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The Impact Of The Covid-19 Pandemic On Teaching And Learning At The School Of Nuclear And Allied Sciences (SNAS)

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Abstract
In response to the global COVID-19 pandemic, many countries implemented school closures to contain virus transmission. At the School of Nuclear and Allied Sciences (SNAS), traditional in-person instruction was rapidly replaced with remote learning modalities. This report evaluates the impact of the COVID-19 crisis on teaching and learning at SNAS, focusing on the challenges encountered, digital tools employed, and the effectiveness of online instruction. Data were collected using a structured electronic questionnaire distributed to both students and lecturers. The survey combined multiple-choice and open-ended questions to assess user experiences, accessibility, and engagement. Results reveal heterogeneous impacts influenced by socioeconomic and technological factors, highlighting critical implications for digital education transformation.
Keywords*: online learning, COVID-19, higher education, Ghana, SNAS, e-learning platforms*

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I. Introduction

School of Nuclear and Allied Sciences (SNAS).

The School of Nuclear and Allied Sciences (SNAS) was established in 2006 through a collaborative effort between the Ghana Atomic Energy Commission (GAEC) and the University of Ghana, with support from the International Atomic Energy Agency (IAEA). SNAS serves as a pivotal institution for postgraduate education in nuclear science and technology, aiming to develop human resources to support Ghana's nuclear energy ambitions and to preserve nuclear knowledge within the region.

SNAS offers a range of postgraduate programs, including twelve Master of Philosophy (MPhil) and four Doctor of Philosophy (PhD) courses, alongside an IAEA-sponsored Postgraduate Education Course (PGEC). These programs are designed to equip students with the necessary expertise in various nuclear applications, ensuring a steady pipeline of qualified professionals in the field.

The onset of the COVID-19 pandemic in March 2020 posed significant challenges to educational institutions worldwide, and SNAS was no exception. Government-imposed lockdowns necessitated a swift transition from traditional in-person instruction to remote learning modalities. This abrupt shift highlighted existing disparities in digital infrastructure and preparedness, underscoring the need for strategic planning to enhance the resilience of educational delivery in the face of such disruptions

II. Preamble To Study

The School of Nuclear and Allied Sciences (SNAS), which offers twelve Master of Philosophy (MPhil) and four Doctor of Philosophy (PhD) programs across five academic departments, along with an IAEA-sponsored Postgraduate Education Course (PGEC), faced severe disruption during the COVID-19 pandemic. With the imposition of national lockdowns, all in-person academic activities were abruptly suspended. International students were repatriated, and the institution was compelled to transition to online teaching with minimal preparation. This sudden shift exposed significant challenges related to digital infrastructure, instructional continuity, and academic engagement, underscoring the urgent need to assess the impact of remote learning on the quality and accessibility of education at SNAS.

III. COVID-19, Over View

The corona virus disease, otherwise known as COVID-19, is an extremely communicable and pathogenic viral infection caused by severe acute respiratory syndrome corona virus 2 (SARS- CoV-2), which emerged in Wuhan, China in December 2019 (Park, 2020) and has spread to almost all the countries in the world (Shereen et

al., 2020). The transmission of the virus is through touching of the nose, eyes, or mouth by a finger that has been contaminated through droplets on a surface when a carrier sneezes or coughs (Parvin et al., 2020). Since the existing teaching and learning devices are predominantly contact based, it implies that they can aid in the transmission of the virus. The need to change focus and orientation towards contactless teaching and learning technologies as sure solution to the fear and animosity expressed towards contact-based classroom learning and contactless techniques were developed to protect lives and to promote the safety of both teachers and students. Some of these new normal teaching and learning techniques have taken the world by surprise and little is known about the impact of COVID – 19 on teaching and learning activities of students in Ghana. There is therefore the need to evaluate the impact of COVID-19 pandemic on teaching and learning at SNAS.

Consequences of COVID-19 on Teaching at SNAS

Ghana recorded its first 2 cases of COVID-19 on 12 March 2020 (Afriyie et al., 2020) and our management had decided to prevent rather than cure COVID – 19, to protect the life of every worker by issuing a directive that stated that 'Due to the uncertainty surrounding the spread of the novel corona virus diseases (COVID-19), Management has decided that the use of biometric system attendance books should be suspended until further notice". Countries all over the world warned the public to exercise caution because infection rate is very high and over 4.312902 million deaths were recorded worldwide. In Ghana, from 3rd January 2020 to 11 August 2021, there have been 108,677 confirmed cases of COVID-19 with 880 deaths (Source: https://covid19.who.int/region/afro/country/gh,8/12/2021). The President of Ghana (Nana Akufo- Addo) was emphatic on curbing the spread of the new corona virus by making a profound statement that "We know how to bring the economy of Ghana back to life, what we do not know is how to bring people back to life" (Akuffo-Addo, 2020), so we should stay at home and observe all COVID – 19 protocols because it was based on SCIENCE. This statement had received worldwide attention (Antwi- Boasiako & Nyarkoh, 2020). Handwashing, wearing face masks, physical distancing, and avoiding mass gatherings and meetings were used as public health protocol for managing the disease. To mitigate the spread of the disease, lockdown, and stay-at-home policies were issued worldwide (Mwainyekule & Frimpong, 2020). Due to the pandemic, the government of Ghana declared a lockdown in some parts of the country on 16th March 2020 which led to the closure of Academic Institutions including Universities (Owusu-Fordjour, et al., 2020). This was necessary by then because early lockdown and strict enforcement were the most effective strategies available to limit virus spread (Guzzetta et al., 2020; Cheng & Khan 2020). Moreover, the virus has no leg, it uses humans to spread. The lockdown was necessary evil because analysts opined that the entire eurozone will experience the largest recession since its creation in the late 1990s. Germany, France and Italy, the three largest economies in the monetary union, have all entered into economic recession, with Eurostat recording an even bigger drop in gross national product (GDP) compared to what markets expected (Maqbool & Khan, 2020; Leung et al., 2020; Chan et al., 2020). In no uncertain terms, Ghana's weaker economy shrank as lockdown continued to affect various aspects of our life, including all levels of the educational system: from pre-school to tertiary education. No wonder, on the 5th of October 2020, restrictions were lifted, and Universities were authorized to resume teaching and learning. One of the conditions for resumption was to have most of the lectures carried on online. This plunged both the lecturers and students into online teaching and learning with very little technical preparation. In addition, there was no harmonization approach to the utilization of the online tools. Consequently, diverse online tools were used depending upon the preferences and the technical backgrounds of lecturers. The above situation had its attendant problems and challenges of implementation. There is therefore the need to access the impact of online teaching and learning to find out lessons that have been learned to improve it as a regular channel for teaching and learning.

IV. Literature Review

The outbreak of COVID-19 in early 2020 precipitated an unprecedented global disruption to higher education, compelling institutions worldwide to rapidly transition from traditional face-to-face instruction to online learning modalities (Crawford et al., 2020). This sudden shift was driven by the need to ensure continuity of education while adhering to public health measures such as social distancing and lockdowns. In this context, evaluating the implementation of online teaching and learning becomes crucial, especially in specialized institutions like the School of Nuclear and Allied Sciences (SNAS), where practical and theoretical components are integral to academic success.

Appraisal of Online Tools Applied During the Pandemic

A prominent aspect of the transition involved the adoption of various digital tools to facilitate instruction, communication, and assessment. Globally, platforms such as Zoom, Microsoft Teams, Google Meet, and WhatsApp emerged as primary channels for live lectures, discussions, and quick dissemination of materials (Bozkurt et al., 2020). For instance, in the Ghanaian context, studies have shown that Zoom was favored for its user-friendly interface despite initial technical limitations (Agyeman & Andoh, 2021). Similarly, in SNAS, the

utilization of Zoom, WhatsApp, and email was reported as prevalent, aligning with findings from other higher education settings where these tools provided accessible means for synchronous and asynchronous engagement (Kibui et al., 2021).

While platforms like Sakai, an LMS used at SNAS, offered institutional support, their usability issues—such as complex login procedures and limited functionality—hampered effective deployment (Almarash, 2020). The efficacy of these online tools depended heavily on their accessibility, reliability, and the digital literacy of both students and lecturers. The effectiveness of online tools in higher education during the pandemic has been linked to the capacity of institutions to select platforms that are adaptable to pedagogical needs and user competencies (Garrison & Kanuka, 2004).

Problems and Challenges Encountered in the Utilization of Online Tools

Despite the promising potential of digital tools, numerous challenges impeded their effective implementation. A recurring theme in the literature is the issue of inadequate digital infrastructure. Many students and faculty in developing countries, including Ghana, faced difficulties due to poor internet connectivity, limited access to devices, and high data costs (Crawford et al., 2020; Adarkwah, 2021). At SNAS, similar problems were observed, with some students unable to afford smartphones or stable internet, thus experiencing restricted participation.

Technological literacy and usability issues further compounded these challenges. Platforms like Sakai, though functional, were often not user-friendly, necessitating additional training for effective utilization (Almarash, 2020). The abrupt transition also exposed the limitations of online assessments, with concerns about academic integrity, standardization, and the inability to replicate laboratory or practical components online, especially relevant to SNAS's emphasis on practical training in nuclear sciences (Hodges et al., 2020).

Furthermore, socio-economic disparities significantly affected engagement levels, with students from less privileged backgrounds facing greater obstacles in accessing online education. This digital divide was particularly stark in resource-limited settings and turned into a barrier to equitable learning (Kibui et al., 2021). Connectivity issues, coupled with the high cost of data packages, resulted in inconsistent participation and reduced motivation among students, thereby impacting the overall quality of online teaching.

Lessons Learned from the Transition to Online Education

The pandemic underscored the importance of preparedness, flexibility, and inclusivity in digital education. Research indicates that institutions that invested in capacity-building for both lecturers and students—such as training on digital tools and online pedagogies—were better positioned to adapt to remote instruction (Adarkwah, 2021). Moreover, the need for user-friendly, reliable platforms that support interactive and practical learning is emphasized across studies (Garrison & Kanuka, 2004; Bozkurt et al., 2020).

SNAS's experience highlights that online teaching should not be viewed solely as a contingency but as a complementary component of the educational ecosystem. The lessons learned include the necessity of developing institutional policies that ensure equitable access, continuous professional development, and technical support. The importance of blended learning models—combining online and face-to-face instruction—was also reinforced as a way to mitigate the limitations of purely online approaches, particularly for practical and laboratory-based courses (Garrison & Kanuka, 2004).

V. Research Objectives

The overall objective of the survey is, therefore

To evaluate the implementation of online teaching and learning at SNAS during the COVID-19 pandemic period.

Specifically, it seeks to:

- appraise the online tools applied during this period
- assess problems and challenges encountered in the utilization of the online tools
- draw out lessons learned and make recommendations for effective implementation of online teaching and learning.

VI. Methodology

Study Design

This study utilized a descriptive survey approach to evaluate the impact of COVID-19 on teaching and learning at School of Nuclear and Allied Science University of Ghana Atomic Campus. Both qualitative and quantitative data were collected through structured questionnaires.

Instrumentation

Questionnaire Survey

Formulation of Questionnaire

In the formulation of the questionnaire the primary method used was multiple choice questions in the form of:

a) Single answer multiple-choice questions
b) Multiple answers multiple choice questions
c) Open-ended questions

The 22 questions, among others, sought to determine whether:

- Respondents were lecturers or students
- Online tools utilized
- Frequency of utilization
- Internet connectivity issues
- Cost of data for internet connectivity
- Problems and challenges

Examples of the questions developed is as shown in Appendix 2.

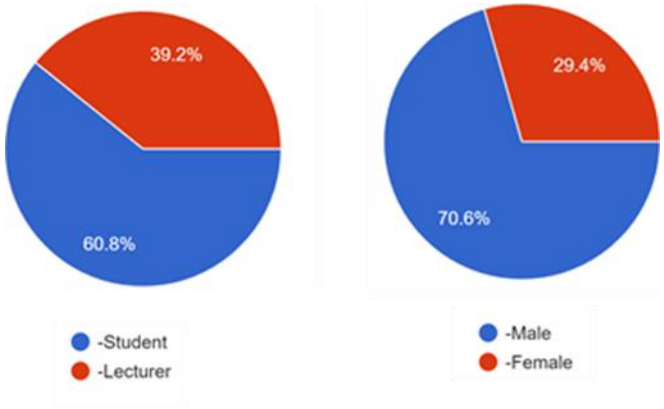
Distribution of Questionnaire

The questionnaire was delivered online through the WhatsApp addresses of the respondents.

The targeted groups were lecturers and students of SNAS. Completed questions by the respondents were similarly returned online to the author's email. Questionnaires were sent to seventy (70) persons including lecturers and students and data capture was 72.85

VII. Results And Discussions

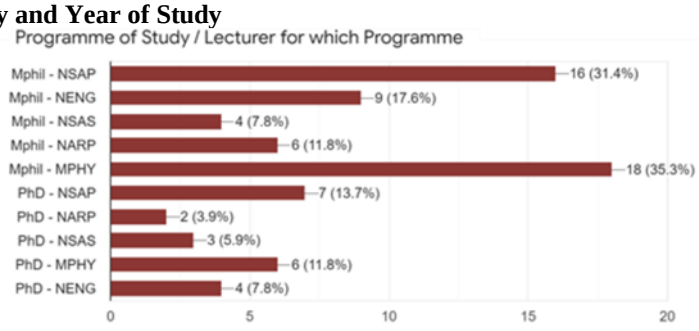
Demographic Characteristics

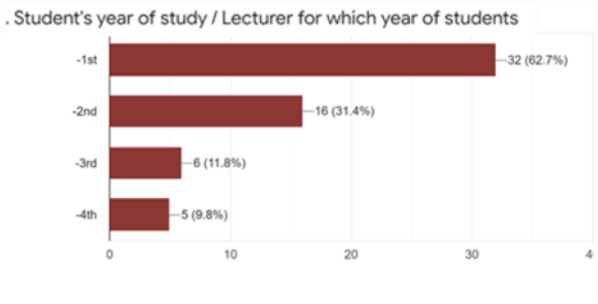


Demographics Characteristics

Lecturers constituted about thirty-nine percent (39.2%) of the respondents whilst students constituted sixty-one percent (60.8%). Out of the eighteen (18) lecturers who participated in the survey, 27.8% were females whilst 72.2% were males. Out of the thirty-three (33) students who responded, 30.7% were females whilst 69.7% were males. Twelve percent (12.1%) of the students were Ph.D. students whilst 87.9% were studying for their MPhil. The MPhil students were composed of 30.3% and 69.7 % respectively of female and male students. The Ph.D. students were all males (100%).

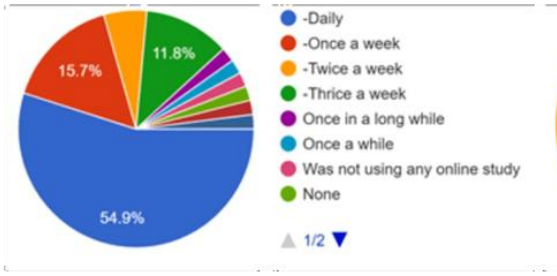
Programmed of Study and Year of Study



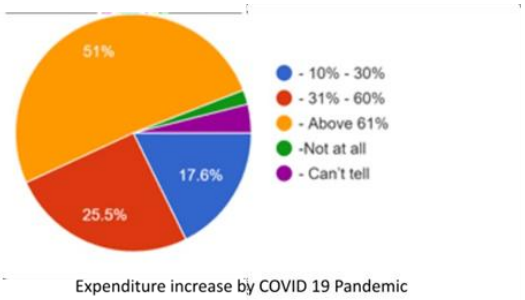


The majority of the student respondents were first-year students. This was followed by those in their second year. The next were those in their fourth year who were entirely Ph.D. students. The majority of the respondents were from either Nuclear Sciences and Applications Department or Medical Physics Department.

On-line Teaching

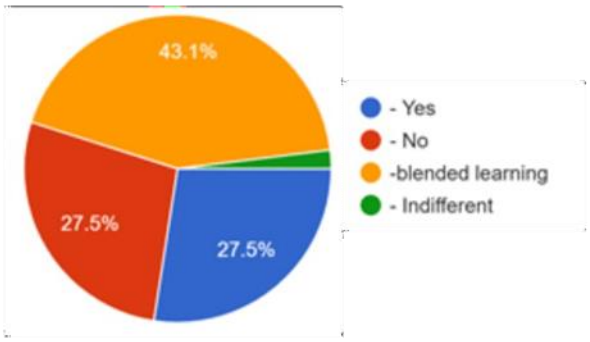


Internet usage before COVID 19 Pandemic

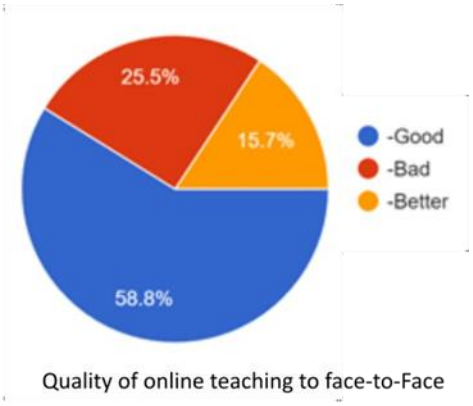


Expenditure increase by COVID 19 Pandemic

Most students and lecturers were using the internet on daily basis before the onset of the COVID-19 pandemic (probably for research and assignments). However, during the lockdown, these students and lecturers relied exclusively on the internet which increased their expenditure on data above 60%.



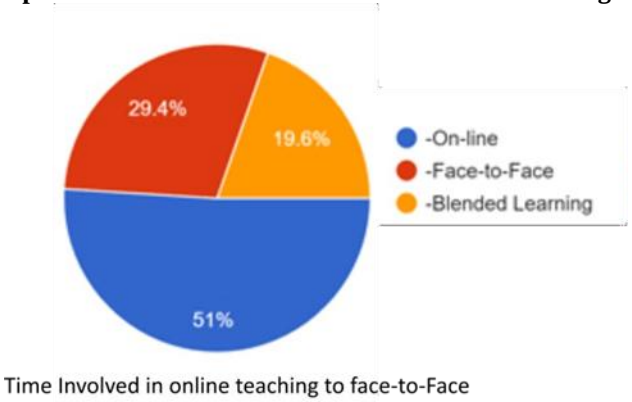
Percentage of respondents who want on-line teaching to continue after the pandemic



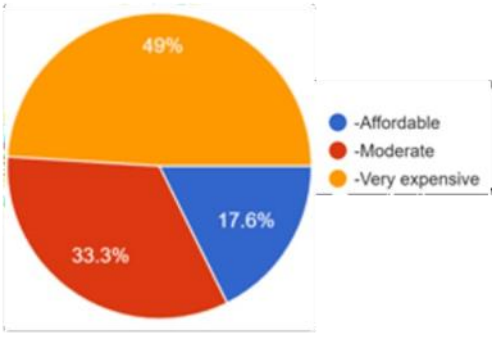
Quality of online teaching to face-to-Face

The majority (58.8) of the respondents believed that the quality of online teaching was good. One-third of respondents want online teaching to continue after the pandemic

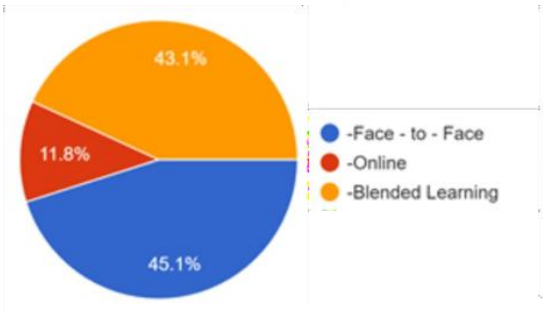
Comparison between On-line and Face-to-Face Teaching



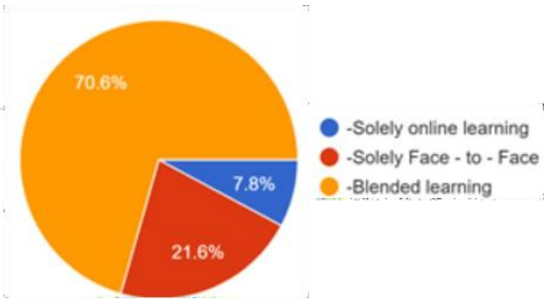
Time Involved in online teaching to face-to-Face



The cost of online teaching to face-to-Face



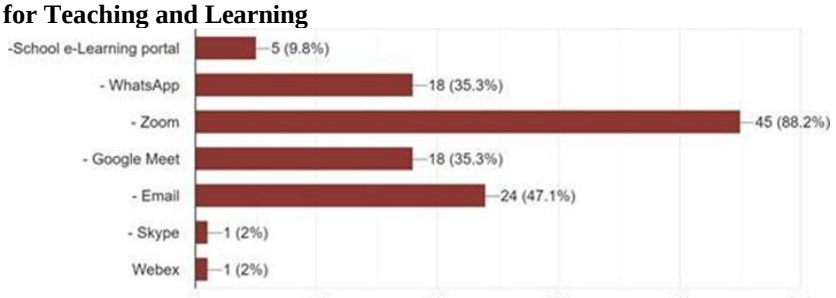
Teaching Methods that Respondents Prefer

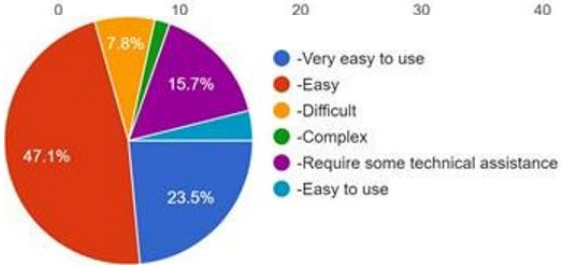


Respondents ratings on the best teaching Method.

According to the respondents:
- Online teaching requires more time than Face-to-face teaching
- On-line teaching is expensive as compared to Face-to-face teaching
- Over 45% of respondents prefer Face-to-face teaching to online teaching
- The majority (70.6%) of respondents want the two methods to be run concurrently after the pandemic

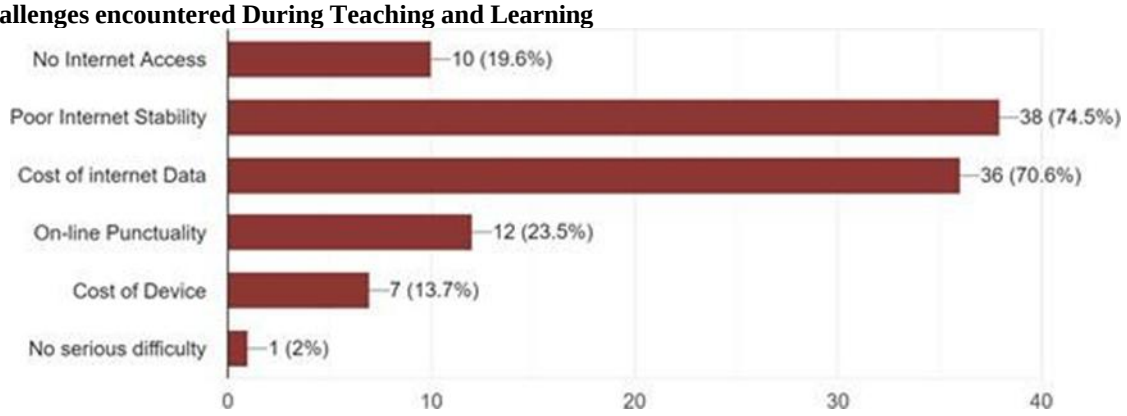
ICT Tools used for Teaching and Learning





The following ICT tools were the top go-to tools for delivering and accessing online courses during the Pandemic (Sakai, Zoom, Google Meet, WhatsApp, Skype, Webex, and Email) our study shows that the majority (88.2%) of respondents used Zoom video conferencing app as it was very user friendly even though it was not meant to be used for online teaching. The next tool that was mostly used was an Email Account. It was a means of delivering teaching or course materials to students. WhatsApp and Google Meet was the third most used Apps for instant delivery of course materials and live lecture streams. Sakai being the main school E- learning platform had the least usage; students and lectures complained it was not user-friendly. A few others scarcely used Skype and Webex for video conferencing.

Challenges encountered During Teaching and Learning



- Both students and lecturers were ill-equipped to cope with the sudden migration to online teaching /learning.
- Internet bandwidth was limited, with fewer access points, and data packages were expensive in comparison to people's income, limiting connectivity and affordability.
- Students were assessed online, which involved a lot of trial and error, as well as ambiguity and confusion among lecturers and students.
- Lectures indicated it was a problem getting 100% of students online; about 40% - 60% were able to make it online.
- Both students and lecturers complained the Sakai E-learning platform lacks functionality and was complicated to use, or not user-friendly.
- Some common issues were:

i. Some lectures were not able to upload simple course materials or files.
ii. login process to the platform was difficult

- Practical work was challenging for both lecturers and students online
- Some students did not have the right device and equipment to access and join online lectures because they could not afford them.

VIII. Conclusions And Recommendations

Before the COVID-19 pandemic, traditional face-to-face classroom meetings were the primary and preferred mode of instruction in universities, including SNAS. Many students regarded in-person learning as the most effective and engaging method, valuing direct interaction with instructors and peers. Regular attendance facilitated active participation, immediate feedback, and dynamic discussions, which helped students organize their learning, understand complex concepts, and foster peer-to-peer collaboration. This mode of instruction also allowed teachers to better understand student personalities, identify learning gaps, and tailor their teaching approaches accordingly.

However, the onset of the COVID-19 pandemic abruptly shifted the educational landscape, compelling institutions like SNAS to adopt online teaching modalities to ensure continuity. This transition exposed both opportunities and significant challenges. The appraisal of online tools revealed that digital platforms such as Zoom, WhatsApp, email, and LMS like Sakai played crucial roles in maintaining instructional activities. Nonetheless, their effectiveness was often limited by infrastructural deficiencies, usability issues, and socio-economic disparities affecting students' access to devices and reliable internet.

Key Strategies For Sustainable Online Education Post-Pandemic: Emphasizing Planning, Capacity Building, And Infrastructure Investment.

Invest in Digital Infrastructure: Substantial investment is needed to improve internet accessibility and affordability, including providing devices to disadvantaged students to bridge the digital divide (Crawford et al., 2020).

Enhance Capacity Building: Prioritize training programs aimed at improving digital literacy and pedagogical skills among lecturers and students, enabling them to navigate online platforms effectively and engage meaningfully (Adarkwah, 2021).

Select and Customize User-friendly Platforms: Institutions should focus on choosing and tailoring online platforms, such as optimized LMS, that facilitate smooth content delivery, interaction, and assessment, reducing barriers caused by technical complexity (Almarash, 2020).

Redesign Curriculum Content: Courses should be adapted to include interactive activities, simulations, and practical exercises that can be effectively delivered online, boosting learner engagement and understanding

(Garrison & Kanuka, 2004).

Develop Inclusive Strategies: Policymakers must implement policies that address socio-economic disparities, ensuring equitable access to online learning resources and opportunities for all students, regardless of their background.

Implement Continuous Feedback Mechanisms: Regular evaluation of online teaching methods and tools should be institutionalized, allowing iterative improvements based on user experiences and emerging challenges.

Conclusions

Students and faculty went about their businesses until the COVID-19 pandemic took over and forced everyone to sit at home. The pandemic compelled students to learn how to interact and learn virtually.

Students were used to the traditional learning method of face-to-face interaction with their professors and colleagues because for them that was the best way to learn. The onset of the COVID-19 pandemic pushed the lecturers and students abruptly into the virtual world with no real concept of what will come next. The COVID-19 pandemic exposed the need for digital learning. However, the learning and teaching via the online platforms saved time and energy commuting between one's home and campus, which were considered more convenient for some of the stakeholders relative to the in-person arrangement.

There were significant differences in the reactions to the lockdowns by lecturers and students. Whereas some students indicated that they were not satisfied, an equal number also opted for online teaching.

The effect of COVID-19 on students' achievement is likely to vary according to socio- economic status. Students from less advantaged backgrounds are likely to experience a larger decline in learning compared to their more advantaged counterparts.

The COVID-19 pandemic has taught us that teachers and students/learners should be trained on how to use various online educational resources. When regular classes resume following the COVID-19 pandemic, teachers and students should be encouraged to continue using online resources to improve teaching and learning.

With a third wave of the pandemic raging again as of June 2021, it is obvious that universities need to be mindful of the many impacts the pandemic will have on their operations at present and in the future.

Experience Gained

The majority of students are likely to suffer a setback in their learning patterns. Despite the widespread move to online teaching, students' progress will not simply be the same as if schools were open.

One item that deserves mentioning is that people have been required to remain at home and avoid contact with third parties; this means that an opportunity is given for quality family time.

The effect of COVID-19 on students' achievement is likely to vary according to socio- economic status. Students from less advantaged backgrounds are likely to experience a larger decline in learning compared to their more advantaged counterparts.

Recommendations

- The COVID-19 pandemic has taught us that teachers and students/learners should be trained on how to use various online educational resources. When regular classes resume following the COVID-19 pandemic, teachers and students should be encouraged to continue using online resources to improve teaching and learning.
- There should be a review of content delivery of the ways lectures are organized and held e.g. greater use of online activities including Seminars and other social events to make it more creative, innovative and interactive.
- There is the need to balance the use of both teaching methods to tap the benefits in both
- The affordability and accessibility of educational tools for all learners from various economic backgrounds has been described as a challenge, for which educational tool developers should concentrate on customization.

Acknowledgement

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Conflicts Of Interest

The author declares that there is no conflict of interest

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