

Management of Higher Educational Institutions in Pandemic Situations: The Case of Covid-19 in Dambai College of Education

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Abstract

Outbreak of Covid-19 revolutionised global education system and Ghana was no exception. This study explored the heat period of Covid-19, 2020/2021 and 2021/2022 academic years on strategic management of personnel, material resources and contact hours. Quantitative procedures employed determined faculty, students and material resource management whilst qualitative approaches used ascertained efficiency of resource management. Fourteen staff members and nineteen students conveniently sampled answered close and open-ended questionnaires. Findings include adequate and equitable resource distribution of personal protective equipment, effective communication through collaboration, efficient use of resources, improved digital skill as well as inadequate digital skill among some staff and students. Conclusion was that resilient managerial strategies facilitated effective use of contact hours and economic resources however improvement on digital skill among all sectors should be pursued. Recommendations include implementing continuous professional development programmes on technological competence for members of the College community, procurement of additional technological resources, and designing college-based Learning Management System (LMS) were necessary.

Keywords: *Management, Higher Education Institution, Pandemic, Covid-19, Dambai College*

Introduction

Educational institutions, like any other organisation, have their clear path and calendar of operation. Colleges of Education in Ghana are among the many post-secondary institutions which through the passage of Act 778, Education Act, were recommended to be transited into tertiary institutions from their former known non-tertiary status. Thus, by Act 847, Colleges of Education Act 2012, all the teacher training colleges were transited into tertiary institutions. The Colleges always have their annual schedules of activities which often were religiously followed in ensuring the smooth running of their mandates for teaching, research and community services. The case of 2019/2020 and 2020/2021 academic years became different from the norm. A number of deviations had to be allowed and managed for continuation of society and general growth of education in the country. The 46 public Colleges of Education like all other educational and corporate institutions were hit hard by the negative impact of the deadly Covid-19 novel virus.

Coronavirus disease (COVID-19) is an infectious disease caused by the SARS-CoV-2 virus (World Health Organisation, 2020). The Covid-19 pandemic disrupted the academic calendars of Colleges of Education, jeopardising their role in producing competent teachers for basic schools. Given that basic education is foundational for child development and national education, such disruptions pose significant risks. The government of Ghana took precautionary measures to mitigate the impact of the disease in anticipation of its potential ravaging effects.

Prior to the confirmation of the outbreak in Ghana, a readiness assessment was conducted, and a response strategy developed led by the National Disease Surveillance Department of Ghana Health Service. In addition, the country conducted orientation at the Kotoka International Airport (KIA) and other Ports of Entry for effective screening and handling of suspected cases as well as contact tracing training for Alumni and Residents of the Ghana Field Epidemiology and Laboratory Training Program (Ghana FELTP) and staff of the Ghana Health Service (GHS). The GHS and all other Ministry of Health (MoH) agencies had heightened routine surveillance in all health facilities. Government of Ghana on 11 March, committed \$100 million to enhance Ghana's coronavirus preparedness and response plan. The Ministries of Health, Information and media instituted aggressive mass education and

campaigns to create the necessary awareness in Ghana (Kenu, Frimpong & Koram, 2020, p. 72).

According to Sasu (2022), by March 14, 2020, Covid-19 cases were registered in the country and by December 2020, a total of 54,771 cases had been registered. The cases went up to have a record of 142,986 by 31st December 2021. January 5, 2022, witnessed an overall total of 148,079 Covid-19 within which 876 were newly confirmed cases with an overall number of deaths reaching 1,313 (Sasu, 2022). These cases had student infections inclusive. The welfare of the youths is of paramount concern to all citizens. The youths also form the greatest population of the education populace of the country. The protection of all citizens including students from the ravaging effect of the disease is the outermost concern of all governments all over the world. This had led to issuance of several directives on management of work at various sectors of economies.

Particularly in Ghana, the education sector had to take to blended teaching and learning modes in tertiary education. Track systems were held to reduce the number of students in institutions for in-person's lessons. Ghana Tertiary Education Commission served several letters to tertiary educational leaders to reiterate total obedience to the directives in observance of Covid-19 protocols to avoid infection and reinfection of students and workers. A number of updates were given on monthly bases by His Excellency, the President of the Republic, Nana Addo Dankwa Akuffo-Addo on the infection rates and also precautionary measures to take in all households, institutions and individually to curb the infection rate of the country. The country's Ministry of Health also circulated several letters and memoranda for compliance by all citizens to ensure the country does not totally run down due to the pandemic and related impact.

Initially, vaccines were unavailable in Ghana, prompting caution among educational leaders, particularly College Principals, regarding operational practices, especially considering the unique boarding system of Colleges of Education. The World Health Organisation (WHO) and International Labour Organisation (ILO) issued warnings in their Policy Brief regarding the need for adequate accommodation and feeding facilities to ensure social distancing if colleges reopen for in-person instruction.

Nonetheless in some sectors there are clear trends indicating increased risk of transmission. This is notable for service and sales workers, cleaning and domestic workers, education workers, meat-processing workers, hospitality workers, drivers and transportation workers, public safety workers, construction workers and the people in social service occupations. Workplaces

with physical person-to-person contact, inadequate ventilation, common eating areas, shared work accommodations and travel are more likely to report COVID-19 outbreaks. The evidence supports the existing WHO and ILO recommendations for preventative measures for COVID-19, such as remote work directives, restricting worksite entrance to key workers, physical distancing, routine screening, isolation of infected persons, contact tracing and quarantining of contacts, regular worksite disinfection (especially of high touch surfaces), hand hygiene, environmental monitoring and appropriate use of personal protective equipment (WHO & ILO, 2021).

McCormack (2021) highlights that the Centre for Disease Control and Prevention in the United States warned educational leaders in February 2020 about the potential drastic impact of Covid-19 on school operational systems. This prompted institutional leaders worldwide, including Ghana, to innovate engagement methods due to the global impact of the pandemic (Brock, Beach, Musselwhite & Holder, 2021). Schools globally, including the USA, had to adapt instructional delivery significantly in the spring 2020 semester. Consequently, Colleges of Education in Ghana shifted to online engagement to mitigate the negative effects of clustered face-to-face lessons, despite facing challenges (Arias, Swinton & Anderson, 2008).

The covid-19 pandemic has significantly disrupted global educational systems, including Higher Education Institutions (HEIs), and this has necessitated research into how leadership managed institutions during the crisis. Dambai College of Education, like many HEIs encountered unique challenges, including the abrupt shift to online learning, resources constraints, and the need to ensure the safety and wellbeing of the college community. This research is crucial to understand how the college navigated the challenges, the effectiveness of the strategies that were employed by leadership, and the prospects of those strategies for future pandemic preparedness. Examining this pandemic situation in the case of Dambai College of Education provide valuable insights into the unique challenges that confronted HEIs in resource-constrained settings. This research is essential to inform policy and practice on management of HEIs during pandemics. The outcome highlights best practices and innovative strategies used by management of Dambai College of Education, which could serve as blueprints for analogous institutions. The research identified approaches that enabled work progress among faculty and students, teased out mechanisms that resulted in efficient resources utilisation and cost reduction, and the general effect of the pandemic on the institution, where actionable recommendations are offered to enhance resilience and adaptability in the face of future disruptions.

Although numerous research has explored the effect and impact of the covid-19 pandemic on HEIs globally, there remains a gap in unearthing how Colleges of Education in Ghana, especially resource-constrained settings like Dambai College of Education managed the pandemic. There exists extensive research that focused on universities globally and in Ghana, where researchers generally overlooked the unique strategies colleges of education in Ghana adapted to navigate the complexities of the covid- 19 pandemic (Shinde & Mahadalkar, 2018; Gyampoh, 2020; Mncube, Mutongoza and Olawale, 2021). Also, there appear to be limited empirical evidence on the long-term implications of pandemic management strategies on the contextual Ghanaian teacher education programmes and the capacity of these programmes to produce quality teachers in a post-pandemic era (Ibrahim, Gusau & Uba, 2020; Tadesse & Wuluye, 2020; Di Pietro, Biagi, Costa, Karpinski, & Mazza, 2020). This research seeks to fill this gap by providing detailed analyses of the strategies used to manage a typical college of education in Ghana (Dambai College of Education), offering insights that are critical for strengthening teacher education institutions in similar contexts.

Purpose of the study

Thus, many institutions if not all, carried out some paths of management of their institutions in unique ways as viewed suitable. This research envisioned to analyse and review what happened so far in the College within the two academic years, 2019/2020 and 2020/2021, which were the peak periods of the Covid-19 pandemic worldwide. Relevant questions institutional leaders need to ask and answer in mapping out their clientele engagement include but not limited to 1) how should staff and students be managed to ensure effective work progresses? 2) How should staff and students be engaged to ensure effective and efficient use of resources during the pandemic? 3) How could the period of the pandemic be managed in educational institution to avoid economic down-drum? This study concentrates on Dambai College of Education in analysing the management of educational institutions within the pandemic to unearth the positive and the negative effect made by covid-19 pandemic on the development of the College.

Research questions

The study was guided by the following questions to give it a focus.

1. Which strategies were adopted to manage staff and students for effective progress of work in the college during the Covid-19 pandemic?
2. How were students engaged to ensure effective and efficient use of resources in the college during the Covid-19 pandemic?

3. How were institutional resources managed in curbing economic downturn in the College during the pandemic?
4. What was the effect of the Covid-19 pandemic on the College of Education?

Significance of the study

In practice, the study produced information relevant in helping College Management of Dambai College of Education and analogous institutions in crafting strategic paths in managing periods of pandemics to ensure effective and efficient running of their sectors. The study also revealed the strategies adopted by the Students Representative Council in harnessing the opportunity to increase productivity in institutional management and teaching-learning experiences during the period of the pandemic. This information therefore would guide other students' leadership to improve their sectors of engagement. The study has revealed practicable blueprints that challenge leaders to transform difficulties into opportunities and guide the practices of leaders in the management of institutions during natural eventualities. The research has revealed the need for management to engage staff in contextually based technology-driven professional development programmes towards maintaining the global mandate of providing education that meet the industrial needs of society.

Theoretically, the revelations of the study give historical evidence of pandemic management, and this contributes knowledge to the theoretical perspective of educational administration. The theoretical and methodological paths adopted by the study serve as guidance and research frameworks for modelling the infection, spread and prevention of similar pandemics. The study has revealed a concept map of the Bertalanffy's Systems Theory that can guide investigations regarding managing pandemic in higher educational institutions.

For policy, the study brought on board information relevant to Ghana Tertiary Education Commission (GTEC), Ministry of Education (MoE) and all the teaching universities including National Teaching Council (NTC) with respect to management of Colleges of Education in similar pandemics. The Oti Regional Coordinating Council, Krachi East Municipal Assembly, Krachi East Education Directorate, the Chonky Traditional Area, VOLTI PRINCOF, TTAG and other stakeholders of Dambai College of Education would find the content of this research very informative for planning of support for the College and other institutions in their jurisdictions. The findings of the study will also inform management of the need to consider the level of compliance of community members when formulating policies towards managing institutions during pandemics. The success of educational administrative

policies is heavily influenced by the community members' level of compliance.

Theoretical and Conceptual Framework

The objectives of the study were based on approaches of organisational management in higher educational institutions in Ghana. Therefore, the theoretical antecedence of the study is underpinned by Systems Theory. The theoretical perspectives of Von Bertalanffy's Systems Theory (1968) form the stands of the study. Bertalanffy's Systems Theory (1968) was used to establish basis for describing the organisational strategic Inputs made, Transformations undertaken, and the resulting Outputs and Feedback obtained while managing the institution during the pandemic. The systems theory opined that institutions are made of systems with goals that must be achieved (Mele, Pels & Polese, 2010; Mncube, Mutongoza & Olawale, 2021).

The application of systems theory provides a robust theoretical perspective for understanding the complexities of managing HEIs during the covid-19 pandemic, especially in the case of Dambai College of Education. The systems theory underlines the interconnectedness and interdependence of the respective components within an institution, such as administrative structures, teaching and learning processes, resource allocation, and stakeholder engagements, which were all critically affected by the covid-19 pandemic. Dambai College of Education is a complex system, and the systems theory provides a framework which allows a holistic analysis of how disruptions in one or more components (for example, change of academic calendar, sudden shift to online teaching) reverberated across other components (for example, resources utilisation, staff workload, institutional finances, student performance) of the College. The adaptation of the systems theory to unique environments like the Dambai College of Education aligns with the unique challenges posed by covid-19, which enables this research to identify the immediate response strategies of the College as well as the long-term systemic strategies needed for resilience and sustainability. The systems theory is therefore an ideal lens for examining the multifaceted management strategies employed by leadership to manage the complexities of the covid-19 at Dambai College of Education and derive lessons that are applicable in similar institutions during such crisis.

It is postulated that the theory comprises four phases which are inputs, transformation, outputs, and feedback (Mncube *et al.*, 2021; Shinde & Mahadalkar, 2018; Mele *et al.*, 2010). The "inputs" were defined as the capital and human resources that contributes to operating the institution (Mncube *et al.*, 2021). The capital resources and human resources need to be well planned, organised, and motivated towards achieving the institutional goals (Mncube *et*

al., 2021). Different covid-19 resources were provided, and staff and students trained towards managing the pandemic within the college. Health professionals of the Ministry of Health also provided expert supports towards managing the pandemic.

At the “transformation” stage, the processes include the guidelines and directions that controls and regulates the resources utilisation towards attaining the institutional goals (Mele *et al.*, 2010; Mncube *et al.*, 2021). The transformation phase is said to be vital as it should provide clear procedures for effective resources usage and define duty roles for all field players. The formation of committees to monitor covid-19 souvenirs, establishment of covid-19 isolation centres, building ICT competence of teachers and students, and decentralised distribution of covid-19 resources were transformative procedures towards controlling spread of the pandemic.

Also, “outputs” represents the final results and services provided by the institution, justifying the resources invested into managing the institution to achieving some defined goals (Mele *et al.*, 2010; Mncube *et al.*, 2021). The outputs are measured based on the initial goals of the institution upon which resources were provided and some transformations undertaken. The system of effective online lessons and equity in access to safety materials represent outputs of the covid-19 management process.

Finally, “feedback” is obtained from the human resources who undertook the transformations. Feedback is obtained through research, which measures how the resources were used, report improvements and challenges in operating the system (Mele *et al.*, 2010; Mncube *et al.*, 2021). Highly satisfactory feedback about the strategic management of the institution during the pandemic was reported. The systems theory in this study informed the democratic and collaborative leadership approach in managing the institution where students, staff, SRC and leadership worked collectively together towards controlling the pandemic. The theory guided in tracking the input resources and transformation procedures by the institution and compared it with the accompanying outputs and feedback in the context of managing Dambai College of Education during the covid-19 pandemic.

The effect of the “transformations” using the available “inputs” results in an “output” which is assessed through research to obtain “feedback” for institutional management is conceptualised in Figure 1.

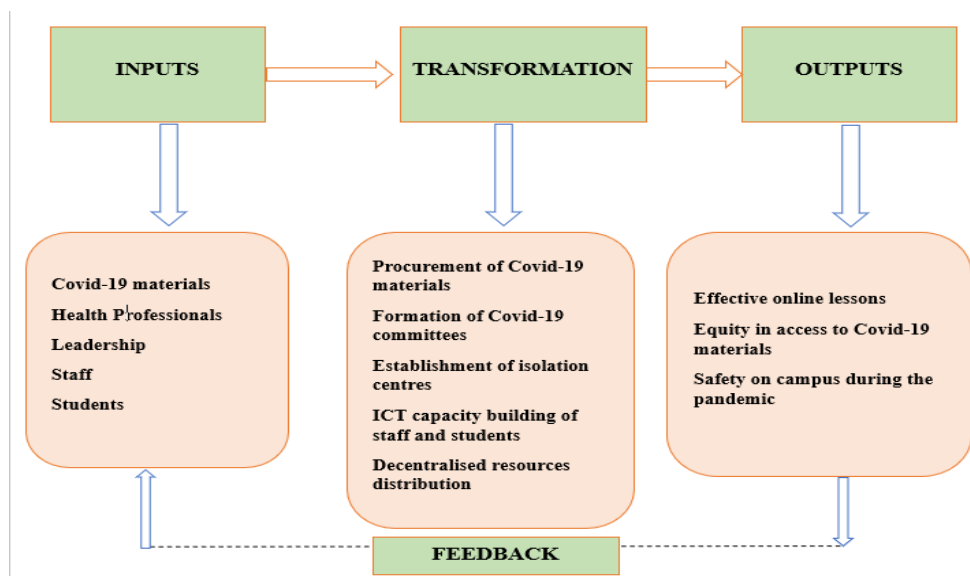


Figure 1: Conceptual Framework Based on General Systems Theory for Managing Institutions during Covid-19

Source: Adapted from (Shinde & Mahadalkar, 2018; Mncube, Mutongoza and Olawale, 2021)

Following Mncube *et al.* (2021) disposition of the General Systems Theory as exemplified in Figure 1, the “inputs” phase in this study is characterised by the covid-19 materials and the human resources including health professionals, institutional leaders, staff and students who are following and undertaken various transformation procedures using the inputs to manage the covid-19 pandemic in the institution. Some transformation procedures that were employed includes procurement of the covid-19 materials, formation of emergency committees, establishment of isolation centres, building the digital competence of staff and students, and adopting decentralised mechanism of resources distribution. The theoretical outputs were hypothesised to be the institution’s ability to transit into effective online lessons, ensure equity in access to Covid-19 safety materials, and maintain safety for continuous academic activities amidst the pandemic.

Literature Review

Higher Education Institutions (HEIs) management strategies employed during covid-19 pandemic

During the Covid-19 pandemic, countries, corporate organisations, educational institutions and the world experienced challenges that were

globally intertwined. It was the first time some corporate and educational institutions faced such a global pandemic. The inexperienced institutional leaders with respect to such pandemics for the first time in their leadership roles had to adapt and design strategies that would sustain their institutions through the pandemic.

Research has reported that the covid-19 pandemic caused HEIs to adapt remarkable to the situation using different strategies that meet the needs of students and faculty members efficiently. According to Mncube *et al.* (2021), institutions have designed and provided support materials in the form of course guides, new teaching-learning approaches, and resource packages for transforming instruction to the online space. Also, managements have instituted special learning platforms, and reorganised assessment procedures for various fields of study that are accessible to their students irrespective of location (Mncube *et al.*, 2021). Due to the minimal face-to-face interaction, students and parents were connectively engaged and supported through social media platforms, using text messages and emails (Mncube *et al.*, 2021).

Higher Educational Institutions (HEIs) also developed specific guidelines within their campuses that described how to prepare and respond to the covid-19 emergency cases. HEIs in Ghana instituted emergency response plans, emergency and crisis management plans, and school continuity plans to ensure safety through the school year (Gyampoh, 2020). Again, the institutions were reported to have established covid-19 isolation centres on each campus, intensified education on safety measures, and allocated PPEs to department heads and student leaders for easy access.

Within the Ghanaian context, stakeholders and managements of HEIs introduced online emergency remote teaching systems as a measure to sustain academic activities amidst the pandemic (Ibrahim, Gusau & Uba, 2020). Gyampoh (2020) reported that mentoring universities of Colleges of Education in Ghana extended their virtual teaching-learning platforms to affiliate colleges to ensure continuous teacher education.

Effect of covid-19 pandemic on Higher Education Institutions (HEIs)

The impact of the novel coronavirus was very direct on the education sector across the world. Basic schools, colleges and universities were compelled to be closed to control the spread of the virus, which posed difficult challenges to the students, teachers and parents. Analyses of the consequences of the virus revealed that it intensified the social inequality gap in schools (Tadesse & Wuluye, 2020). Less privileged students who attend low resourced schools experienced low or no distance online learning during the pandemic whilst

advantaged students in technologically equipped schools experienced well designed distance and online programmes through online learning management systems and other robust and interactive online learning platforms (Tadesse & Wuluye, 2020). Globally, the education system adapted online teaching-learning pedagogies for continued learning, but the lack of ICT infrastructures and internet connectivity were challenges to families in developing and underdeveloped countries. The technology competence of teachers in disadvantaged schools to design appropriate online learning content is low which also affected effective teaching-learning processes (Di Pietro, Biagi, Costa, Karpinski, & Mazza, 2020).

The unplanned and immediate need for schools, teachers and students to shift from traditional face-to-face to distance and online instruction posed several difficulties including finance, teachers' digital skills, ICT infrastructure and resources, internet access, online teaching approaches and effective students' assessment and evaluation strategies (Tadesse & Wuluye, 2020). Teachers were challenged on how to remodel online-based assessments for students, and how to monitor the students during assessments. According to Osman (2020), the assessment of students' performance in online learning during the pandemic in areas such as technical competence, teaching-practicum, and practical skills was notable difficult.

Another stringent impact of coronavirus was the resources and financial burden brought upon schools at a season where normalised financial supports were not readily available to the institutions. Colleges of Education relies on tuition fees from students for major operations. Due to schools' closure, the expected financial sources were closed which affected the progress of usual academic routines of the institutions (Mncube et al., 2021). Colleges of Education like many other public institutions relied on governmental and non-governmental agencies for protective equipment and teaching-learning resources. The unaffordability and inaccessibility were described to have serious negative implications on students of higher educational institutions (Haleem, Javaid, & Vaishya, 2020).

Ofori-Manteaw, Dzidzornu, and Akudjedu (2022) reported variant effects of covid-19 on HEIs including heavy traffic on internet connectivity, difficulties getting access to facilities to engage in practicum, and limited time to engage in interactive academic discourses. Research students also experienced challenges with data collection procedures and support from supervisors due to limited face-to-face interaction (Ofori-Manteaw *et al.*, 2022).

Methods

Research paradigm, approach and design

The study used multiple research methods to obtain and analyse data. Results interpretation and discussions were anchored on the assumptions of the post-positivist paradigm where variant perspectives are used for conclusions (Mncube *et al.*, 2021). A mixed method approach was adapted to obtain both quantitative and qualitative data. The approach was employed to determine the in-depth experiences of staff and students of Dambai College of Education during the peak of covid-19 in relation to the thematic areas of the research. The research thereby employed the concurrent embedded mixed methods design where both quantitative and qualitative data were used to augment each other to explain the experiences of the participants. The management strategies adopted by leadership to manage staff and students was described using quantitative data. In research objective two, qualitative data was used to describe how staff and students effectively and efficiently used available resources during the pandemic. Finally, the third and fourth objectives which concerned how resources were managed to avoid economic downturn as well as the effect of the pandemic on the College were respectively addressed using quantitative data.

The adoption of the embedded mixed methods design was justified by the use of different types of data to address different specific objectives and the results augment each other towards addressing the main objective of the study. The design formulated the dependent variable as the management strategies leadership adopted to manage Dambai College of Education during the Covid-19 pandemic. The independent variables were strategies leadership mounted to manage staff and students, how staff and students effectively and efficiently used available resources, what strategies leadership adopted to avoid economic downturn, and how the pandemic affected (positively/negatively) the College. By principle, the design allowed collection of both qualitative and quantitative data simultaneously for addressing the respective themes of the study.

Sample and sampling techniques

The population of the study was made of the academic and support services staff, and all level 400 students at the College. The study sample was obtained through convenient sampling. This sampling procedure was employed due to compliance of the College community members to covid-19 protocols. Thus, available staff members and students at the point of data collection responded to the questionnaire. The sample of the study is 53 participants comprising 14 academic and support services staff and 39 level 400 students. The sample size was obtained from the sample size calculator provided by Raosoft Sample

Calculation Guide (Al-Sayaghi, 2023). With a staff population of about 50, a sample of 14 was an appropriate representation (Al-Sayaghi, 2023). Also, the Level 400 students had a population of about 280 students, and 39 were conveniently sampled as participants of the study.

Research measures and data analysis

Both quantitative and qualitative data were collected using close-ended and open-ended questionnaire. Quantitative data was collected using the closed-ended questionnaire while the qualitative data collected with the open-ended questionnaire. The quantitative data was obtained using a five-point Likert scale and multiple response items. The qualitative data was also obtained from self-reported open-ended questionnaire. All sampled respondents (14 staff and 39 students) responded to both the quantitative (close-ended Likert-scale) and qualitative (open-ended items) questionnaire, and all 53 participants responded to the exact same type of questionnaire. The research questionnaire for staff and the students was structured in five sections: Section one contained the personal profile of the participants; section two was a five-point Likert scale which sort to determine the satisfaction of participants about how they were managed; section three was open-ended questionnaire designed to determine how staff or students used resources effectively and efficiently; section four also used multiple response items to determined how institutional resources were managed to curb economic down-drum; and section five used a five-point Likert scale to ascertain the effect of covid-19 on the college. The validity of the measures was ensured and the internal reliability coefficients of the five-point Likert scale measuring satisfaction of participants with respect to management's managerial strategies was 0.825 for staff and 0.807 for students. The Cronbach alpha of the multiple response items measuring management of resources to curb economic down-drum was 0.963 for staff and 0.873 for students. Finally, the reliability coefficients of the five-point Likert scale measuring the effect of Covid-19 on the College were 0.825 for staff and 0.758 for students.

The quantitative data was analysed using descriptive statistical tools whilst content analysis was used to thematically present responses from the qualitative data and supported with participants' direct quotes. Research objectives one, three and four were addressed using quantitative data. Statistical tools used were frequency counts and percentages, means and standard deviations. Qualitative data which was analysed and presented in themes and direct quotes of participants were used to address research objective two.

Results and Discussion

This research is structured to determine how the College staff, students and instructional time were managed to sustain academic activities; how management ensured effective use of resources, how resources were managed to curb economic down-drum; and the effect of the pandemic on the College. The results are presented in the order of the research questions.

Demographic characteristics of participants

The study used teaching staff, support services staff, and level 400 students at the College for the study. Table 1 details the demographic features of the study participants.

Table 1: Demographic characteristics of research participants

Demographic characteristics	Categories	Frequency	Percentages (%)	
Sex	<u>Staff (N=14)</u>	Male	13	92.9
		Female	1	7.1
	<u>Students (N=39)</u>	Male	24	61.5
		Female	15	38.5
Staff years of experience	(1-5) years	6	42.8	
	(6-10) years	4	28.6	
	(11+) years	4	28.6	
Staff Highest Academic Qualification (N=14)	Masters with Research	10	71.4	
	Masters without Research	4	28.6	

Source: Field Data (2021)

Out of the 53 participants who completed the questionnaire, 73.6% (39) were students, while 26.4% (14) represented the academic and support service staff of the College. Hence, the managerial strategies adopted by management is predominantly reported by the students whom the decisions affect directly. The sex distribution of the sample was notable skewed, with 92.9% of staff and 61.5% of students being male, leaving only 7.1% of staff and 38.5% of students as female participants. Regarding the professional experience of staff, 42.8% had one to five years of experience, 28.6% had six to ten years, and another 28.6% possessed over eleven years of experience. This suggests a substantial presence of experienced faculty members within the College, potentially equipped with valuable managerial skills that proved beneficial in handling the challenges posed by the Covid-19 pandemic. In terms of academic qualifications, the majority of staff members (71.4%) held a Master's Degree with a research component, while a minority (28.6%) possessed Master's Degrees without a research component. This highlights the high professional qualification standards upheld by the College staff members. The high academic qualifications of the staff enabled them to adapt during the pandemic and made informed innovations such as transitioning to online teaching and learning and ensuring equitable access to resources.

Management of staff and students in Dambai College Education during covid-19

Descriptive statistics were used to describe how the management of Dambai College managed the staff and the students at the peak of Covid-19 during the 2019/2020 and 2020/2021 academic years. The level of satisfaction of the College community to the managerial strategies adapted by management towards sustaining academic and administrative activities of the institution was determined on a five-point Likert scale. The interpretation scale used for the means of the five-point Likert scale was: 1.0 – 1.8 (very low satisfaction); 1.9 – 2.6 (low satisfaction); 2.7 – 3.4 (moderate satisfaction); 3.5 – 4.2 (high satisfaction); and 4.3 – 5.0 (very high satisfaction). Means and standard deviations were used to report and explain both staff and students' experiences. The results are reported in Table 2.

Table 2: Staff and students' satisfaction with management strategies during covid-19

Management engagement with staff and students during Covid-19	Staff		Students		Overall management of staff and students		Satisfaction with management strategies
	Mean	SD	Mean	SD	Mean	SD	
Supply of covid-19 materials	3.93	.475	4.03	1.158	4.98	.071	Very high satisfaction
Prioritisation of community members welfare	3.71	.469	4.31	.766	4.01	.424	High satisfaction
Transparency with information	4.00	.679	3.90	1.046	3.95	.071	High satisfaction
Excellent communication	4.29	.611	4.03	1.013	4.16	.184	High satisfaction
Good listening to the concerns of college community	4.00	.555	3.74	1.186	3.87	.184	High satisfaction
Appreciating and encouraging teamwork	4.29	.611	3.77	1.111	4.03	.368	High satisfaction
Consistency and reliability	4.07	.475	3.77	1.202	3.92	.212	High satisfaction
Management was trustworthy	4.14	.535	4.05	.944	4.10	.064	High satisfaction
Exhibited good decision making	4.14	.475	4.28	.857	4.21	.09	Very high satisfaction

Demonstrated the drive to accomplish set goals	4.07	.616	4.44	.552	4.25	.262	Very high satisfaction
Overall	4.06	.334	4.03	.858	4.05	.023	High satisfaction

Source: Field Data (2021)

Dambai College's management employed a diverse array of strategies to ensure uninterrupted academic activities during the Covid-19 pandemic. Key measures included procuring PPEs, prioritising staff and student well-being, and maintaining transparent communication with the community. They emphasised transparency and collaboration, actively listening to feedback and fostering trust. Their decisive decision-making and commitment to safety underscored their reliability in managing the challenges posed by the pandemic effectively.

The results presented in Table 2 underscore the high level of satisfaction among staff, and students regarding the managerial strategies employed by leadership during the Covid-19 crisis. The overall mean score (Mean = 4.05, SD = .023) indicates that the management's handling of staff and students throughout the pandemic was exceedingly effective and satisfactory. This is evident by the reported high level of satisfaction (Mean = 4.21, SD = .09) with leadership's decision-making strategies exhibited during the period, which showcases the proactive leadership style of the management of the College.

Specific management strategies adopted by the institution received remarkable positive evaluations from both staff and students. Notable, the provision of PPEs revealed the highest mean score (Mean = 4.98, SD = .071), with an overwhelming 97.4% of participants acknowledging the receipt of Covid-19 preventive materials. These materials included items such as nose/face masks, hand sanitisers, health safety signages, and educational materials on Covid-19 prevention. Key supporting agencies in this endeavour included the Dambai College of Education (DACE) Management, the Government of Ghana (GoG) through Krachi East Municipal Assembly (KEMA), Oti Region of Ghana Education Service (GES), and ZoomLion Company. Consequently, the effectiveness of the management's strategies in addressing the Covid-19 pandemic closely aligns with the high percentage of positive responses from participants regarding the provision of these preventive materials. This strategy agrees with the global caution to governments and institutions to

ensure provision of PPEs to help reduce the spread of the virus (WHO, 2020). The reported high level of satisfaction of the students and staff regarding the provision of PPEs indicate the measure was significant towards ensuring safety of the college community.

Weine, Bosland, Rao, Edison, Ansong, Chamberlain, and Binagwaho (2021) affirm the importance of the management's transparency, effective communication, and accessibility in fostering community engagement during COVID-19. This approach cultivated a sense of shared responsibility and addressed the psychological impact of the pandemic. Stakeholder engagement, including the Students Representative Council (SRC), led to innovative solutions such as transitioning to a canteen system to reduce crowding and constructing a Sickbay on campus. These efforts demonstrate proactive management strategies that addressed the challenges posed by the pandemic.

Globally, the need to manage educational institutions during the Covid-19 to ensure safety while continuing academic activities became necessary. In Ghanaian educational institutions, and Dambai College for that matter, variant strategies were adapted by leadership to manage students and teachers, and other workers during the pandemic. These multifaceted strategies encompassed provision of PPEs through agencies; developed a decentralised system that monitors the welfare of members; and formulated open lines of quality communication that provides transparency, active listening and timely feedback.

Engagement of staff and students to effectively and efficiently use resources during covid-19 pandemic

Qualitative data was obtained from all staff and all students which enumerates the engagement strategies adopted by the institution to ensure effective and efficient use of resources during the Covid-19 pandemic. The results are reported in themes and supported with direct quotations from the participants.

Based on the staff and students' engagements towards efficient use of resources during the pandemic, various health safety resources were stated to have been provided by the institution to ensure safety of the college community members. These resources included PPEs like nose masks, hand sanitisers, and teaching-learning tools. Notably, MasterCard Foundation subsidised smartphones for needy students, while platforms like Zoom, Google Meet, Telegram, and WhatsApp enabled active engagement between management and the college community, facilitating continuous academic activities. The resources were described to offer a platform that provided active engagements between management and the college community and fostered continuous academic activities during the pandemic.

Themes from the self-reported questionnaire highlighted management's engagement strategies for effective resource utilisation among staff and students. Strategies included meticulous resource distribution and monitoring, provision of computers, smartphones, and internet services, and ICT capacity building initiatives.

Decentralised distribution and monitoring of resources: It was reported that the student leaders were engaged to foresee equitable distribution of the PPEs to the college student community. Respective Heads of Departments (HODs) were also engaged to distribute the available Covid-19 resources to departmental staff members. Student respondent '5' wrote, *'I was the rep for my Hall. The Covid-19 materials were always given to me every week. My Hall members come to me for their materials as and when they needed it.'* This revealed that student representatives were used to ensure easy accessibility of resources among the students. In a similar manner, HODs also made needed resources available to their respective departmental members. Student respondent '9' also highlighted that each hall representative was required to submit daily resource inventory to their hall tutors- *"I use to send report every day to the hall tutor, to know how much we have used and what we needed next"*.

The equitable distribution and monitoring of Covid-19 resources at the college involved collaboration between College Heads of Departments and student leaders, showcasing a decentralised management approach. This aligns with Gyampoh (2020), who illustrated how Ghanaian HEIs utilised emergency committees to allocate PPEs, establish isolation centres, and implement crisis management plans to ensure safety throughout the academic year.

Provision of computers, smartphones and internet services: This was reported to be an engagement strategy that enabled teachers to transit easily from traditional face-to-face teaching to online teaching strategies with less resource challenges. Personal computers were reported to be provided at different central points which were accessible to faculty and students. Smartphones were also provided for selected students to enable them access online resources for continuous learning amidst the pandemic. Through the SRC and NGOs, internet data was accessible on campus, at staff bungalows, and the students' residential halls. Staff "8" stated that; *"We were supported with internet service packages for online teaching-learning activities, and computers were provided at a central point where staff could go use for online instruction or design of online teaching-learning resources."* This initiative was directly related to the need to effectively support staff with necessary online resources and reduce access related factors. Student "2" confirmed how a smartphone was given to him and many other students to foster their ability

to join online classes and access learning materials both synchronously and asynchronously. Student 23 recalled; *“I was among the students who were given smartphones to help us join the online teaching sessions, take part in online group discussions, and access videos, audios, and soft copies of handouts”*. The course by leadership to ensure technological tools for staff and students were provided was remarkable noted by the respondents.

Mncube et al. (2021) found face-to-face interaction to be risky and costly during the pandemic, prompting a shift to online platforms for effective resource management. Engaging students and parents online facilitated learning continuity. Provision of synchronous and asynchronous online resources by teachers enhanced student participation, leading to efficient resource utilisation during the pandemic. Teachers, empowered with resources and capacity, and conducted online lessons with fewer challenges promoted effective resource utilisation during the pandemic. This initiative enhanced teachers' ability to engage students synchronously and asynchronously, aligning with literature emphasising HEIs' provision of support materials like computers, internet connectivity, and resource packages for online instruction (Mncube et al., 2021).

ICT-based professional development training: Both students and staff members of the college were reported to have been engaged in teaching-learning ICT-based training to enable lessons continue despite the pandemic. Basic lessons on how to follow and participate on respective online learning platforms was organised for the students. Student “11” reported that, *“the ICT tutors introduced us to Zoom, Google meet and Telegram, and taught us how we can follow lectures on each platform.”* Others also reported that the introductory lessons on how to use these platforms for learning lasted for a week, and it was their first-time gaining knowledge and experience of a different learning strategy other the traditional face-to-face lessons.

The results also revealed that ICT capacity building was organised for staff members to equip them with the necessary knowledge, skills and expertise to effectively use the ICT resources and platforms for effective teaching and learning. A professional based certificate course was rolled out for all faculty members. Staff ‘14’ revealed topical areas learnt during the capacity building which includes; *“how to teach using Zoom, Google meet, and Telegram; online assessment, use of different software for teaching and learning; effective communications on online platforms; and ensuring data safety during online interactions with students”* The efforts to equip the staff on how to use online teaching-learning platforms was reported to help reduced direct interaction between management, teachers, and students. It was also noted to have helped improve the pedagogical practices of teachers, which in turn

facilitated effective resources utilisation during the pandemic. Additionally, staff '31' recounted that the training sessions had helped them engage the students in appropriate assessment processes and evaluation of the learning process.

Capacity building courses aimed to enhance faculty's digital skills for designing, instructing, and evaluating online lessons during the pandemic is an evident practice in literature during the covid-19 era. For example, Ibrahim, Gusau, and Uba (2020) noted significant digital experiences gained by both students and teachers which enhanced professional knowledge, enabled effective engagement with students in the new normal education system, and optimised digital resources for teaching and assessment.

The college's leadership implemented effective resource management strategies during the Covid-19 pandemic, including decentralised distribution and monitoring, technological resource provision, and technology-based professional development for teachers and students. These strategies significantly impacted academic engagements and resource utilisation, maintaining a healthy academic community while sustaining continuous teacher education. The leadership facilitated a seamless transition to online instruction, maximised institutional resources, enhanced engagement, and managed the pandemic challenges effectively.

Management of institutional resources to curb economic down-drum during covid-19 pandemic

The repercussions of the Covid-19 pandemic have exerted considerable economic strain at global, national, and local levels, affecting every institution. To gain insight into how Dambai College of Education managed its available resources to mitigate economic downturn, multiple response items were used to obtain data and analysed using descriptive statistics. The results are presented in Table 3.

Table 3: Management of institutional resources to curb economic down-drum

Management of institutional resources	Staff responses		Students' responses		Overall Mean	
	Mean (%)	SD	Mean (%)	SD	Mean (%)	SD
Cost reduction strategies	85.7	9.02	75.5	5.48	80.6	5.29
Resources optimisation	82.2	9.24	75.7	2.83	78.9	3.32
Promoting efficiency and innovation	88.8	8.10	75.6	5.03	82.2	6.19
Technology maximisation	80.2	9.65	64.5	11.47	72.3	11.33
Overall Mean	84.98	4.43	72.8	5.55	78.5	4.35

Source: Field Data (2021)

The Management of Dambai College of Education demonstrated a strong commitment to maximising institutional resources to bolster the institution's economic stability during the covid-19 pandemic. The average percentage mean for the strategies employed in resource management was about 78.5%, indicating a robust effort to optimise resource utilisation.

Dambai College of Education's management employed various strategies to mitigate the economic impact of the covid-19 pandemic. They notably implemented cost reduction measures (Mean = 80.6, SD = 5.29), including cutting costs related to sporting events, staff meeting allowances, student enrolment, auxiliary programmes, and reallocating resources. This included acquiring cost-effective items like canteen furniture and cooking equipment, sewing new PPE kits and uniforms, and providing subsidised goods like mobile phones for needy students. Additionally, they expanded student

accommodation by constructing an additional hall of residence and established a sickbay through resources from the Students Representative Council.

The multifaceted cost mitigating approach implemented aimed to sustain the economic stability of the institution, which aligns with Tuffour, Cobbinah, Benjamin and Otibua (2021) emphasis of the need of financially prudent strategies during pandemics for efficient resource allocation. Apenteng, Oduro, and Owusu-Mensah (2021) similarly underscored the criticality of strategic resource allocation for institutional sustainability during economic downturns.

Resources optimisation was another vital aspect of managing the economic pressures (Mean = 78.9, SD = 3.32). This approach significantly contributed to cost reduction during the pandemic. It involved improved facility utilisation, strategic procurement of essential resources, repairs of assets ideal for programme execution, and the responsible use of electrical devices.

Efficiency and innovation in resource management played a pivotal role in sustaining the institution's economic strength during the pandemic. The overall mean of 82.2% suggests that innovative and efficient strategies implemented by the Management made a substantial impact in mitigating economic challenges. These strategies included involving student leaders in decision-making processes, fostering collaboration within the college community, ensuring timely completion of academic activities, offering value-for-money engagement, and encouraging healthy competition based on value.

Furthermore, the strategic utilisation of technology reduced the need for physical interactions and direct resource consumption while enhancing accessibility through interactive online learning platforms. The percentage mean for technology maximisation (Mean = 72.3, SD = 11.3) reflects the successful harnessing of technological potential of the College to improve resource efficiency, access, personalised learning, and collaboration during the pandemic. This involved the transition of face-to-face classrooms to online platforms, reduction in textbook and paper-related costs, adoption of online communication channels, and the implementation of user-friendly online assessment methods.

The college sustained its economic strength through effective cost reduction strategies, resource optimisation, innovative resource utilisation, and maximising available technology. Operational efficiency improved by leveraging resources fully and involving student leaders. This approach fostered trust, support, and collaboration within the college community. Technology integration reduced costs, minimised physical interactions, and

enhanced accessibility to online learning materials, showing its importance in reducing institutional costs during the pandemic.

These findings highlight the multifaceted nature of resource management during pandemics, covering financial management, operational streamlining, resource optimisation, innovation promotion, and technology integration. These strategies enable institutions to address pandemic challenges while maintaining their core missions. Owusu-Fordjour, Koomson and Hanson (2020) affirmed that a multidimensional approach is vital for navigating institutional economic challenges, to ensure continuity of academic activities during and after pandemics.

Effect of covid-19 on the College

The covid-19 pandemic which spread quickly across the globe disrupted almost every sector of society including education. Ghana, like many other countries experienced profound impact on its educational institutions including Colleges of Education. Dambai College of Education experienced variant challenges and transformations as it forged strategies of managing teacher education during the covid-19 pandemic. Means and standard deviations were used to report and explain the extent of the effect of covid-19 on the College. The interpretation scale used for the means of the five-point Likert scale was: 1.0 – 1.8 (very low effect); 1.9 – 2.6 (low effect); 2.7 – 3.4 (moderate effect); 3.5 – 4.2 (high effect); and 4.3 – 5.0 (very high effect). Table 4 presents the results of Dambai College of Education staff and students' responses regarding the extent of effect of covid-19 on the College.

Table 4: Effect of covid-19 on the College

Effect of covid-19 on the college	Staff responses (N=14)		Students' responses (N=39)		Overall Mean	
	Mean	SD	Mean	SD	Mean	SD
Disruption in education and socialisation	3.40	.400	3.30	.394	3.35	.385
Curriculum implementation	2.29	.330	2.28	.355	2.29	.345
Access to technological tools	2.14	.287	2.23	.386	2.19	.312

Source: Field Data (2021)

The effect of covid-19 on every industry, and the education inclusive experienced unprecedented effects. The advent of the pandemic commenced with disruption of the education sector where school going children got compelled to stay home in order to manage spread of the virus. Educational

institutions ran into difficulties of maintaining a consistent academic calendar and implementing structured academic curricula across the world. It is reported that the college academic activities were disrupted, and students instructed to go home for a nationwide lockdown. The intended academic calendar was suspended pending return of the students or employ new instructional approaches of which many teachers were unskilled at adapting at the time.

Table 4 present findings indicating a profound disruption in the educational system experienced by the college community (Mean = 3.35, SD = .385) and significantly affected the socialisation experiences of both staff and students. The closure of the college during the global lockdown resulted in keeping one bracket of students at home to give enough space for another group to stay in school. The academic workload of faculty became increased due to the double-tract system instituted. Notably, teacher-student interpersonal relationships and face-to-face interactions, which provide opportunities for guidance and scaffolding during learning, were minimised. Tadesse and Wuluye (2020) reported how the lockdown and distraction of the traditional academic structure widened the social gap between students in urban and rural communities. While urban communities are resourced to adapt quickly to online learning platforms, students in rural areas were unable to access immediate learning opportunities. In Dambai College, these challenges were evident, which caused leadership to collaborate with other institutions to provide mobile phones for needy students to help bridge the gap.

The implementation of the intended curriculum and the necessary time to execute curriculum objectives was a challenge during the covid-19 pandemic. Staff members highlighted time constraints in completing course objectives, due to the quick transitioning from traditional to technology-driven instruction. The mean score (Mean = 2.29, SD = .345) indicates a moderate acknowledgment of this challenge in adapting to the pandemic's impact. Similarly, the students expressed challenges of adapting to the new normal of unavailable hardcopy handouts, and their immediate inability to effectively use the synchronous and asynchronous learning resources. Specifically, it was reported that engaging students in practical learning activities and having enough group discussions were significantly reduced. In similar findings, Mahaye (2020) posited that about 14% of annual school curriculum coverage was lost due to the mandatory lockdown of schools to be reopened gradually in phases. To recover losses in academic work after the lockdown, Management in collaboration with SRC adapted to canteen dining system which made combination of lecture periods of students and their feeding more flexible, reliable and accessible.

The effect of covid-19 on the college included technological challenges, such as limited laptops for staff and students' inability to access smartphones for online learning. While central computers were provided for staff, inconveniences arose, causing interruptions during online lessons and limited accessibility. This led to rescheduling lessons and instructional time loss. Additionally, some staff and students struggled to operate effectively in the digital academic environment, requiring support from peers.

The covid-19 pandemic had a notable effect on Dambai College of Education, with both staff and students perceiving significant changes. Challenges included disruptions to the education system, curriculum implementation issues, and limited access to technology for some staff and students. However, the pandemic also prompted administrative collaborations, skill development, resource reallocation, and infrastructure construction. Overall, it had both negative and positive effects, highlighting the dual nature of effect on educational institutions like Dambai College of Education.

Key findings

This study was a path of inquiry to unearth managerial strategies adopted to manage Dambai College of Education during the covid-19 pandemic. From the results, the following key findings were realised.

Strategies leadership adopted to manage staff and students during the covid-19 pandemic:

1. There was adequate provision of personal protective equipment to the college community through governmental and non-governmental agencies.
2. The College management instituted a transparent communication system that enhanced accessibility and prompt feedback between leadership and the college community members.
3. Strategic welfare mechanisms were established which demonstrated the relevance of social support systems including the transition of students' dining system, and alternative use of resources for covid-19 sickbay.

How staff and students were engaged to ensure effective and efficient use of resources:

1. Implementation of a decentralised mechanism of resources distribution to ensure equity in accessibility.
2. Staff were provided with computers at defined locations and internet connectivity to facilitate online teaching and learning.
3. Smart mobile phones as well as internet connectivity was provided for needy students to support them access online teaching and learning resources.

4. Technology-based professional development programmes were designed and rolled out for teachers towards enhancing digital skills and competence.
5. Some staff and students had some challenges in effective use of digital and technological tools.

How institutional resources were managed to avoid economic downturn:

1. Adoption of cost reduction strategies were employed through reducing expenses on sports and staff allowances as such personnel related activities went down leading to budgetary allocation virement, suspension of auxiliary programmes, and acquisition of cost-effective items at subsidised prices.
2. Optimisation of resources was ensured through improved facility utilisation, strategic procurement of essential resources and assets such as canteen furniture, additional student hostel construction, Students Representative Council Sickbay construction, repairs of assets ideal for programme execution- renovation of science laboratory block into a more useful space, and the responsible use of electrical devices.
3. Innovative and efficient resource management approaches adopted such as transitioning traditional students dining system into canteen service where meals were taken in a more flexible and lecture schedule friendly manner from 6:00 am -10: am for breakfast, 12:00 pm - 2:00 pm for lunch and 4:00 pm - 6:00 pm for supper respectively to replace the one-time allotted dining period which often posed challenges to managing lecture schedules of individual programmes and students.
4. Effective time and other resource management system introduced ensured good level of satisfaction in academic engagement, offered value-for-money engagement, and encouraged healthy competition based on value.
5. Resources were managed through innovative maximisation of technology in reducing the need for physical interactions and direct resource consumption while enhancing accessibility through interactive online learning platforms.

Effect of the covid-19 pandemic on Dambai College of Education

1. The traditional academic calendar of the College was interrupted due to the nationwide lockdown.
2. Timely completion of annual teaching curriculum and course outlines was hampered.
3. Students were challenged in procuring smart mobile phones and teachers were concerned about visiting a central point to access technological tools.

4. Some staff and students had difficulties in operating effectively in the digital academic world though the period presented a unique opportunity for many staff and students to develop their digital skills.
5. The covid-19 pandemic also presented the challenge to College Management to rethink and adopt innovative ways of providing student's services which brought improvement on the administrative engagement of the institution including cost reduction strategies.

Conclusion

The College experienced variant challenges and transformations in the peak period of the covid-19 pandemic. Thus, the pandemic was a double-edged sword as it presented both challenges and opportunities in the operations of the College. It created substantial disruption in the regular mode of curriculum implementation due to nationwide lockdown and yet created opportunities for innovations. The strategies employed, provision of personal protective equipment to students and staff through statutory and ad hoc committees and transparent effective communication fostered a shared sense of responsibility and belongingness in addressing psychological and emotional impact of the pandemic. Decentralised distribution of resources, technological resources provision and technology-based professional development were adapted to ensure efficient resources utilisation. Though technological resources were leveraged on, and digital skills enhanced through professional development which helped the College to transit into online instruction and maintained academic engagements amidst the pandemic, some students and staff faced difficulties in managing teaching and learning effectively in their programmes of study / delivery due to deficiency in digital and technological competencies. Thus, improving digital skills of staff and students to enhance technological integration in new pedagogical and assessment approaches is needed.

Recommendations

1. The decentralised strategy of resource appropriation fostered equity in accessibility. It is thereby recommended that the College management should maintain statutory and ad hoc internal crisis and emergency management committees to monitor and manage safety, and health related challenges within the institution.
2. Deficiencies in technological resources and digital skills was reported. It is therefore recommended that management engages in procurement of additional requisite technological resources. A user friendly and secured information and online learning management system (LMS) is recommended to be designed for the College to provide space for post-covid-19 blended (face-to-face and online) teaching approaches.

3. The design and implementation of continuous professional development programmes by the College ICT unit on technological competence for staff should be continued to improve the digital skills of both staff and students.
4. It is recommended that leadership of the College continue to prioritise proactive communication and welfare mechanisms, and collaborative resource management strategies to sustain resilience and supportive academic environment in future crisis.

Ethical Statement

The study which involved human participants were reviewed and approved by the Council of the Dambai College of Education. The participants provided their written informed consent to participate in this study.

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Conflict of Interest

The authors affirm that there is no conflict of interest with regards to the publication of this article.

Authorship Contribution Statement

Atiku: Concept and design, data acquisition, critical revision of manuscript, supervision and final approval. Gozah: Data acquisition, critical revision of manuscript and supervision. Erebakere: Literature review, data analysis / interpretation, and drafting manuscript.

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Generative AI Statement

As the authors of this work, we minimally used the AI tool (ChatGPT) for the purpose of summarising. After using this AI tool, we reviewed and verified the final version of our work. We, as the authors take full responsibility for the content of our published work.

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