and questionnaire were reviewed by university administration and education financing experts. Pilot testing of 30 recipients of HESFB loan programmes was also conducted to inspect question wordings, question structure, and question clarity. Quantitative instrument reliability was confirmed by using Cronbach's alpha with an acceptable cut at $\alpha \geq 0.7$ for internal consistency.

For the qualitative strand, trust was established through the following strategies: prolonged engagement, member checking, and peer debriefing. Transcripts were recorded verbatim, and all coding decisions were documented in an audit trail to ensure maximum dependability and verify the findings.

4. Results

The chapter presents the data analysis and interpretation on how funding adequacy influences the success of STEM programmes at Ugandan public universities. The results are presented in response to the four research guiding questions and draw on both quantitative and qualitative data to provide a comprehensive understanding of the effectiveness of student loans. Specifically, information was gathered from STEM students who received the Higher Education Students Financing Board (HESFB) loan programme through a structured questionnaire. Five principal dimensions of loan performance were under attention: coverage, adequacy, sufficiency, flexibility, and overall programme completion impact. Results related to Research Question 1 are summarised in Table 1.

Research Question 1: How much do students in the field of STEM perceive that the funding they receive is adequate?

To this, students responded to survey items assessing their experience with the adequacy of the financial support received through the loan scheme. Specifically, the survey covered four primary areas: Adequacy of the loan support for tuition fees and study-related costs; Coverage of other living allowances such as accommodation, food, and transport; Capacity of the loan to cater for unexpected or emergency financial needs; and Adjustment for inter-regional variation in the cost of living across institutions.

Table 1: Adequacy of the Student Loan Scheme

Item	Valid N	SD	D	A	SA	M	SD
		freq. (%)	freq. (%)	freq. (%)	freq. (%)		
The loan covers tuition and related academic expenses such as textbooks, supplies, and technology, adequately	430	32.6%	38.4%	21.6%	7.4%	3.13	.79
Loans provide enough funds to cover additional expenses	421	34.7%	44.2%	17.3%	3.8%	2.29	.88
The students' loan is adequate and allows for solving unexpected financial challenges	427	22.2%	32.6%	31.6%	13.6%	2.87	.74
Adequate loans consider regional differences	423	19.6%	40.7%	30.7%	9.0%	3.01	.71

Source: Field Data.

The findings in Table 1 reveal significant gaps in the adequacy of Uganda's student loan scheme for students pursuing STEM fields. Regarding tuition and expenses, although a moderate degree of agreement is indicated by the mean rating ($M = 3.13$, $SD = 0.79$), 71% of the participants strongly disagreed or disagreed with the statement that the loan adequately covers tuition and academic-related fees. This finding suggests that the majority of students lack sufficient coverage of essential academic costs, which can impede their ability to persist and complete their courses. These findings underscore the reality that even minimal academic costs are not fully covered by the loan.

Regarding additional living expenses, the inadequacy of the loan in covering non-academic but essential living costs, such as housing, food, transportation, and medical expenses, is even more pronounced. As suggested, 78.9% of the participants disagreed or strongly disagreed that the loan was enough to cover such costs ($M = 2.29$, $SD = 0.88$). Such a glaring deficiency highlights a core issue: students frequently face financial struggles that can negatively impact their academic focus, well-being, and retention in STEM fields. Loans that only cover tuition without comprehensive expense coverage may ultimately contribute to higher dropout rates.

Concerning unexpected financial challenges, financial room to manoeuvre, especially in emergencies or unforeseen academic requirements, is essential in ensuring student persistence. However, over a third of the respondents (54.8%) stated that the student loan was insufficient to cover such exigencies ($M = 2.87$, $SD = 0.74$). Failure to manage emergencies, such as research project costs, laboratory materials, or family crises, puts additional burdens on students and may force them to suspend or abandon their studies. This finding underscores the need for a more adaptable and responsive loan structure.

Regarding regional cost considerations, an inquiry was made into whether the loan takes into account regional differences in cost of living. The average score in this instance was $M = 3.01$ ($SD = 0.71$), with 50.3% disagreeing or strongly disagreeing. This finding reflects an assumed lack of fairness in loan design, as a fixed loan amount disadvantages students in more costly urban areas or resource-intensive programs.

Failure to consider regional economic variance diminishes the principle of fairness of access to education.

Overall, the quantitative data suggest that most STEM students perceive the current student loan scheme as deficient in several areas, including tuition, living costs, emergency costs, and fairness at the regional level. The loan covers part, but not all, of the expenses associated with facilitating students to pursue and complete a STEM degree. These findings suggest the need to restructure the design, form, and delivery of student financial aid to promote higher retention and graduation rates in the STEM disciplines.

Qualitative data were collected through focus group discussions and in-depth interviews, which primarily focused on how funding adequacy affects the completion of STEM-based programmes in public universities in Uganda. The interviews were conducted among key informants, university staff, and student loan beneficiaries, whose views reflect shared concerns about the limited coverage and scope of the student loan scheme.

Most student participants reiterated that the loan amounts were not sufficient to finance their entire academic period. Although tuition and functional fees are covered, students repeatedly pointed out that other necessities, such as accommodation, meals, transportation, and study materials, remain unaddressed. One student noted:

".... No. What they are offering us is not enough. It only covers tuition. Because, as a student, there are some other things that you may need, and which are not part of tuition. So, we have rent, we have these activities that we are undertaking here, some feeding, but you find yourself. Yes, I am assured of tuition, but then my belly is also calling, and there are other things. Therefore, the loan amount is insufficient". [Focus Group Discussion at University B3, 2024]

Another student elaborated on the Ugandan loan programmes' shortcomings, contrasting them with Kenya's more comprehensive system:

"... The Ugandan scheme is not adequate. Better for some students. You know that it's covering disadvantaged students, but even if you pay tuition for them, there is still accommodation, and you find that some of them don't readily afford it. So, yes, you have cleared their tuition, but you haven't covered their accommodation, stipend, or other financial needs to empower them. Therefore, a student can easily become frustrated and choose to drop out of school because they lack sufficient funds to cover their tuition. So, if you look at it in comparison with the Kenyan scheme, the Kenyan scheme has all the needs to be taken care of. You apply for all your needs; it's not just for functional and tuition purposes. You can apply for a loan to purchase a laptop, which will be provided to you upon approval. You apply for a stipend, and they give it to you as long as you agree to repay it. Hey, don't restrict students. So, I see that limitation within the Ugandan scheme. If there were documents like the ones in Kenya, it would be very effective." [FGD, University B1, 2024]

These issues were reiterated in focus group discussions. One student explained;

"... We receive money based on tuition for our courses, but not money for accommodation, food, rent or laptops." [FGD, University B1, 2024]

Another added:

"... The Kenyan loan scheme caters to all students' needs, as compared to Uganda's, which is very limited." [FGD, University B1, 2024]

Students provided testimony about the dire consequences of lacking finances for necessities. One focus group discussant reported;

"... One student ran away because he could not afford food. The scheme does not provide allowances for food. Another student dropped out due to hunger." [FGD, University B1, 2024]

Another explained,

"... Without accommodation support, food, many students cannot afford to stay on campus." [FGD, University B1, 2024]

As the discussion continued, one of the third-year students pointed out that;

"... the inadequacy of the loan has long-term implications. The insufficiency of the loan amount not only adds to our financial burden but also raises questions about our ability to maintain our academic performance upon graduation. The students' loans are made to cover ancillary costs such as laptops, research materials, and even internship placement and stipend." [FGD, University B1, 2024]

Contrary to the students' concerns, some administrative staff members offered a different perception. An accounts officer had this to say,

"... funds are generally adequate for the purpose they are intended for, that is, tuition and functional fees. Delays or failure to request funds can be a problem, especially during graduation, when unpaid balances can delay the clearance process." [Key Informant, 2024]

A university administrator was also content with the loan coverage,

“... the loan in terms of functional fees and tuition fees is enough and adequate because each student’s functional fees and tuition fees are catered for in full, so there is no cause to worry about fees.” [Key Informant, 2025]

These understandings reflect a gap between institutional expectations and students’ actual experiences. While administrators perceive the loan as sufficient within its set parameters, students experience severe financial pressure due to unmet expenses that exceed the scheme’s parameters. This difference reflects one key structural issue: the scheme is tuition-centred and does not consider the broader cost of education, particularly for STEM students who will often require additional materials and resources to succeed.

The narratives assembled suggest that the current student loan framework, although helpful in covering tuition fees, is insufficient to meet overall student expenses. The mismatch between the cost of university attendance and the level of financial aid provided leads to adverse effects such as stress, poor academic performance, and, in some instances, dropout. Students all advocated for the expansion of the loan scheme to include living expenses, study equipment, and other ancillary charges, consistent with more inclusive models like Kenya’s. These findings demonstrate the urgent need for a broader and more responsive financing model to improve equitable access, persistence, and completion of STEM programmes.

Research Question 2: What relationship is there between financial adequacy and completion rate of Ugandan public universities’ STEM programmes?

To determine the impact of funding adequacy on the completion of STEM programmes, linear regression analysis was employed. For this, a basic linear regression model was used with funding adequacy as the independent variable and programme completion of STEM-based programmes as the dependent variable. The regression results are displayed in Table 2.

Table 2: Simple Linear Regression Model of STEM-Based Programme Completion Against Funding Adequacy

Model	Unstandardised Coefficients		Standardised Coefficients	T	P	Collinearity Statistics	
	B	SE	β			Tolerance	VIF
(Constant)	2.52	0.08		29.88	.000		
Adequacy	0.22	0.03	0.32	6.85	.000	1.00	1.00

Dependent Variable: Completion of STEM-Based Programme

Adjusted $R^2 = 0.360$; $F(1,428) = 242.10$, $p < .001$

Variance Inflation Factor (VIF) = 1.00; Breusch-Pagan test $p = .806$

The regression equation explained approximately 36.0% of the variation in completion rates (Adjusted $R^2 = .360$), which can be considered a measure of a significant and moderate association between funding adequacy and STEM programme completion. The

model was ($F(1, 428) = 242.10, p < .001$), and all diagnostic tests were used to confirm that the main assumptions—normality, linearity, and homoscedasticity—were met, ensuring the validity of using linear regression. The perceived funding adequacy coefficient ($B = 0.22, SE = 0.03$) was significant ($t = 6.85, p < .001$), indicating that a one-unit increase in perceived funding adequacy is associated with a 0.22-point rise in the probability of programme completion, when controlling for other variables. The beta coefficient ($\beta = 0.32$) also shows a moderate effect size.

These findings provide substantial evidence in support of the hypothesis that funding adequacy positively impacts STEM programme completion. Those students who believe they have more financial resources are significantly more likely to complete their programme. This finding is a crucial demonstration of the importance of funds widely supported in facilitating student persistence, particularly in highly resource-demanding STEM programmes.

Although the model hypothesises a high variance percentage (36%), it also suggests that other determinants, such as educational support, internal motivation, and institutional infrastructure, likely play a dominant role in programme success. Additional research would seek to identify such complementary factors to understand better the ecosystem influencing STEM persistence and success among Uganda's public universities.

Research Question 3: How do financial challenges affect the completion of STEM programmes among university students?

Findings indicate numerous systemic and personal financial barriers deterring STEM students from programme completion. Although the student loan programme in Uganda significantly expands its scope, accessibility, and responsiveness, it presents enormous challenges to student success and continuation. One of the biggest challenges is the funding gap against the requirements. Contrary to the fact that over 6,000 applications are submitted annually, only 1,500 students are sponsored due to the limited available funds. The shortfalls leave a significant number of qualified STEM students without financial means, resulting in delayed admissions, programme withdrawal, or resorting to insecure sources of funding in an attempt to continue studying.

Additionally, rigorous caps on the fee levels preclude costly STEM programmes, such as Medicine, Engineering, Aviation, and Petroleum studies, from full loan coverage. Fees exceeding UGX 12 million per year are beyond the scheme's fund limit, and students are responsible for paying these fees themselves or arranging for withdrawals. As a student remarked;

"... The loan must be substantial enough to cover these costly courses. My Mum indicated that she cannot meet the cost of paying for these schemes ... treating both of us to go for private tuition at leading universities would be a financial strain." (FGD, University B1, 2024)

Disadvantaged groups and rural students are disproportionately affected. Geographic lending discrimination continues to exacerbate inequity, with wealthier areas, such as Wakiso, Mpigi, and Mbarara, taking out loans in a greater proportion to their share, while poorer s, such as Karamoja and Sebei, are underrepresented. This guarantees continued system exclusion for students from disadvantaged regions.

Payment delay and freezing of appeals reports also hindered their academic continuity. The suspension of new loans for the 2023/24 academic year and the freezing of pending appeals made it difficult for most students to register, sit for exams, or proceed with their programmes. The scale of this constraint, as witnessed by one of the administrators in one of the universities, was as follows:

"... 27.5% of the applicants passed. There are more youth in need of the loan than there are available loan opportunities." (Key Informant, 2024)

While the scheme accommodates tuition, functional, and research fees, as well as disability assistance, it does not cover expenses such as residence, food, transportation, or study equipment. The shortcoming compels students to obtain part-time jobs, borrow from friends, or live in poverty, which in turn affects their academic performance and overall well-being. The following is a description of the burden by a student;

"... Borrowings are very convenient; however, it's not enough to cover the cost of living, so I keep working some 15–20 hours a week. And thus ... I don't have rest days for months, and yet I have to go to lectures; this will affect my completion." (FGD, University B1, 2024)

One student had been withdrawn from an exam because she owed them fees,

"... pulled from an exam paper? That was the time when life became hardest ... I was in second year, and had to scout around searching for people to borrow money from in a bid to finish." (FGD, University A, 2024)

They were further upset about the lack of an integrative and responsive support framework, venting their frustration that they could not find accurate information and were overwhelmed by a deluge of bogus sites posing as legitimate loan sites. This finding exacerbates student distress, particularly among non-qualifying and unsuspecting individuals who pay fees at unlicensed outlets. One explained,

"... There is the official loan scheme website ... but the loan scheme has plenty of scam websites. ... What if I am not accepted for a loan? Hundreds of students have been conned out of cash." (FGD, University B2, 2024)

There are stories of having to leave education because one cannot continue, taking “dead years” to work and save up, as one woman narrator narrated her ordeal.

“... Economic woes made me drop out of my teaching career. Although this setback will mean graduating no earlier than 2026, it has made me re-evaluate my goals and shift towards a more stable career path.” (FGD, University B3, 2024)

Despite these constraints, the majority of students appreciated the value of the loan scheme. Others referred to it as a lifeline, which enabled them to study, although the assistance was not enough:

“... It’s the only hindsight loan that I don’t regret.” (FGD, University A, 2024)

These comments note that the barriers to accessing STEM courses are not scholarly but financial in nature. Financing shortages, tight funding restrictions, spatial and gender disparities, systemic lag, limited coverage of basic needs, and institutional rigidity reinforce one another to diminish the educational channels of a gigantic majority of STEM students in public universities. Students’ experiences necessitate the imperative need for reforms in policy planning, regional equity, and expanding the financial coverage to meet the full cost of higher education.

Research Question 4: What are the strategies which can be put in place to improve funding adequacy and programme completion of STEM Programmes?

Evidence from key informant interviews and focus group discussions (FGDs) identifies a set of strategies recommended by students and stakeholders to support funding adequacy and successful programme completion of STEM programmes in Ugandan public universities. These strategies encompass policy reform, institutional responsibility, operational reform, and enhanced student welfare.

One of the most significant recommendations the students proposed was adding stipends or living allowances to the loan bundle. Most students stated that tuition fees do not suffice to cover the general expenses of attending the university, especially for low-income students who need to work part-time to finance their costs.

According to one participant,

“... Most teenagers have to work for money so they can afford to do things.” (FGD, University B1, 2024)

Another student echoed this need, suggesting a systemic shift in expectations around student labour and self-sufficiency,

“... I think a stipend should be involved ... we’re living in a time ... most high school students don’t even volunteer anymore.” (FGD, University A, 2024)

Yet another plan frequently mentioned was the leniency of loan extensions for essential needs, such as food, shelter, computer hardware and software, and transportation, over tuition charges. These necessary expenses directly impact students' ability to attend class, complete assignments, and remain academically engaged. One of the students from the Science Education department recommended that,

"... there should be inclusion of provision for other essentials like food and accommodation taken up by the scheme." (FGD, University D, 2024)

As far as increasing the visibility and reach of the loan scheme is concerned, students called for increased sensitisation and awareness, particularly in rural and deprived regions. One student opined,

"... There should be an improvement on publicity, advertisement, and sensitisation about the Students' Loan Scheme." (FGD, University B2, 2024)

Aside from functional and structural deficits, the students also raised concerns about institutional integrity and trust issues. A participant made the following frank but perceptive proposal for change in scheme management;

"... Sack corrupt officials." (FGD, University A, 2024)

This remark pertains to a universal call for accountability and transparency regarding how the scheme is being managed. One of the long-serving stakeholders at the Higher Education Students' Financing Board Secretariat (HESFB) identified the funding and mandate issues that the scheme is currently experiencing. One of the officials acknowledged that the scheme has not reached the level of growth as management had planned.

"... We have not reached the number of students/applicants we had planned for ... we would increase 1,000–3,000 additional support annually, but we have been unable to achieve this due to funding puzzles." (Key Informant Interview, 2024)

However, decentralisation and equal distribution plans are in the pipeline. As another HESFB representative explained;

"... The Ministry will provide guidelines ... when the funds are released, each district will receive [a quota]. The loan scheme needs to be decentralised to all the districts for fair distribution. Even some universities desire the student loan scheme to be implemented for continuing students as well." (Key Informant Interview, 2024)

Students also looked to the regional level for lessons. The comparative success of the neighbouring states' plans, particularly in Kenya and Tanzania, was praised for more comprehensive coverage and more liberal arrangements. For example, a new student noted that;

"... Kenya and Tanzania have opened up the student loan scheme ... There should be no limit on student loans because there is no sense in charging the same for science subjects such as Medicine, Dentistry and Architecture as humanities subjects" (FGD, University B1, 2024)

In general, therefore, the evidence suggests that although Uganda's student loan scheme is highly valued for its ability to expand access to higher education, it is not, in its current form, sufficient to meet the needs of students in STEM fields. The current model's sole focus on tuition and functional fees, at the expense of living costs, programme-related expenditure, and regional diversity, severely limits its effectiveness in maintaining academic perseverance and accomplishment.

Secondly, the data points out the imperative of a multi-dimensional approach towards reform in the areas of: Rise in loan guarantee to ancillary costs and allowances, Greater regional balance through decentralisation and quotas, Improved communication and sensitisation drives, Improved anti-corruption and accountability practices, Removal of blanket ceilings on loan size for costly STEM programmes. Combined, the suggested approaches imply that increasing funding adequacy for STEM students is not merely a matter of allocating more resources, but of implementing more innovative and equitable policy planning. In doing so, not only will levels of completion rise, but Uganda will be investing in future scientists, engineers, and innovators.

5. Discussion

The research results reveal glaring loopholes in Uganda's student loan scheme, particularly concerning the successful graduation of students in STEM-based programmes. Quantitative and qualitative evidence confirm that the financial terms provided are mostly inadequate to cover the full range of students' academic and extracurricular requirements, compromising their prospects of thriving and succeeding in university education. Quantitative results, as presented in Table 1, consistently show low satisfaction levels with the sufficiency of loan support, with a mean rating of 2.82 (SD = 0.78), indicating that STEM beneficiaries are mostly dissatisfied. These results demonstrate that the scheme is unable to fulfil its core mission of facilitating easy academic progression.

Although the loan scheme was designed to cover tuition and academic expenses, only 29% of the students agreed that it adequately meets these needs. The majority (71%) disagreed or strongly disagreed with the adequacy claim, with a mean response of 3.13, symbolising moderate dissatisfaction. This finding is consistent with earlier research by

Fan *et al.* (2015), which showed that inadequate tuition payment has implications for delayed registration, course dropout, or delayed academic progress. Among STEM majors, who require unique materials, laboratory usage, and high-cost equipment, the impact is particularly dire. The inadequacy from an academic requirement standpoint reduces the quality of learning and the possibility of graduation.

Even when compared to other non-academic expenses such as housing, living expenses, transportation, and healthcare, the lack is that much more pronounced. Nearly 79% of the students did not strongly disagree or agree that the loan was sufficient to meet such expenses ($M = 2.29$, $SD = 0.88$). These findings confirm previous work by Goldrick-Rab *et al.* (2015) and align with Tinto's (1993) theory of long-term student engagement, which posits that financial, academic, and social integration are all necessary for sustained engagement. For students in the STEM fields, whose education is protracted and provides minimal opportunity for the formation of secondary income, economic insecurity significantly interferes with academic focus and increases the likelihood of dropping out.

The scheme's failure to provide a financial buffer against unforeseen spending was also evident. With 54.8% of students indicating that the loan prevents them from accessing money to cover immediate needs ($M = 2.87$, $SD = 0.74$), such a shortfall poses a significant and real danger to the continuity of learning. These sentiments are also echoed by Nanyangwe and Ssenyonga (2022), who recognise that unforeseen expenses, such as medical or project-related costs, are likely occurrences that force students to withdraw or apply for academic leave. In this regard, a more flexible and compassionate loan system would be key to preventing such outcomes.

The second point is that the scheme does not account for differences in expenses across geographical areas. Urban students in Kampala face significantly higher living costs compared to those in rural areas, yet loan amounts are not adjusted to reflect these regional differences. The mean score for this question ($M = 3.01$, $SD = 0.71$) reflects mild dissatisfaction. Tamale and Namirembe (2023) also criticised this one-size policy, stating that a "one-size-fits-all" system heightens inequalities and disadvantages students from low-cost and high-cost areas.

The qualitative findings provide positive validation of the quantitative results. Focus group interviews (FGDs) revealed that although students appreciated the funding of fees, they often struggled to cope with unresolved fundamental needs, including accommodation, food, transportation, and gadgets. In their own words, one of the respondents described the scenario as follows;

"... Occasionally I go hungry or sleep during class because the loan covers only half the fees, but not anything else. You cannot concentrate if you are hungry or concerned about where you will sleep" (FGD, University A, 2024).

Another respondent mentioned that even when paid, survival is always a concern,

"... Yes, I am sure of tuition, but then the stomach is rumbling too. So, the loan is not enough." (FGD, University B3, 2024)

They refer to the material effects of budget shortages. They also demonstrate how economic disadvantage can erode both academic engagement and mental well-being, issues that are barely mentioned in policy briefing notes.

Comparative student attitudes highlighted the greater flexibility of those countries' student loan systems, for instance, as in Kenya. One of the respondents described it;

"... In Kenya, you request money to buy a laptop, your allowance... Uganda's strategy is very limited." (FGD, University B1, 2024)

Such remarks point to policy gaps and missed opportunities for innovation. Kenya's situation-based disbursement strategy, whereby students can request additional funds depending on their specific circumstances, could be a starting point in Uganda. Alternative institutional explanations were, nonetheless, offered. University officials explained the adequacy of the scheme on its central mandate,

"... The monies are normally adequate for the intended use, covering tuition and functional fees." (Key Informant, 2024).

Another student interviewee said,

"... The loan is sufficient enough since all the learning fees and functional fees of all students are all taken care of; these are paid but delayed to be remitted to the university." (Key Informant, 2025)

These responses demonstrate a limited, instrumental understanding of sufficiency that is insensitive to the broader structural, economic, and social determinants of learning, particularly in challenging STEM subjects. Dramatic accounts by the students indicated how a lack of coordination of support leads to withdrawal from learning. As one student described,

"... One student ran away since he could not buy food. Another also dropped out because of hunger." (FGD, University B1, 2024)

Another interviewee added:

"... The insufficiency of the loan amount not only aggravates the burden of the students but also raises doubts whether their performance after graduation would be sustainable." (FGD, University B2, 2024)

These accounts suggest that current funding levels are insufficient for ensuring student well-being and retention, particularly for low-income students. Students again requested additional subsidies for basic costs, including technology, research supplies, living expenses, and internship fees. These are not budgetary outlays; these are integral to STEM education. As Goldrick-Rab *et al.* (2015) aptly note, any decent and equitable system of funding students should be sensitive to the diverse range of socio-economic and academic needs of its recipients. The current system, commendable as it is, risks losing focus and failing to benefit every student for whom it is intended to help if it fails to change, become flexible, and remain relevant.

6. Conclusion and Recommendations

This research asserts that the current student loan scheme in Uganda is not well-suited in its current form to support the graduation of STEM programmes in public universities. This research claims that academic and related non-academic costs, including tuition fees, accommodation, food, travel, and unforeseen emergencies, are not comprehensively covered. This deficit disproportionately weighs on STEM students, who must finance the higher costs of higher education and demanding programme requirements, and in the process, become economically vulnerable and liable to be delayed in graduation or even drop out. Unless Uganda wants to achieve its strategic goal of building its STEM human capital and reaching a competitive knowledge-driven economy, the student funding needs radical reforms.

To make the student loan programme more efficient and fair, its delivery and design must be examined in great detail. The government must redesign the loan size to reflect the actual cost of learning, taking into account regional and programme-specific costs. Greater flexibility must be incorporated to respond to unforeseen financial demands, and fair funding arrangements, based on geography and socio-economics, can be facilitated through flexible funding mechanisms. For this, as well, the programme must be more holistic and evidence-based, encompassing regular check-ins with colleges on students' needs and disbursements tied to actual programme expenses. Bolstering such coordination among providers of higher education and loan agencies will be the foundation for making financial aid work not only for access but also for persistence, attainment, and graduation in the STEM fields.

Data Availability Statement

Data shall be made available on request from the corresponding author.

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Declaration of Conflicts of Interest

The authors declare that they have no potential conflicts of interest.

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