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Towards best practices in digital content development and pedagogy: A comparative study of opportunities and challenges in United States International University-Africa and Kwame Nkrumah University of Science and Technology

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A joint research between

United States International University-Africa
and
Kwame Nkrumah University of Science and Technology

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ABSTRACT

The increased uptake of online education in developing nations due to the COVID-19 pandemic has made online content development and delivery an area of focus as institutions establish quality online education. Studies indicate the importance of quality content development and delivery to satisfy a new demand for online education. This study sought to investigate the status of online education in two institutions and looked out for the opportunities and challenges in online content development and delivery. The challenges included; little exposure and little experience in proper online content development and delivery coupled with poor internet access and the need for enhanced faculty training toward best practices in online education. There in the challenges lie great opportunities for those who wish to get involved in online education in developing nations such as Kenya and Ghana where this study took place. Successful online education will take the collaboration of many stakeholders such as telecommunication companies, governments, learning institutions, and non-governmental stakeholders where each will play a crucial part in creating an enabling environment for best practices.

Keywords: Content development, Online Education, online content delivery, Higher education institutions

EXECUTIVE SUMMARY

This study came about as a result of the Mastercard Foundation e-Learning Initiative which is an off-shoot of the Mastercard Foundation Scholars Program. The e-Learning Initiative came up as an intervention during the COVID-19 pandemic upon the realization that many institutions of higher education hosting the Mastercard Foundation Scholars Program struggled to offer online education. Learning institutions especially in developing countries were caught off-guard and struggled to train teaching and non-teaching staff for online teaching and learning. Some of the institutions had Learning Management Systems (LMS) while others needed to acquire the basic technologies to facilitate the move to Emergency Remote Teaching and Learning (ERT&L) under the new circumstances they found themselves in.

Under the Mastercard Foundation e-Learning Initiative, it became necessary to investigate how participating institutions were faring in the space of online teaching and learning. Thus, this comparative research sought to investigate the opportunities and challenges of online learning in USIU-Africa and KNUST; two participating institutions under the e-Learning Initiative. The researchers found that faculty members have had little exposure to ERT&L as well as proper online content development and delivery. On the other hand, students have a positive outlook towards online education, indicating the newly found realization of its possibilities especially flexibility in online education.

The necessity for instructor training is both a challenge and an opportunity towards the provision of high quality online education in institutions of higher learning in Africa. Numerous interconnected factors contribute to the provision of high-quality online education. Notably, faculty training plays a pivotal role in shaping the utilization of the institutional Learning Management System (LMS) and associated technologies for online learning. The ways in which the LMS and other integrated technologies are used is a key determinant of success in online education. The findings of this study have the potential to establish a foundation for best practices in online learning within the African context.

ABBREVIATIONS AND ACRONYMS

COVID-19	Corona Virus Disease of 2019
CUE	Commission for University Education
ERT	Emergency Remote Teaching
ERT&L	Emergency Remote Teaching and Learning
IRB	Institutional Review Board
KNUST	Kwame Nkrumah University of Science and Technology
LMS	Learning Management System
MCFSP	Mastercard Foundation Scholars Program
NAB	National Accreditation Board
NACOSTI	National Council of Science, Technology and Innovation
SME	Subject Matter Expert
STEM	Science, Technology, Engineering and Mathematics
USIU-Africa	United States International University – Africa
WASC	Western Association of Schools and Colleges

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PROJECT DESCRIPTION

Project Background

Africa is characterized by the utmost educational needs and high rates of educational exclusion. However, there is enormous potential in online education because it is more accessible, both in terms of cost and by providing access in areas where it was impossible to reach out to the distance learner (Rwirahira, 2018). Harnessing this potential means that higher educational institutions need to acclimatize to how they deliver online teaching and learning in response to an unparalleled learner expectation (Cisco, 2017). This dire necessity to adapt has not only brought many challenges to higher educational institutions but also many new affordances. Amid these affordances, online instructional content should be cautiously designed to take into consideration not only the validity of the content itself, but also the efficiency of the content in terms of the context within which the online pedagogical activities will take place. Ironically, even if instructional content has been sufficiently contextualized, it might need to be modified further before it would be appropriate in another context.

Over the years, the number of online courses has increased (Allen & Seaman, 2008; Sugar, Martindale, & Crawley, 2007; Wait & Lewis, 2003). As the number of online courses and student enrolment continue to rise, higher education institutions must also be willing to tackle associated challenges. Some of the challenges have to do with online content development while others have to do with online content delivery. Even though some successful e-learning implementation and capacity building experiences have been reported (Davis & Surajballi, 2014; Deepwell, 2007; Deepwell & Beaty, 2005; Deepwell & Syson, 1999; McGill, Klobas, & Renzi, 2014; Raspopovic, Jankulovic, Runic, & Lucic, 2014), many institutions have experienced setbacks and failures (Keegan et al., 2007). Very few instructors in higher education institutions have experienced any form of online education on how to develop standardized online content. This has resulted in a reduction in the perceived usefulness of online instructional content and a subsequent reduction in student impetus to learn in online environments. Traditionally, faculty members in higher education are Subject Matter Experts (SMEs) who are not necessarily equipped with pedagogy and this complicates online content development and delivery.

Problem statement

Digital technologies have become indispensable in the delivery of instruction in higher education across universities in the world. There are expectations for policymakers and educators to

integrate digital technologies into teaching and learning. Learners are expected to develop capacities for effective participation in blended and online learning. This call was renewed when the COVID-19 pandemic forced almost all academic institutions to go online to continue academic activities. Large public universities in Africa struggle to exploit online teaching and learning, not to mention academic assessments. Stakeholders in higher education including governments and external partners such as Mastercard Foundation Scholars Program (MCFSP) became aware of challenges facing the e-Learning ecosystem. MCFSP recognized the disruption caused to education by the pandemic in partner universities across the world and introduced an intervention dubbed the *e-Learning Initiative* to better enable the development and delivery of online courses, mentoring and student outreach. Their intervention is aimed at deepening the capacity of institutions and building their resilience to recover and respond better to future crises.

As part of the intervention the participating universities have nominated e-Learning champions to be trained as instructional designers and online pedagogy experts in their respective institutions. This was because of a rapid needs assessment survey of 22 universities (11 African and 11 non-African) in the MCFSP network that revealed that, majority of African universities have very limited e-Learning capability. Other major constraints identified include connectivity, access to devices, electricity, and cost of access. It is also emerging in interactions amongst participating African universities that the respective institutions have different practices around the design and delivery of online instruction. Universities are having varying degrees of success with their efforts to transition to online learning and related support services for effective, efficient, and engaging learning without any documented best practices so far.

For e-learning to be successful in any higher educational institution, it requires competent staff, robust instructional design, strong online pedagogical practices and adequate infrastructure. An understanding of the differentiated online pedagogical practices would provide an empirical knowledge base for African universities to develop capacities rapidly and enhance institutional processes to facilitate the transformation of face-to-face lecture instruction to online suitable instruction for effective and engaging learning.

Context and Rationale

This study took place in two institutions of higher learning; United States International University-Africa (USIU-Africa) and Kwame Nkrumah University of Science and Technology (KNUST). USIU-Africa is a private university in Nairobi, Kenya while KNUST is a public university in Accra, Ghana. Both institutions are active participants in the Mastercard

Foundation e-Learning Initiative and have comparable Science, Technology, Engineering and Mathematics (STEM) related courses.

USIU-Africa was founded in 1969 and has remained a relatively medium sized private higher learning institution while KNUST is an expansive public university and is the largest university in the Ashanti region of Ghana. According to Wikipedia, USIU-Africa has about 8,500 students in five schools while KNUST has over 100,000 students in both undergraduate and postgraduate courses in five colleges. The administrative organization of the two universities in this study differs substantially.

Online pedagogical approaches and content development in higher education are gaining traction in Africa. Governments and higher education institutions in recent times are investing in digital infrastructure and building capacities to enhance online teaching and learning to make the online learning environment effective at delivering learning outcomes at par with traditional face-to-face classroom-based education. The changing educational landscape as a result of the pandemic and the growing awareness about learner-centered instructional design and development makes it imperative to rethink pedagogical practices in higher education. This institutional quest has resulted in a dynamic online pedagogical landscape that has generated immense interest among researchers, educators, and policymakers.

In the African context, online learning in higher education is a relatively new concept that has come in place due to the pandemic. Before then, higher learning institutions were warming up to the use of the Learning Management Systems (LMSs). When the pandemic struck, governments closed learning institutions to control its spread. There was no immediate plan on how learning would continue. Institutions that were using LMSs were quick to move on to Emergency Remote Teaching (ERT). Content that was developed and delivered face-to-face was quickly put up in the LMSs to facilitate continuity in learning. There was no time to properly design and develop course materials for online delivery. Crawford et. al. (2020) established that higher education instructors rushed to convert curriculum to an online environment as it was a test of organizational agility. At the same time, there was no training on how to design and develop content for online teaching. There was little training on how to use some basic technologies to deliver synchronous sessions online, but there was no capacity building on how to deliver asynchronous online learning materials. Considering these underlying scenarios, the authors of this study seek to identify institutional opportunities and challenges in content development and online delivery.

Research Questions

The study will seek to answer four research questions:

1. What is the current state of online content development and delivery at USIU-A and KNUST STEM courses?
2. What are the challenges of developing and delivering online learning in STEM related courses at USIU-A and KNUST?
3. What are the critical success factors for online content development and delivery in STEM related courses at USIU-A and KNUST?
4. What are the opportunities in developing and delivering online learning in the institutions under study?

LITERATURE REVIEW

Pedagogical concerns on the state of online content development

In the year 2019, just before the COVID-19 pandemic struck, Zawacki-Richter & Qayyum, (2019) had concluded that in Africa, online technologies were being used to support learning and provide resources rather than being a mainstream mode of delivery for learning. Universities cancelled all face-to-face classes and transitioned to online digital learning platforms such as learning management systems (LMS) (Dlamini & Ndzinisa, 2020). The pandemic therefore escalated the uptake of digital technologies in the African higher education context (Akahome & Ekakitie, 2022).

The outbreak of the pandemic forced higher education institutions to transform curriculum into online formats that resulted in many challenges (Almazova et al., 2020). The associated challenges of pedagogical concerns in developing online content were: (i) making knowledge visible to students; (ii) making instructors' thinking visible to students and (iii) making students' thinking visible to themselves and their instructors. The challenges were compounded by the quick, unplanned capacity building sometimes given by peers who were equally struggling with concepts of online education during a pandemic. Content should align with appropriate instructional design methodology, learning objectives and expected outcomes and be reusable across various LMSs. Developing online contents to stimulate learning means that content materials must focus on the cognitive perspective, emotional perspective, behavioral perspective and contextual perspective.

A vital component of instructional design theory is the analysis of content to-be-learned. Merrill (1997) concluded that, content analysis focuses on components, and not integrated wholes. Merrill therefore illustrated the shortcomings of what has come to be known as the First Generation Instructional Design. The components that result from content analysis are separate items, such as concepts, facts, principles, and procedures. Tennyson and Rasch (1988) opined that, learning theories must be linked to educational goals, learning objectives, and instructional prescriptions. Embracing strategic principles for executing online education has the potential of providing authentic learning (Herrington et al., 2010) and enhancing educational delivery and reducing costs (Curran, 2004; Sharpe, Benfield, & Francis, 2006). The popularity of online learning implementation strategy (synchronous, asynchronous and blended) using theoretical and conceptual models (Collis & Moonen, 2001; Rogers, 2003) has gained significant attention

due to the complexities involved with the process and provision of authentic e-learning (Herrington, Reeves, & Oliver, 2010).

Many existing online instructional contents in Africa's higher educational institutions assume that students will have the prerequisite skills to function effectively in an online environment; an incorrect assumption. It is thus imperative to ensure that content for online courses are designed to usher students to scaffolding approaches that enhance confidence and motivation and effective online study. This approach is central in the African context where students might already be faced with countless online learning barriers such as faculty heavy workload, low administrative support, content quality, and equipment concerns (Nelson and Thompson, 2005).

Challenges of developing and delivering online education

The challenges of developing and delivering online learning in this study inevitably emanate from those experienced during the COVID-19 pandemic because online education was not clearly mapped in the African context before then. One of the immediate challenges was the lack of working, teaching and Learning materials (Koi-Akrofi et al., 2020) for online learning since almost all programs had been taught face-to-face. Universities had to invest heavily in digital technologies to embrace emergency remote teaching and learning and adapt to the changing landscape (Dlamini & Ndzinisa, 2020).

Post pandemic and after seeing the affordances of online learning, institutions of higher learning are convinced about developing online learning programs. However, there are no best practices for higher education institutions to mimic and no known models to follow (Akahome & Ekakitie, 2022). Post pandemic there are some glaring challenges towards offering online education. Some of the challenges as seen by Zawacki-Richter & Qayyum (2019) and Akahome & Ekakitie, (2022) are lack of devices, inadequate infrastructure, limited but expensive bandwidth, lack of faculty capacity to teach online, lack of political will and limited access to LMS off campus. These challenges will have to be overcome before online education can start to take shape in Africa.

In an exploratory factor analysis study, Siddiquei & Kathpal (2021) summarized instructor, institutional, student and content challenges as: transition to online from offline, communication barriers, lack of online teaching pedagogy; lack of training for teachers and students, poor technical and multimedia support, lack of technical troubleshooting team; poor student readiness, lack of technical skills to learn online, network issues, identity, interaction, and participation issues; and poor development of new material, lack of multimedia tools (Videos,

PPT, and Animation), lack of regular assignments, irregular feedback from students. All these challenges did not have immediate solutions and there was no reference point thus all those involved in online teaching and learning were at crossroads.

As the world learnt to live with the pandemic, accrediting bodies demanded that face-to-face programs be taught on campus and both students and lecturers were recalled to physical learning. Although face-to-face lectures are slowly being normalized again, teaching and learning will never be the same again (Akahome & Ekakitie, 2022).

Critical success factors for online content development and delivery

In his book titled “Planning and delivering quality online education”, Wa-Mbaleka (2020) outlines major considerations for those who wish to start providing online education as: the right mindset, quality personnel, adequate technical infrastructure, adequate library services and quality online programs. Most significant factors influencing E-learning success during the COVID-19 pandemic were related to technology knowledge management, support from management, increased student awareness of utilizing E-learning systems, and demanding a high level of information technology from the instructors, students, and universities (Alqahtani & Rajkhan, 2020).

There are three critical success factors in online delivery: technology (ease of access and navigation, interface design and level of interaction); the instructor (attitudes towards students, instructor technical competence and classroom interaction); and the previous use of the technology from a student’s perspective (Volery & Lord, 2000). Another important factor according to Volery & Lord (2000) is the level of interaction between students and lecturers in online courses which calls for a shift in the academic role from the intellect-on-stage and mentor towards lecturers being learning catalysts through content development and delivery.

Upon doing a comprehensive literature review, Cheawjindakarn, et al. (2013) summarized online education success factors as 1) institutional management – market research, program framework, operational plan, cost effectiveness, 2) learning environment – course management system, technical infrastructure, access and navigation, 3) instructional design – clarity of objectives, content quality, learning strategies, psychology of learning, learning assessment, 4) services support – training, communication tools, help desk, and 5) course evaluation. Their point number three directly touches on content development and delivery and gives the specific success factors in this area.

Opportunities in online education

There are many foreseeable opportunities for online education. Among the opportunities are the immense need to use online distance education as a means to respond to the huge need for flexible, affordable and quality education (Zawacki-Richter & Qayyum, 2019). As information and communication technologies have kept advancing, online education has become more feasible technologically, economically, and operationally where mobile-based learning seems to be headed towards a critical mass and may have a major impact (Palvia et al., 2018).

Within some of the challenges experienced in online education so far, there lies the opportunities. For example, Mallison & Krull (2013) suggested a capacity building intervention to enable academic staff to successfully support online learning. Such interventions are required even now and they come with the opportunity to provide education to the masses who really need it.

Role of instructors and instructional designers in online content development

Successful online content development necessitates the commitment of all primary stakeholders. In higher education, instructors and instructional designers are often assigned courses together for development of online content. Sometimes, instructors are unaware of the instructional design field and the valuable knowledge instructional designers bring to course development (Hart, 2018). Often, instructors may not realize that the assistance and recommendations of instructional designers can improve content development.

Instructional designers possess knowledge and skills on learning theories and design models that are the keys to improving quality of online content. Yet as Hassan (2021) realized, universities did not utilize instructional design services, as faculty designed their online courses based on previously practiced face-to-face delivery and they were not familiar with services of instructional designers. When such specialized knowledge and skill sets are unexploited, the outcome is low-level contents courses where students are unsuccessful. Therefore, it is important for individuals within academia to understand the role of instructional designers in improving the quality of content for online courses in higher institutions (Hart, 2018). There is, plenty to do in online content development if we are to prepare students to play a dynamic and critical role in the digital future.

THEORETICAL FRAMEWORK

The study subscribes to the notion that cohesion between the skills of instructional designers and subject matter experts work in favor of a more effective approach when implementing an instructional design process. Smith and Ragan (1993) define the instructional design process as "the systematic process of translating principles of learning and instruction into plans for instructional materials and activities." Instructional design process and delivery process is never a simple and straight forward process. It is an iterative process where the evaluation of one stage can send one backwards to improve on previously done areas. The ADDIE model of instructional design is the basis of how content development happens and all other instructional design models find their origin in ADDIE. This study therefore uses ADDIE as the instructional design model that guides content development as the cooperation between instructional designers and subject matter experts moves the process from one stage to the next. The ADDIE process is conceptualized as involving five steps (Branch, 2009) illustrated in Figure 1.

1. Analyze – This is the first stage and it involves analyzing the current scenario and identifying training and knowledge gaps. This is what helps to come up with a training plan for a particular group of people such as instructors.
2. Design – This is the second stage where the course map is put in place by the course design team which should have the subject matter expert and instructional designer in place. Practical decisions about courses are made at this stage. For example, the length of the course, the number of modules the course will have, the course learning outcomes the course will address etc.
3. Develop – Course development in the Learning Management System (LMS) happens. This is guided by the design plans and may lead to corrections on the design plan thus iteration can happen in this stage. All planned for course resources are put in place and alignment of all those resources towards meeting the specified learning outcomes is ensured.
4. Implement – Implementation involves exposing the course so far developed to the learners with course delivery processes being followed for the first time in the course. All learner engagement activities happen during the implementation stage and both instructional designers and subject matter experts monitor and identify any issues that may need correction throughout the first cohort.
5. Evaluate – As illustrated in figure 1, evaluation takes place at every stage of course content development. It is not an isolated stage on its own but touches on all the stages. Evaluation is what involves the need for iterations as both instructional designers and subject matter experts come up with quality online courses.

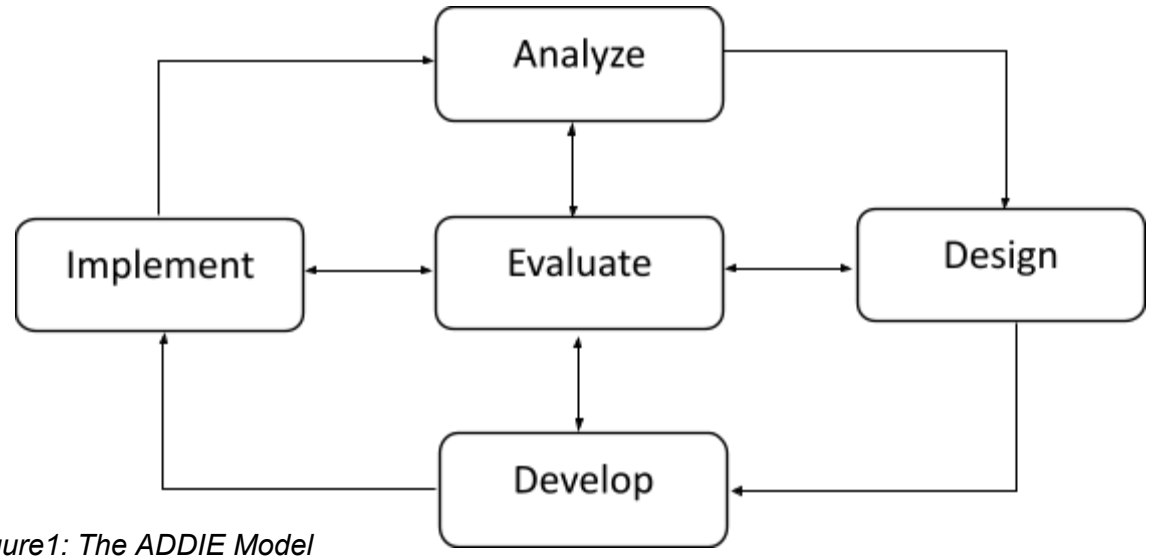

Figure1: The ADDIE Model

Source: (Researchers)

The ADDIE model would be used fundamentally to define steps in the design and delivery of online instruction to understand the content development and delivery in the contexts of this study. In addition, the concept of learning culture, which has a three-dimensional construct namely *Personal, Pedagogical interactions, and Organizational Dimension;* would be employed to assess the effectiveness of online instruction at delivering learning outcomes and promoting sustainable education development in respective universities under study. The authors gravitate towards this concept because it takes the whole-institutional perspective to educational development by encouraging learning culture in higher education primarily from the learners' point of view (Jenert, 2011).

RESEARCH DESIGN

Methods and Modes of Analysis

This study adopted an exploratory descriptive design which was cross sectional in nature. Since all the research questions were descriptive, qualitative, and quantitative data were collected in USIU-Africa and KNUST. Descriptive research describes the characteristics of objects, people, groups, organizations, or environments and usually a precursor to explanation research (Moflih, 2016). The target population in this study were the teaching staff and students at USIU-Africa and KNUST in the comparative schools/colleges teaching and undertaking STEM courses respectively. In USIU-Africa, the study focused on School of Science & Technology and School of Pharmacy & Health Sciences while in KNUST the study focused on College of Science and College of Health sciences as shown in Table 1.

Table 1

Targeted Schools/Colleges

	School/College	Programs	Departments	Percentage
1	School of Science and Technology USIU-Africa	7	7	11.1
2	School of Pharmacy & Health Sciences USIU-A	2	4	6.3
3	College of Science - KNUST	2	10	15.9
4	College of Health Sciences -KNUST	5	42	66.7
	Total	26	63	100

Source: *USIU-A and KNUST Websites, Spring 2022*

The target population was reached using a mixed multistage sampling technique. First the schools were conveniently chosen based on the courses taught. This study focused on the STEM courses. Sampling was done to select a sufficient number of elements from the population, so that a study of the sample and an understanding of its properties or characteristics would make it possible to draw conclusions about the population (Cooper & Schindler, 2014). Secondly, different approaches were used in USIU-Africa and KNUST due to differences in the number of STEM programs. At USIU-Africa, a census survey of the full-time faculty and simple random sampling of students were done. At KNUST stratified random sampling was done due to the large numbers as seen from Table 1. Thirdly, programmes per university were cascaded per school forming the strata for the study. From each stratum, simple random sampling was used to come up with departments targeted for the study. At departmental level simple random sampling was used to select faculty and students who served as respondents for the study.

At USIU-Africa a census survey was used for to collect data from all the faculty members in the two STEM programs. On the other hand, a stratified sampling technique was used for faculty members. Within each stratum, simple random sampling was applied to come up with a representative sample. Simple random sampling was used to collect data from students in both institutions.

Table 2. Respondents from Schools/Colleges in USIU-A and KNUST

No.	**Schools**	**No. of Faculty**			
		Fulltime	**Adjunct**	**Total**	**%**
1	School of Science and Technology USIU-Africa	21	25	46	8.4
2	School of Pharmacy and Health Sciences - USIU-Africa	11	28	39	7.1
3	College of Science - KNUST	191	20	211	35.0

4	College of Health Sciences -KNUST	270	206	476	49.5
	Total	**483**	**289**	**772**	**100**

This study used both primary and secondary data. Primary data was collected using a questionnaire. The questionnaire was prepared from scratch by the researchers. The questionnaire had structured and open-ended questions which were used to collect data from faculty members and students in the targeted schools and/or colleges. Secondary data was collected from School/College reports and data analytics from the institutional learning management systems. This data complemented the data collected from the questionnaire to answer the research questions for the study.

The proposal was submitted to Institutional Review Board (IRB) to evaluate the ethical orientation and quality of the proposal before seeking regulatory research permit from the National Commission for Science, Technology and Innovation (NACOSTI). In order to comply with government policy, permit to conduct the study was applied for and given from NACOSTI. Ethical consideration was adhered to during the entire research to ensure integrity and objectivity of researchers, respect of respondents, avoidance of harm to the respondents, volunteerism and right to withdraw through obtaining informed consent form the respondents, explaining the study to the respondents and maintaining anonymity (Saunders et al., 2016).

Descriptive statistics techniques were used for data analysis. These included frequencies, percentages, mean and standard deviation of the study variables. Correlations generated from SPSS were also used to show significant parameters for the different research questions. Further, analysis was done through content analysis and descriptive statistics including mean, mode, standard deviation, percentages and frequencies. The results are presented through narratives and tables

RESEARCH FINDINGS

Faculty members' demographic information

In all, this study generated 97 responses from faculty members in KNUST and USIU-Africa. The respondents were asked to provide some demographic information for this study. They provided information that informed the study on their institutional affiliation (Table 3), overall teaching experience at higher learning institutions (Table 4), their experience in online teaching (Table 5), the LMS used (Table 6) and the STEM related disciplines available (Table 7). This Demographic information proved useful for this study which sought to investigate the challenges and opportunities in online content design and development towards best practices in future.

Table 3. Institutional affiliation of faculty members

Institutional Affiliation	Frequency	Percent
Kwame Nkrumah University of Science and Technology (KNUST)	65	67.0
Unites States International University - Africa (USIU-A)	32	33.0
Total	97	100.0

Majority of the respondents (67%, N=65) were from KNUST while the rest (33%, N = 32) of the respondents were from USIU-Africa. This differences in respondent's numbers was mainly because of the institutional numbers from which the sub-samples were taken.

Table 4. Teaching experience

	Frequency	Percent
1-5 years	24	24.7
6-10 years	31	32.0
11-15 years	24	24.7

16-20 years	9	9.3
21-25 years	6	6.2
26 years and above	3	3.1
Total	97	100.0

It is worth noting that a majority (75.3%, N = 73) of the faculty members who responded to the questionnaire for this study have teaching experience above 6 years, an indication that the respondents were all instructors prior to the COVID-19 pandemic.

Table 5. Online teaching experience

	Frequency	**Percent**
1-5 years	79	81.4
6-10 years	15	15.5
11-15 years	3	3.1
Total	97	100.0

One of the objectives of this research was to establish the status of online teaching and learning in both institutions. Majority (81.4%, N = 79) of the faculty members who took part in this study had 1 – 5 years online teaching experience. Given the time that this study was done, it can be deduced that majority of the respondents participated in Emergency Remote Teaching and Learning (ERT&L) which for them is synonymous with online teaching and learning. A minority (18.4%, N = 15) of the faculty members had online teaching and learning experience prior to the pandemic. This data gave the researchers an insight on the status of online content development and delivery in the two institutions.

Table 6. Learning management system used

Learning Management System (LMS) used		
	Frequency	**Percent**
Blackboard	32	33.0
Moodle	65	67.0
Total	97	100.0

In online learning, the choice of the LMS determines how courses will be developed and delivered in online learning because different LMSs have different features that may be employed during course design, development and delivery. The two institutions used different Learning Management Systems (LMSs); USIU-Africa uses Blackboard Learn while KNUST uses Moodle.

Table 7. STEM related disciplines

Disciplines		
	Frequency	**Percent**
Science	36	37.1
Technology	11	11.3
Engineering	6	6.2
Mathematics	19	19.6
Medicine	20	20.6
Non-STEM	3	3.1
Unknown	2	2.1
Total	97	100.0

This study requested the participation of faculty members in specific STEM related areas that were purposefully chosen to ensure the two participating institutions were comparable. The specific STEM related areas chosen for this study were; Science, Technology, Engineering, Mathematics and Medicine. The other schools and colleges in the two institutions proved too diverse to be included in the study.

Student demographic information

Student respondents from both USIU-Africa and KNUST provided demographic information relevant to this study. Whereas the link to the questionnaire was sent to over 2000 students, 695 students responded to the questionnaire in full.

KNUST provided 52.4% of the student respondents while USIU-Africa provided 47.6% (Table 8). In terms of gender, 41.7% of the student respondents were female while 52.9% were male (Table 9). A great majority (86.2% N = 599) of the student respondents were in the 18-25 years' age group (Table 10). The data indicated that majority of the respondents were undergraduate students in the two institutions. Table 11 shows that majority of the student respondents' marital status was single.

Table 8. **Student institutional affiliation**

Institution	Frequency	Percent
KNUST	364	52.4
USIU-Africa	331	47.6
Total	695	100.0

Table 9. Student gender

Gender	Frequency	Percent
Female	290	41.7
Male	368	52.9
Prefer not to say	37	5.3
Total	695	100.0

Table 10. Student age

Age	Frequency	Percent
Below 18 Years	29	4.2
18-25 Years	599	86.2
26-30 years	67	9.6
Total	695	100.0

Table 11. *Student marital status*

Marital Status	Frequency	Percent
Single	617	88.8
Married	76	10.9
Total	693	99.7
Neutral	2	.3
Total	695	100.0

Table 12. Devices used by students

Device used	Frequency	Percent
Smartphone	230	33.1
Tablet	37	5.3
Laptop	396	57.0
Desktop Computer	22	3.2
Others	8	1.2
Total	693	99.7

A majority (57%, N = 396) of the students who took part in this study use laptops for their online learning activities as shown in Table 12. Smartphones featured as being used for online

education among a considerable number of respondents (33.1%, N = 230). This means that during content development and delivery, faculty members must be aware that some students are likely to use smartphones for learning online. Whereas smartphones are not optimized for online learning, their penetration rate in Africa is high and thus their prevalence in online education can only increase with time especially in low resourced public universities where students may not afford high end laptops.

Table 13. Student stem related field

Stem related field	Frequency	Percent
Science	111	16.0
Technology	220	31.7
Engineering	100	14.4
Mathematics	52	7.5
Medicine	129	18.6
Non-Stem	80	11.5
Unknown	2	.3
Total	694	99.9

Table 13 shows that student respondents were drawn from purposefully selected STEM related disciplines just like the faculty members who responded to the questionnaire in this study. This was carefully considered by the researchers to ensure proper triangulation of the data received from respondents.

Table 14. Student academic level

Academic level	Frequency	Percent
Year One	253	36.4
Year Two	187	26.9
Year Three	146	21.1
Year Four	100	14.4
Year Five	8	1.2
Total	694	100

The data showed that students respondents ranged from first to fifth years (Table 14). Majority of the courses at the undergraduate level take four years to complete in both USIU-Africa and KNUST. This explains the low number of fifth year students who answered the questionnaire.

Faculty basic e-Learning skills

The first objective of the study was to establish the current state of online content development and delivery. In order to do this, the study sought to establish whether faculty members had the basic e-Learning skills such as; basic technical skills, access to LMS with minimal help, effective communication and the ability to research and select online content resources. Table 15 shows the descriptive statistics while Table 16 shows the Pearson's correlations holding demographic information constant.

Table 15 shows that respondents from USIU-Africa generally rated their basic e-Learning skills highly compared to respondents from KNUST. It would be worthwhile to find out why KNUST respondents were relatively not very confident in e-learning skills.

Table 16 indicates that institutional affiliation is correlated to teaching comfortably online, effective communication and relatability to accessibility concepts for online content development and delivery.

Table 15. Faculty basic e-Learning skills

Basic e-Learning skills		Strongly Disagree	Disagree	Moderate	Agree	Strongly Agree	Total
I have all the basic technical skills for operating computing gadgets	USIU-A	0.0	3.1	3.1	15.6	78.1	100.0
	KNUST	2.6	5.1	5.1	35.9	51.3	100.0
I can access all my courses in the Learning	USIU-A	0.0	0.0	6.3	21.9	71.9	100.0

Management System (LMS) with minimal help	KNUST	0.0	10.3	12.8	48.7	28.2	100.0
I am comfortable teaching all my courses in an online environment	USIU-A	0.0	0.0	15.6	31.3	53.1	100.0
	KNUST	2.6	20.5	15.4	43.6	17.9	100.0
I am comfortable teaching all my courses in an online environment	USIU-A	0.0	0.0	15.6	31.3	53.1	100.0
	KNUST	2.6	20.5	15.4	43.6	17.9	100.0
I can effectively communicate verbally to my students in online teaching and learning environment	USIU-A	0.0	0.0	3.1	37.5	59.4	100.0
	KNUST	0.0	10.3	12.8	46.2	30.8	100.0
I can effectively communicate in written form to my students in online teaching and learning environment	USIU-A	0.0	0.0	3.1	28.1	68.8	100.0
	KNUST	2.6	7.7	12.8	56.4	20.5	100.0
I can relate to the concept of course content accessibility for all in online learning	USIU-A	0.0	0.0	6.3	28.1	65.6	100.0
	KNUST	0.0	12.8	12.8	48.7	25.6	100.0
I can research and select resources online for courses that I teach online	USIU-A	0.0	0.0	6.3	25.0	68.8	100.0
	KNUST	5.1	2.6	5.1	48.7	38.5	100.0

Table 16. Faculty e-Learning skills descriptive statistics

Descriptive Statistics	Mean	Std. Deviation	N
Institutional Affiliation	1.33	.473	97
Teaching Experience	2.49	1.300	97
Online Teaching Experience	1.22	.484	97
Learning Management System (LMS) used	1.67	.473	97
STEM Related Discipline	2.93	1.804	97
Basic Technical Skills	2.88	.439	97
Access LMS Courses with minimal help	2.82	.500	97
Teach Comfortably Online	2.64	.680	97
Effectively Communicate Verbally Online	2.85	.464	97
Effectively Communicate in Writing Online	2.80	.533	97
Relate to Online Accessibility Concepts	2.77	.550	97
Ability to Research and Select Online Resources	2.88	.439	97

Table 17

Faculty e-Learning skills correlations

Correlations		Institutional Affiliation	Teaching Experience	Online Teaching Experience	Learning Management System (LMS) used	STEM Related Discipline	Basic Technical Skills	Access LMS Courses Minimal Help	Teach Comfortably Online	Effectively Communicate Verbally Online	Effectively Communicate in Writing Online	Relate to Online Accessibility Concept	Ability to Research and Select Online Resources
Institutional Affiliation	Pearson Correlation	1	0.189	-0.088	-1.000**	-0.179	0.048	0.159	.212*	0.188	.218*	.211*	0.098
	Sig. (2-tailed)		0.063	0.392	0	0.079	0.64	0.12	0.037	0.066	0.032	0.038	0.338
	Sum of Squares and Cross-products	21.443	11.165	-1.928	-21.443	-14.691	0.959	3.608	6.546	3.948	5.268	5.258	1.959
	Covariance	0.223	0.116	-0.02	-0.223	-0.153	0.01	0.038	0.068	0.041	0.055	0.055	0.02
	N	97	97	97	97	97	97	97	97	97	97	97	97
Teaching Experience	Pearson Correlation	0.189	1	0.159	-0.189	0.069	-.202*	-0.138	0.098	0.025	-0.009	-0.075	-0.038
	Sig. (2-tailed)	0.063		0.119	0.063	0.504	0.047	0.179	0.339	0.811	0.93	0.468	0.714
	Sum of Squares and Cross-products	11.165	162.247	9.608	-11.165	15.464	-11.062	-8.588	8.32	1.423	-0.598	-5.113	-2.062
	Covariance	0.116	1.69	0.1	-0.116	0.161	-0.115	-0.089	0.087	0.015	-0.006	-0.053	-0.021
	N	97	97	97	97	97	97	97	97	97	97	97	97
Online Teaching Experience	Pearson Correlation	-0.088	0.159	1	0.088	0.054	0.029	0.115	0.177	0.104	0.085	0.069	0.029
	Sig. (2-tailed)	0.392	0.119		0.392	0.6	0.776	0.26	0.083	0.309	0.406	0.501	0.776
	Sum of Squares and Cross-products	-1.928	9.608	22.454	1.928	4.515	0.598	2.68	5.577	2.247	2.113	1.763	0.598
	Covariance	-0.02	0.1	0.234	0.02	0.047	0.006	0.028	0.058	0.023	0.022	0.018	0.006
	N	97	97	97	97	97	97	97	97	97	97	97	97

Learning Management System (LMS) used	Pearson Correlation	-1.000**	-0.189	0.088	1	0.179	-0.048	-0.159	-.212*	-0.188	-.218*	-.211*	-0.098
	Sig. (2-tailed)	0	0.063	0.392		0.079	0.64	0.12	0.037	0.066	0.032	0.038	0.338
	Sum of Squares and Cross-products	-21.443	-11.165	1.928	21.443	14.691	-0.959	-3.608	-6.546	-3.948	-5.268	-5.258	-1.959
	Covariance	-0.223	-0.116	0.02	0.223	0.153	-0.01	-0.038	-0.068	-0.041	-0.055	-0.055	-0.02
	N	97	97	97	97	97	97	97	97	97	97	97	97
STEM Related Discipline	Pearson Correlation	-0.179	0.069	0.054	0.179	1	-0.011	-0.072	-0.03	-0.076	-0.026	-0.069	0.002
	Sig. (2-tailed)	0.079	0.504	0.6	0.079		0.912	0.484	0.771	0.461	0.803	0.501	0.986
	Sum of Squares and Cross-products	-14.691	15.464	4.515	14.691	312.495	-0.866	-6.227	-3.526	-6.082	-2.371	-6.588	0.134
	Covariance	-0.153	0.161	0.047	0.153	3.255	-0.009	-0.065	-0.037	-0.063	-0.025	-0.069	0.001
	N	97	97	97	97	97	97	97	97	97	97	97	97
Basic Technical Skills	Pearson Correlation	0.048	-.202*	0.029	-0.048	-0.011	1	0.043	0.163	.263**	.251*	0.185	0.136
	Sig. (2-tailed)	0.64	0.047	0.776	0.64	0.912		0.679	0.111	0.009	0.013	0.07	0.185
	Sum of Squares and Cross-products	0.959	-11.062	0.598	-0.959	-0.866	18.515	0.897	4.67	5.144	5.649	4.278	2.515
	Covariance	0.01	-0.115	0.006	-0.01	-0.009	0.193	0.009	0.049	0.054	0.059	0.045	0.026
	N	97	97	97	97	97	97	97	97	97	97	97	97
Access LMS Courses Minimal Help	Pearson Correlation	0.159	-0.138	0.115	-0.159	-0.072	0.043	1	.455**	.376**	.417**	.612**	.564**
	Sig. (2-tailed)	0.12	0.179	0.26	0.12	0.484	0.679		< .001	< .001	< .001	< .001	< .001
	Sum of Squares and Cross-products	3.608	-8.588	2.68	-3.608	-6.227	0.897	24.021	14.866	8.371	10.67	16.144	11.897
	Covariance	0.038	-0.089	0.028	-0.038	-0.065	0.009	0.25	0.155	0.087	0.111	0.168	0.124
	N	97	97	97	97	97	97	97	97	97	97	97	97
Teach Comfortably Online	Pearson Correlation	.212*	0.098	0.177	-.212*	-0.03	0.163	.455**	1	.614**	.694**	.615**	.372**
	Sig. (2-tailed)	0.037	0.339	0.083	0.037	0.771	0.111	< .001		< .001	< .001	< .001	< .001
	Sum of Squares and Cross-products	6.546	8.32	5.577	-6.546	-3.526	4.67	14.866	44.371	18.588	24.144	22.062	10.67
	Covariance	0.068	0.087	0.058	-0.068	-0.037	0.049	0.155	0.462	0.194	0.252	0.23	0.111
	N	97	97	97	97	97	97	97	97	97	97	97	97

Effectively Communicate Verbally Online	Pearson Correlation	0.188	0.025	0.104	-0.188	-0.076	.263**	.376**	.614**	1	.508**	.514**	.212*
	Sig. (2-tailed)	0.066	0.811	0.309	0.066	0.461	0.009	< .001	< .001		< .001	< .001	0.037
	Sum of Squares and Cross-products	3.948	1.423	2.247	-3.948	-6.082	5.144	8.371	18.588	20.68	12.062	12.598	4.144
	Covariance	0.041	0.015	0.023	-0.041	-0.063	0.054	0.087	0.194	0.215	0.126	0.131	0.043
	N	97	97	97	97	97	97	97	97	97	97	97	97
Effectively Communicate in Writing Online	Pearson Correlation	.218*	-0.009	0.085	-.218*	-0.026	.251*	.417**	.694**	.508**	1	.700**	.563**
	Sig. (2-tailed)	0.032	0.93	0.406	0.032	0.803	0.013	< .001	< .001	< .001		< .001	< .001
	Sum of Squares and Cross-products	5.268	-0.598	2.113	-5.268	-2.371	5.649	10.67	24.144	12.062	27.278	19.691	12.649
	Covariance	0.055	-0.006	0.022	-0.055	-0.025	0.059	0.111	0.252	0.126	0.284	0.205	0.132
	N	97	97	97	97	97	97	97	97	97	97	97	97
Relate to Online Accessibility Concepts	Pearson Correlation	.211*	-0.075	0.069	-.211*	-0.069	0.185	.612**	.615**	.514**	.700**	1	.487**
	Sig. (2-tailed)	0.038	0.468	0.501	0.038	0.501	0.07	< .001	< .001	< .001	< .001		< .001
	Sum of Squares and Cross-products	5.258	-5.113	1.763	-5.258	-6.588	4.278	16.144	22.062	12.598	19.691	29.01	11.278
	Covariance	0.055	-0.053	0.018	-0.055	-0.069	0.045	0.168	0.23	0.131	0.205	0.302	0.117
	N	97	97	97	97	97	97	97	97	97	97	97	97
Ability to Research and Select Online Resources	Pearson Correlation	0.098	-0.038	0.029	-0.098	0.002	0.136	.564**	.372**	.212*	.563**	.487**	1
	Sig. (2-tailed)	0.338	0.714	0.776	0.338	0.986	0.185	< .001	< .001	0.037	< .001	< .001	
	Sum of Squares and Cross-products	1.959	-2.062	0.598	-1.959	0.134	2.515	11.897	10.67	4.144	12.649	11.278	18.515
	Covariance	0.02	-0.021	0.006	-0.02	0.001	0.026	0.124	0.111	0.043	0.132	0.117	0.193
	N	97	97	97	97	97	97	97	97	97	97	97	97

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

The data showed that teaching experience was negatively correlated to basic technical skills for teaching online which the researchers believe that the more faculty members teach face to face, the less likelihood for them to desire the basic technical skills for teaching online. Furthermore, teaching online was correlated to effective communication during course development and delivery. Teaching comfortably online is related to LMS used and effective communication as well as the ability of faculty member to research and select online resources. All the parameters in the correlation table were important in establishing the status of online content development and delivery thus answering the first objective of this study.

Student e-Learning skills are important for online learning. Students were asked to rate their digital skills and their responses are as summarized Table 18. A majority (69.7%, N = 485) of the student respondents rated their digital skills as advanced and intermediate. This indicates that they view themselves as possessing the skills that are required for online learners. The minority (28.1%, N = 195) represent students who would need training to acquire the digital skills necessary for smooth online learning. The data thus suggests that opportunity exist in both institutions to train students on how to effectively engage in online learning.

Table 18. Students' digital skills

Digital skills rating	Frequency	Percent
Advanced	165	23.7
Intermediate	320	46.0
Basic	195	28.1
No Experience	14	2.0
Total	694	99.9

Table 19. Students institutional LMS access

Institutional LMS use/access	Frequency	Percent
Once a day	181	26.0
Twice a week	234	33.7
Once a month	22	3.2
Occasionally	239	34.4
Never	16	2.3

Total	692	99.6
System	3	.4
Total	695	100.0

Student responses on how they access the LMS was not consistent with high quality online learning. Considering that these are full time students, the ideal situation would be where the majority of the students accessed the LMS on daily basis to interact with the content. The fact that more than 33.7 % accessed the LMS twice a week and another 34.4 % accessed the LMS occasionally may not augur well with for student online learning because of limited engagement in both institutions. Probably this is affected by the push towards bringing back face-to-face instructions for majority of the courses offered at the undergraduate level where majority of the respondents come from.

The overall student experience in online learning can inform the status of online content development and delivery. Students were asked to state their experience and their responses are summarized in the Table 20.

Table 20. Student overall online learning experience

Overall online learning experience	Frequency	Percent
Poor	20	2.9
Satisfactory	144	20.7
Good	232	33.4
Very Good	204	29.4
Excellent	86	12.4
Total	686	98.7
System	9	1.3
Total	695	100.0

The majority (97.1%, N = 666) of student respondents from both KNUST and USIU-Africa rated their overall online learning experience as satisfactory, good, very good and excellent. This indicates that so far, the status of online content development and delivery has achieved a lot in the students' view.

Table 21 shows the challenges faculty member with developing and delivering online content at both KNUST and USIU-Africa. This study considers disagreement and moderate responses as possible areas of challenge.

Table 21. Faculty online content development challenges

Online content development							
Statement		**Strongly Disagree**	**Disagree**	**Moderate**	**Agree**	**Strongly Agree**	**Total**
I have been trained on online content development	USIU-A	0.0	0.0	9.4	40.6	50.0	100.0
	KNUST	5.1	15.4	15.4	51.3	12.8	100.0
I can develop different types of online content/resources for teaching	USIU-A	0.0	3.1	9.4	37.5	50.0	100.0
	KNUST	5.1	5.1	20.5	51.3	17.9	100.0
I can use a variety of LMS features to develop online learning resources	USIU-A	0.0	0.0	18.8	34.4	46.9	100.0
	KNUST	5.1	12.8	33.3	35.9	12.8	100.0
I can properly organize learning materials in the LMS	USIU-A	0.0	0.0	9.4	43.8	46.9	100.0
	KNUST	5.1	5.1	15.4	59.0	15.4	100.0
I ensure that my courses are accessible to learners with special needs.	USIU-A	3.1	12.5	25.0	18.8	40.6	100.0
	KNUST	5.1	17.9	43.6	25.6	7.7	100.0
I use visual graphics in content development	USIU-A	0.0	0.0	28.1	31.3	40.6	100.0
	KNUST	2.6	10.3	20.5	51.3	15.4	100.0
I prepare my online teaching resources before the semester begins	USIU-A	0.0	6.3	3.1	34.4	56.3	100.0
	KNUST	2.6	10.3	23.1	48.7	15.4	100.0
I create online content based on thorough research on course concepts	USIU-A	3.1	3.1	3.1	25.0	65.6	100.0
	KNUST	2.6	5.1	12.8	46.2	33.3	100.0

I develop content according to the course and module learning outcomes	USIU-A	0.0	0.0	6.3	37.5	56.3	100.0
	KNUST	2.6	0.0	15.4	48.7	33.3	100.0
I align course content, learning outcomes and assessments to the course level,	USIU-A	3.1	0.0	0.0	37.5	59.4	100.0
	KNUST	0.0	0.0	15.4	48.7	35.9	100.0
I use subject specific language when developing course content	USIU-A	0.0	0.0	12.5	31.3	56.3	100.0
	KNUST	0.0	0.0	17.9	59.0	23.1	100.0
I maintain a consistent tone throughout content development	USIU-A	0.0	0.0	18.8	28.1	53.1	100.0
	KNUST	0.0	12.8	25.6	51.3	10.3	100.0
I provide a variety of reference materials when developing course content	USIU-A	0.0	0.0	9.4	37.5	53.1	100.0
	KNUST	0.0	0.0	7.7	51.3	41.0	100.0
I incorporate Quality Assurance/Quality Matters Standards during content development	USIU-A	0.0	0.0	21.9	40.6	37.5	100.0
	KNUST	0.0	2.6	28.2	59.0	10.3	100.0

The majority of the respondents from both institutions agreed with the statements posed on content development. For example, they agreed that they have received training on content development. USIU-Africa faculty members rated their content development training and skills higher than NKUST. There are some skills that draw attention as possible opportunities for training because they feature significantly in the moderate and disagreement columns of the responses and these are; ensuring that content is accessible to learners with special needs, using a variety of features in the LMS, using visual graphics during content development, incorporating quality in content development, maintaining a consistent tone throughout content development and using subject specific language in content development. Both institutions need to pay attention to these parameters to improve content development.

Table 22. Faculty online content development challenges statistics

Descriptive Statistics	Mean	Std. Deviation	N
Institutional Affiliation	1.33	.473	97
Teaching Experience	2.49	1.300	97
Online Teaching Experience	1.22	.484	97
Learning Management System (LMS) used	1.67	.473	97
STEM Related Discipline	2.93	1.804	97
Trained on online Content Development	2.73	.604	97
Develop Different types of online content/resources	2.70	.580	97
Can use variety of LMS Features	2.59	.658	97
Properly organize Learning Materials in LMS	2.79	.519	97
Ensure Courses are Accessible to Special Needs Learners	2.32	.744	97
Use Visual Graphics in Content Development	2.65	.596	97
Prepare Online Teaching resources before Semester begins	2.64	.664	97
Create Online Content using thorough Research on Course Concepts	2.78	.563	97
Develop Content according to the Course and Module Learning Outcomes	2.88	.389	97
Align Course Content, Learning Outcomes and Assessments to course level	2.92	.312	97
Use Subject Specific Language in Course Content Development	2.81	.417	97
Maintain a consistent tone throughout content development	2.66	.575	97
Provide a variety of reference materials when developing course content	2.93	.260	97
Quality Assurance/Quality Matters Standards during content development	2.75	.457	97

Table 23

Faculty online content development challenges correlations

Correlations		Institutional Affiliation	Teaching Experience	Online Teaching Experience	Learning Management System (LMS) used	STEM Related Discipline	Trained on online Content Development	Develop Different types of online content/resources	Can use variety of LMS Features	Properly organise Learning Materials in LMS	Ensure Courses are Accessible to Special Needs Learners	Use Visual Graphics in Content Development	Prepare Online Teaching resources before Semester begins	Create Online Content using thorough Research on Course Concepts	Develop Content according to the Course and Module Learning Outcomes	Align Course Content, Learning Outcomes and Assessments to course level	Use Subject Specific Language in Course Content Development	Maintain a consistent tone throughout content development	Provide a variety of reference materials when developing course content	Quality Assurance/Quality Matters Standards during content development
Institutional Affiliation	Pearson Correlation	1	0.189	-0.088	-1.000**	-0.179	.203*	0.173	.241*	0.153	0.112	0.082	.217*	0.075	0.111	0.045	0.103	0.187	-0.059	0.044
	Sig. (2-tailed)		0.063	0.392	0	0.079	0.046	0.089	0.017	0.135	0.275	0.425	0.033	0.463	0.279	0.66	0.318	0.066	0.569	0.667
	Sum of Squares and Cross-products	21.443	11.165	-1.928	-21.443	-14.691	5.577	4.567	7.196	3.598	3.773	2.216	6.546	1.928	1.959	0.639	1.938	4.887	-0.691	0.918
	Covariance	0.223	0.116	-0.02	-0.223	-0.153	0.058	0.048	0.075	0.037	0.039	0.023	0.068	0.02	0.02	0.007	0.02	0.051	-0.007	0.01
	N	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
Teaching Experience	Pearson Correlation	0.189	1	0.159	-0.189	0.069	0.065	-0.05	-0.027	-0.171	-.241*	-0.177	-0.105	-0.179	-0.146	-0.104	-0.136	-0.121	-0.047	-0.09
	Sig. (2-tailed)	0.063		0.119	0.063	0.504	0.53	0.624	0.794	0.093	0.018	0.083	0.307	0.079	0.155	0.312	0.183	0.239	0.645	0.382
	Sum of Squares and Cross-products	11.165	162.247	9.608	-11.165	15.464	4.866	-3.649	-2.206	-11.103	-22.34	-13.175	-8.68	-12.608	-7.062	-4.041	-7.093	-8.67	-1.536	-5.124
	Covariance	0.116	1.69	0.1	-0.116	0.161	0.051	-0.038	-0.023	-0.116	-0.233	-0.137	-0.09	-0.131	-0.074	-0.042	-0.074	-0.09	-0.016	-0.053
	N	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
Online Teaching Experience	Pearson Correlation	-0.088	0.159	1	0.088	0.054	0.058	0.159	.218*	0.138	.240*	0.121	0.084	0.059	0.089	0.051	0.098	-0.032	0.043	0.198
	Sig. (2-tailed)	0.392	0.119		0.392	0.6	0.572	0.12	0.032	0.177	0.018	0.236	0.416	0.565	0.389	0.623	0.339	0.755	0.678	0.052
	Sum of Squares and Cross-products	-1.928	9.608	22.454	1.928	4.515	1.629	4.278	6.66	3.33	8.289	3.361	2.577	1.546	1.598	0.732	1.897	-0.856	0.515	4.196
	Covariance	-0.02	0.1	0.234	0.02	0.047	0.017	0.045	0.069	0.035	0.086	0.035	0.027	0.016	0.017	0.008	0.02	-0.009	0.005	0.044
	N	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97

Learning Management System (LMS) used	Pearson Correlation	-1.000**	-0.189	0.088	1	0.179	-.203*	-0.173	-.241*	-0.153	-0.112	-0.082	-.217*	-0.075	-0.111	-0.045	-0.103	-0.187	0.059	-0.044
	Sig. (2-tailed)	0	0.063	0.392		0.079	0.046	0.089	0.017	0.135	0.275	0.425	0.033	0.463	0.279	0.66	0.318	0.066	0.569	0.667
	Sum of Squares and Cross-products	-21.443	-11.165	1.928	21.443	14.691	-5.577	-4.567	-7.196	-3.598	-3.773	-2.216	-6.546	-1.928	-1.959	-0.639	-1.938	-4.887	0.691	-0.918
	Covariance	-0.223	-0.116	0.02	0.223	0.153	-0.058	-0.048	-0.075	-0.037	-0.039	-0.023	-0.068	-0.02	-0.02	-0.007	-0.02	-0.051	0.007	-0.01
	N	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
STEM Related Discipline	Pearson Correlation	-0.179	0.069	0.054	0.179	1	-0.104	-0.011	-0.017	-0.005	0.079	0.034	0.065	0.056	-0.087	0.063	0.093	-0.084	0.055	0.029
	Sig. (2-tailed)	0.079	0.504	0.6	0.079		0.311	0.916	0.872	0.962	0.439	0.738	0.527	0.584	0.396	0.538	0.366	0.413	0.59	0.781
	Sum of Squares and Cross-products	-14.691	15.464	4.515	14.691	312.495	-10.876	-1.093	-1.887	-0.443	10.237	3.546	7.474	5.485	-5.866	3.423	6.701	-8.381	2.495	2.268
	Covariance	-0.153	0.161	0.047	0.153	3.255	-0.113	-0.011	-0.02	-0.005	0.107	0.037	0.078	0.057	-0.061	0.036	0.07	-0.087	0.026	0.024
	N	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
Trained on online Content Development	Pearson Correlation	.203*	0.065	0.058	-.203*	-0.104	1	.334**	.296**	.320**	-0.016	0.084	-0.062	0.073	0.168	0.158	0.131	-0.055	0.141	0.097
	Sig. (2-tailed)	0.046	0.53	0.572	0.046	0.311		< .001	0.003	0.001	0.876	0.416	0.548	0.48	0.1	0.122	0.199	0.59	0.169	0.345
	Sum of Squares and Cross-products	5.577	4.866	1.629	-5.577	-10.876	35.031	11.227	11.278	9.639	-0.691	2.887	-2.381	2.371	3.784	2.856	3.175	-1.845	2.124	2.567
	Covariance	0.058	0.051	0.017	-0.058	-0.113	0.365	0.117	0.117	0.1	-0.007	0.03	-0.025	0.025	0.039	0.03	0.033	-0.019	0.022	0.027
	N	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
Develop Different types of online content/resources	Pearson Correlation	0.173	-0.05	0.159	-0.173	-0.011	.334**	1	.656**	.588**	.320**	.266**	.231*	.405**	.388**	.380**	.242*	0.004	.201*	0.189
	Sig. (2-tailed)	0.089	0.624	0.12	0.089	0.916	< .001		< .001	< .001	0.001	0.008	0.023	< .001	< .001	< .001	0.017	0.968	0.049	0.063
	Sum of Squares and Cross-products	4.567	-3.649	4.278	-4.567	-1.093	11.227	32.33	24.041	17.021	13.268	8.835	8.536	12.722	8.412	6.608	5.619	0.134	2.907	4.825
	Covariance	0.048	-0.038	0.045	-0.048	-0.011	0.117	0.337	0.25	0.177	0.138	0.092	0.089	0.133	0.088	0.069	0.059	0.001	0.03	0.05
	N	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
Can use variety of LMS Features	Pearson Correlation	.241*	-0.027	.218*	-.241*	-0.017	.296**	.656**	1	.694**	.230*	.239*	.300**	.319**	.410**	.239*	.250*	-0.072	0.129	.246*
	Sig. (2-tailed)	0.017	0.794	0.032	0.017	0.872	0.003	< .001		< .001	0.024	0.019	0.003	0.001	< .001	0.019	0.013	0.484	0.209	0.015
	Sum of Squares and Cross-products	7.196	-2.206	6.66	-7.196	-1.887	11.278	24.041	41.505	22.753	10.784	8.979	12.567	11.34	10.052	4.701	6.577	-2.608	2.113	7.103
	Covariance	0.075	-0.023	0.069	-0.075	-0.02	0.117	0.25	0.432	0.237	0.112	0.094	0.131	0.118	0.105	0.049	0.069	-0.027	0.022	0.074
	N	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97

Properly organize Learning Materials in LMS	Pearson Correlation	0.153	-0.171	0.138	-0.153	-0.005	.320**	.588**	.694**	1	.226*	.235*	.386**	.380**	.543**	.280**	.351**	0.111	0.197	.222*
	Sig. (2-tailed)	0.135	0.093	0.177	0.135	0.962	0.001	< .001	< .001		0.026	0.02	< .001	< .001	< .001	0.006	< .001	0.277	0.053	0.029
	Sum of Squares and Cross-products	3.598	-11.103	3.33	-3.598	-0.443	9.639	17.021	22.753	25.876	8.392	6.99	12.784	10.67	10.526	4.351	7.289	3.196	2.557	5.052
	Covariance	0.037	-0.116	0.035	-0.037	-0.005	0.1	0.177	0.237	0.27	0.087	0.073	0.133	0.111	0.11	0.045	0.076	0.033	0.027	0.053
	N	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
Ensure Courses are Accessible to Special Needs Learners	Pearson Correlation	0.112	-.241*	.240*	-0.112	0.079	-0.016	.320**	.230*	.226*	1	.491**	.215*	.291**	.282**	.429**	0.16	.305**	0.174	.419**
	Sig. (2-tailed)	0.275	0.018	0.018	0.275	0.439	0.876	0.001	0.024	0.026		< .001	0.035	0.004	0.005	< .001	0.118	0.002	0.088	< .001
	Sum of Squares and Cross-products	3.773	-22.34	8.289	-3.773	10.237	-0.691	13.268	10.784	8.392	53.093	20.866	10.186	11.711	7.835	9.557	4.753	12.546	3.237	13.67
	Covariance	0.039	-0.233	0.086	-0.039	0.107	-0.007	0.138	0.112	0.087	0.553	0.217	0.106	0.122	0.082	0.1	0.05	0.131	0.034	0.142
	N	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
Use Visual Graphics in Content Development	Pearson Correlation	0.082	-0.177	0.121	-0.082	0.034	0.084	.266**	.239*	.235*	.491**	1	0.151	.330**	.395**	.459**	0.197	0.044	.238*	.367**
	Sig. (2-tailed)	0.425	0.083	0.236	0.425	0.738	0.416	0.008	0.019	0.02	< .001		0.14	< .001	< .001	< .001	0.053	0.672	0.019	< .001
	Sum of Squares and Cross-products	2.216	-13.175	3.361	-2.216	3.546	2.887	8.835	8.979	6.99	20.866	34.082	5.732	10.639	8.794	8.196	4.691	1.433	3.546	9.588
	Covariance	0.023	-0.137	0.035	-0.023	0.037	0.03	0.092	0.094	0.073	0.217	0.355	0.06	0.111	0.092	0.085	0.049	0.015	0.037	0.1
	N	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
Prepare Online Teaching resources before Semester begins	Pearson Correlation	.217*	-0.105	0.084	-.217*	0.065	-0.062	.231*	.300**	.386**	.215*	0.151	1	.541**	.430**	.307**	.320**	0.166	.209*	.286**
	Sig. (2-tailed)	0.033	0.307	0.416	0.033	0.527	0.548	0.023	0.003	< .001	0.035	0.14		< .001	< .001	0.002	0.001	0.104	0.04	0.005
	Sum of Squares and Cross-products	6.546	-8.68	2.577	-6.546	7.474	-2.381	8.536	12.567	12.784	10.186	5.732	42.371	19.423	10.67	6.113	8.505	6.093	3.474	8.34
	Covariance	0.068	-0.09	0.027	-0.068	0.078	-0.025	0.089	0.131	0.133	0.106	0.06	0.441	0.202	0.111	0.064	0.089	0.063	0.036	0.087
	N	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
Create Online Content using thorough Research on Course Concepts	Pearson Correlation	0.075	-0.179	0.059	-0.075	0.056	0.073	.405**	.319**	.380**	.291**	.330**	.541**	1	.590**	.490**	.493**	0.124	.248*	.397**
	Sig. (2-tailed)	0.463	0.079	0.565	0.463	0.584	0.48	< .001	0.001	< .001	0.004	< .001	< .001		< .001	< .001	< .001	0.226	0.014	< .001
	Sum of Squares and Cross-products	1.928	-12.608	1.546	-1.928	5.485	2.371	12.722	11.34	10.67	11.711	10.639	19.423	30.454	12.402	8.268	11.103	3.856	3.485	9.804
	Covariance	0.02	-0.131	0.016	-0.02	0.057	0.025	0.133	0.118	0.111	0.122	0.111	0.202	0.317	0.129	0.086	0.116	0.04	0.036	0.102
	N	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97

Develop Content according to the Course and Module Learning Outcomes	Pearson Correlation	0.111	-0.146	0.089	-0.111	-0.087	0.168	.388**	.410**	.543**	.282**	.395**	.430**	.590**	1	.688**	.564**	0.136	.426**	.295**
	Sig. (2-tailed)	0.279	0.155	0.389	0.279	0.396	0.1	< .001	< .001	< .001	0.005	< .001	< .001	< .001		< .001	< .001	0.185	< .001	0.003
	Sum of Squares and Cross-products	1.959	-7.062	1.598	-1.959	-5.866	3.784	8.412	10.052	10.526	7.835	8.794	10.67	12.402	14.515	8.01	8.773	2.918	4.134	5.031
	Covariance	0.02	-0.074	0.017	-0.02	-0.061	0.039	0.088	0.105	0.11	0.082	0.092	0.111	0.129	0.151	0.083	0.091	0.03	0.043	0.052
	N	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
Align Course Content, Learning Outcomes and Assessments to course level	Pearson Correlation	0.045	-0.104	0.051	-0.045	0.063	0.158	.380**	.239*	.280**	.429**	.459**	.307**	.490**	.688**	1	.442**	0.132	.568**	.367**
	Sig. (2-tailed)	0.66	0.312	0.623	0.66	0.538	0.122	< .001	0.019	0.006	< .001	< .001	0.002	< .001	< .001		< .001	0.197	< .001	< .001
	Sum of Squares and Cross-products	0.639	-4.041	0.732	-0.639	3.423	2.856	6.608	4.701	4.351	9.557	8.196	6.113	8.268	8.01	9.34	5.515	2.278	4.423	5.021
	Covariance	0.007	-0.042	0.008	-0.007	0.036	0.03	0.069	0.049	0.045	0.1	0.085	0.064	0.086	0.083	0.097	0.057	0.024	0.046	0.052
	N	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
Use Subject Specific Language in Course Content Development	Pearson Correlation	0.103	-0.136	0.098	-0.103	0.093	0.131	.242*	.250*	.351**	0.16	0.197	.320**	.493**	.564**	.442**	1	0.125	.452**	.358**
	Sig. (2-tailed)	0.318	0.183	0.339	0.318	0.366	0.199	0.017	0.013	< .001	0.118	0.053	0.001	< .001	< .001	< .001		0.222	< .001	< .001
	Sum of Squares and Cross-products	1.938	-7.093	1.897	-1.938	6.701	3.175	5.619	6.577	7.289	4.753	4.691	8.505	11.103	8.773	5.515	16.66	2.876	4.701	6.546
	Covariance	0.02	-0.074	0.02	-0.02	0.07	0.033	0.059	0.069	0.076	0.05	0.049	0.089	0.116	0.091	0.057	0.174	0.03	0.049	0.068
	N	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
Maintain a consistent tone throughout content development	Pearson Correlation	0.187	-0.121	-0.032	-0.187	-0.084	-0.055	0.004	-0.072	0.111	.305**	0.044	0.166	0.124	0.136	0.132	0.125	1	0.182	0.192
	Sig. (2-tailed)	0.066	0.239	0.755	0.066	0.413	0.59	0.968	0.484	0.277	0.002	0.672	0.104	0.226	0.185	0.197	0.222		0.074	0.06
	Sum of Squares and Cross-products	4.887	-8.67	-0.856	-4.887	-8.381	-1.845	0.134	-2.608	3.196	12.546	1.433	6.093	3.856	2.918	2.278	2.876	31.773	2.619	4.835
	Covariance	0.051	-0.09	-0.009	-0.051	-0.087	-0.019	0.001	-0.027	0.033	0.131	0.015	0.063	0.04	0.03	0.024	0.03	0.331	0.027	0.05
	N	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
Provide a variety of reference materials when developing course content	Pearson Correlation	-0.059	-0.047	0.043	0.059	0.055	0.141	.201*	0.129	0.197	0.174	.238*	.209*	.248*	.426**	.568**	.452**	0.182	1	.286**
	Sig. (2-tailed)	0.569	0.645	0.678	0.569	0.59	0.169	0.049	0.209	0.053	0.088	0.019	0.04	0.014	< .001	< .001	< .001	0.074		0.004
	Sum of Squares and Cross-products	-0.691	-1.536	0.515	0.691	2.495	2.124	2.907	2.113	2.557	3.237	3.546	3.474	3.485	4.134	4.423	4.701	2.619	6.495	3.268
	Covariance	-0.007	-0.016	0.005	0.007	0.026	0.022	0.03	0.022	0.027	0.034	0.037	0.036	0.036	0.043	0.046	0.049	0.027	0.068	0.034
	N	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
Quality Assurance/Quality Matters Standards during content development	Pearson Correlation	0.044	-0.09	0.198	-0.044	0.029	0.097	0.189	.246*	.222*	.419**	.367**	.286**	.397**	.295**	.367**	.358**	0.192	.286**	1
	Sig. (2-tailed)	0.667	0.382	0.052	0.667	0.781	0.345	0.063	0.015	0.029	< .001	< .001	0.005	< .001	0.003	< .001	< .001	0.06	0.004	
	Sum of Squares and Cross-products	0.918	-5.124	4.196	-0.918	2.268	2.567	4.825	7.103	5.052	13.67	9.588	8.34	9.804	5.031	5.021	6.546	4.835	3.268	20.062
	Covariance	0.01	-0.053	0.044	-0.01	0.024	0.027	0.05	0.074	0.053	0.142	0.1	0.087	0.102	0.052	0.052	0.068	0.05	0.034	0.209
	N	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Training correlated with developing different kinds of resources, use of variety of features in the LMS and proper organization of learning materials. Developing different types of learning materials correlated with preparation of content before the start of the semester, use of subject specific language and providing a variety of materials for online learning. Use of a variety of features in the LMS has a correlation with training, the LMS used, online teaching experience, use of visual graphics and proper organization of content in the LMS as well as adhering to quality assurance. Using visual graphics correlated with developing a variety of content materials, course accessibility to students with disability and providing a variety of references in the content developed. These correlations are very revealing towards best practices in online content development.

Online content delivery challenges

Content delivery has a lot to do with the pedagogy used by instructors. Online pedagogy is different from the face-to-face pedagogy in several fronts. To establish the challenges that faculty members experience in online content delivery, instructors responded to several areas as shown Table 24.

Table 24. Faculty online content delivery challenges

Statement		Strongly Disagree	Disagree	Moderate	Agree	Strongly Agree	Total
I have received adequate training in online content delivery	USIU-A	0	12.5	21.9	31.3	34.4	100
	KNUST	5.1	17.9	17.9	48.7	10.3	100
I am able to competently deliver content to my online students	USIU-A	0	3.1	0	31.3	65.6	100
	KNUST	0	10.3	10.3	51.3	28.2	100
I use variety of learning tools during online content delivery	USIU-A	0	0	6.3	40.6	53.1	100
	KNUST	0	10.3	25.6	48.7	15.4	100
I provide timely feedback to online learners	USIU-A	0	0	15.6	31.3	53.1	100
	KNUST	2.6	15.4	23.1	51.3	7.7	100
I am aware of the demands of online teaching	USIU-A	0	0	6.3	21.9	71.9	100
	KNUST	2.6	0	10.3	43.6	43.6	100
I adhere to Quality Assurance/Quality Matters Standards in content delivery	USIU-A	3.1	0	18.8	28.1	50	100
	KNUST	0	0	33.3	46.2	20.5	100
I maintain instructor presence in various ways during online delivery	USIU-A	6.3	0	9.4	31.3	53.1	100
	KNUST	2.6	2.6	23.1	46.2	25.6	100
I use interactive methods of online content delivery	USIU-A	0	3.1	6.3	43.8	46.9	100
	KNUST	2.6	5.1	23.1	51.3	17.9	100
I provide clear instructions for online assessments	USIU-A	0	0	9.4	25	65.6	100
	KNUST	0	5.1	20.5	46.2	28.2	100
I use announcements in course modules in the LMS to prompt/encourage learners	USIU-A	0	3.1	12.5	28.1	56.3	100
	KNUST	0	20.5	28.2	38.5	12.8	100
I organize my course content logically for ease of understanding	USIU-A	0	3.1	6.3	31.3	59.4	100
	KNUST	0	0	7.7	64.1	28.2	100
I avoid information overload during content delivery	USIU-A	0	3.1	6.3	34.4	56.3	100
	KNUST	0	0	15.4	61.5	23.1	100
I use visual graphics in online course delivery	USIU-A	0	3.1	15.6	40.6	40.6	100
	KNUST	0	5.1	30.8	33.3	30.8	100
I use presentation slides in online delivery	USIU-A	0	0	6.3	15.6	78.1	100
	KNUST	0	0	7.7	38.5	53.8	100

Whereas a majority of the faculty members agree with the statements related to online content delivery, there are still areas that stand out as possible challenges and opportunities in online content delivery such as; the use of visual graphics in online course delivery, use of announcements to prompt learners during online content delivery, provision of clear instructions,

use of interactive methods of online content delivery, maintaining instructor presence during online learning, giving students timely feedback and using a variety of tools to deliver online content. All these factors are dependent on training on quality online content delivery.

Table 25. Statistics of challenges of online content delivery

Descriptive Statistics	Mean	Std. Deviation	N
Institutional Affiliation	1.33	.473	97
Teaching Experience	2.49	1.300	97
Online Teaching Experience	1.22	.484	97
Learning Management System (LMS) used	1.67	.473	97
STEM Related Discipline	2.93	1.804	97
Adequate training in online content delivery	2.51	.738	97
Able to competently deliver content to my online students	2.84	.514	97
use variety of learning tools during online content delivery	2.74	.545	97
provide timely feedback to online learners	2.59	.673	97
aware of the demands of online teaching	2.88	.389	97
adhere to Quality Assurance/Quality Matters Standards in content delivery	2.76	.451	97
maintain instructor presence in various ways during online delivery	2.77	.510	97
use interactive methods of online content delivery	2.72	.554	97
provide clear instructions for online assessments	2.80	.471	97
use announcements in course modules in the LMS to prompt/encourage learners	2.61	.654	97
organize my course content logically for ease of understanding	2.93	.297	97
avoid information overload during content delivery	2.85	.417	97
use visual graphics in online course delivery	2.71	.539	97
use presentation slides in online delivery	2.92	.312	97

Table 26

Faculty online content delivery challenges correlations

Correlations		Institutional Affiliation	Teaching Experience	Online Teaching Experience	Learning Management System (LMS) used	STEM Related Discipline	Adequate training in online content delivery	Able to competently deliver content to my online students	use variety of learning tools during online content delivery	provide timely feedback to online learners	aware of the demands of online teaching	adhere to Quality Assurance/Quality Matters Standards in content delivery	maintain instructor presence in various ways during online delivery	use interactive methods of online content delivery	provide clear instructions for online assessments	use announcements in course modules in the LMS to prompt/encourage learners	organize my course content logically for ease of understanding	avoid information overload during content delivery	use visual graphics in online course delivery	use presentation slides in online delivery
Institutional Affiliation	Pearson Correlation	1	0.189	-0.088	-1.000**	-0.179	0.025	0.141	.252*	.268**	0.111	-0.02	0.011	0.195	0.153	.220*	-0.125	0.05	0.091	0.045
	Sig. (2-tailed)		0.063	0.392	0	0.079	0.808	0.17	0.013	0.008	0.279	0.845	0.914	0.055	0.135	0.03	0.221	0.626	0.373	0.66
	Sum of Squares and Cross-products	21.443	11.165	-1.928	-21.443	-14.691	0.835	3.278	6.247	8.196	1.959	-0.412	0.258	4.907	3.268	6.536	-1.691	0.948	2.237	0.639
	Covariance	0.223	0.116	-0.02	-0.223	-0.153	0.009	0.034	0.065	0.085	0.02	-0.004	0.003	0.051	0.034	0.068	-0.018	0.01	0.023	0.007
	N	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
Teaching Experience	Pearson Correlation	0.189	1	0.159	-0.189	0.069	-0.057	-0.001	0.005	-0.181	-0.104	-0.153	-0.143	-0.11	-0.061	-0.027	-0.068	0.104	-0.032	0.05
	Sig. (2-tailed)	0.063		0.119	0.063	0.504	0.579	0.99	0.958	0.076	0.309	0.135	0.162	0.281	0.551	0.794	0.506	0.31	0.757	0.625
	Sum of Squares and Cross-products	11.165	162.247	9.608	-11.165	15.464	-5.247	-0.082	0.371	-15.206	-5.062	-8.619	-9.113	-7.639	-3.598	-2.196	-2.536	5.423	-2.144	1.959
	Covariance	0.116	1.69	0.1	-0.116	0.161	-0.055	-0.001	0.004	-0.158	-0.053	-0.09	-0.095	-0.08	-0.037	-0.023	-0.026	0.056	-0.022	0.02
	N	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
Online Teaching Experience	Pearson Correlation	-0.088	0.159	1	0.088	0.054	.216*	0.103	0.135	-0.011	0.033	0.094	0.032	-0.006	-0.041	0.106	0.037	-0.091	0.042	0.051
	Sig. (2-tailed)	0.392	0.119		0.392	0.6	0.034	0.314	0.188	0.916	0.747	0.357	0.754	0.953	0.693	0.301	0.717	0.378	0.68	0.623
	Sum of Squares and Cross-products	-1.928	9.608	22.454	1.928	4.515	7.392	2.464	3.412	-0.34	0.598	1.979	0.763	-0.155	-0.887	3.227	0.515	-1.753	1.062	0.732
	Covariance	-0.02	0.1	0.234	0.02	0.047	0.077	0.026	0.036	-0.004	0.006	0.021	0.008	-0.002	-0.009	0.034	0.005	-0.018	0.011	0.008
	N	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97

Learning Management System (LMS) used	Pearson Correlation	-1.000**	-0.189	0.088	1	0.179	-0.025	-0.141	-.252*	-.268**	-0.111	0.02	-0.011	-0.195	-0.153	-.220*	0.125	-0.05	-0.091	-0.045
	Sig. (2-tailed)	0	0.063	0.392		0.079	0.808	0.17	0.013	0.008	0.279	0.845	0.914	0.055	0.135	0.03	0.221	0.626	0.373	0.66
	Sum of Squares and Cross-products	-21.443	-11.165	1.928	21.443	14.691	-0.835	-3.278	-6.247	-8.196	-1.959	0.412	-0.258	-4.907	-3.268	-6.536	1.691	-0.948	-2.237	-0.639
	Covariance	-0.223	-0.116	0.02	0.223	0.153	-0.009	-0.034	-0.065	-0.085	-0.02	0.004	-0.003	-0.051	-0.034	-0.068	0.018	-0.01	-0.023	-0.007
	N	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
STEM Related Discipline	Pearson Correlation	-0.179	0.069	0.054	0.179	1	0.082	0.009	-0.019	0.001	-0.043	0.081	0.095	0.126	0.008	-0.086	0.087	0.013	0.128	0.026
	Sig. (2-tailed)	0.079	0.504	0.6	0.079		0.422	0.926	0.853	0.992	0.679	0.43	0.354	0.22	0.94	0.403	0.395	0.902	0.211	0.798
	Sum of Squares and Cross-products	-14.691	15.464	4.515	14.691	312.495	10.536	0.845	-1.804	0.113	-2.866	6.34	8.412	12.052	0.629	-9.742	4.495	0.918	11.979	1.423
	Covariance	-0.153	0.161	0.047	0.153	3.255	0.11	0.009	-0.019	0.001	-0.03	0.066	0.088	0.126	0.007	-0.101	0.047	0.01	0.125	0.015
	N	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
Adequate training in online content delivery	Pearson Correlation	0.025	-0.057	.216*	-0.025	0.082	1	.359**	.249*	0.193	.256*	.332**	.224*	.220*	0.168	.263**	.310**	-0.048	.213*	0.138
	Sig. (2-tailed)	0.808	0.579	0.034	0.808	0.422		< .001	0.014	0.058	0.011	< .001	0.027	0.03	0.1	0.009	0.002	0.639	0.036	0.179
	Sum of Squares and Cross-products	0.835	-5.247	7.392	-0.835	10.536	52.247	13.082	9.629	9.206	7.062	10.619	8.113	8.639	5.598	12.196	6.536	-1.423	8.144	3.041
	Covariance	0.009	-0.055	0.077	-0.009	0.11	0.544	0.136	0.1	0.096	0.074	0.111	0.085	0.09	0.058	0.127	0.068	-0.015	0.085	0.032
	N	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
Able to competently deliver content to my online students	Pearson Correlation	0.141	-0.001	0.103	-0.141	0.009	.359**	1	.813**	.524**	.366**	.413**	.452**	.569**	.683**	.363**	.603**	-0.023	.540**	.564**
	Sig. (2-tailed)	0.17	0.99	0.314	0.17	0.926	< .001		< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	0.823	< .001	< .001
	Sum of Squares and Cross-products	3.278	-0.082	2.464	-3.278	0.845	13.082	25.361	21.876	17.402	7.021	9.206	11.371	15.546	15.866	11.732	8.845	-0.474	14.381	8.68
	Covariance	0.034	-0.001	0.026	-0.034	0.009	0.136	0.264	0.228	0.181	0.073	0.096	0.118	0.162	0.165	0.122	0.092	-0.005	0.15	0.09
	N	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
Use variety of learning tools during online content delivery	Pearson Correlation	.252*	0.005	0.135	-.252*	-0.019	.249*	.813**	1	.530**	.241*	.469**	.499**	.518**	.653**	.385**	.398**	0.052	.524**	.425**
	Sig. (2-tailed)	0.013	0.958	0.188	0.013	0.853	0.014	< .001		< .001	0.017	< .001	< .001	< .001	< .001	< .001	< .001	0.613	< .001	< .001
	Sum of Squares and Cross-products	6.247	0.371	3.412	-6.247	-1.804	9.629	21.876	28.557	18.691	4.907	11.072	13.33	15.041	16.103	13.206	6.196	1.134	14.784	6.938
	Covariance	0.065	0.004	0.036	-0.065	-0.019	0.1	0.228	0.297	0.195	0.051	0.115	0.139	0.157	0.168	0.138	0.065	0.012	0.154	0.072
	N	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97

Provide timely feedback to online learners	Pearson Correlation	.268**	-0.181	-0.011	-.268**	0.001	0.193	.524**	.530**	1	.400**	.395**	.422**	.443**	.531**	.244*	.266**	.253*	.386**	.332**
	Sig. (2-tailed)	0.008	0.076	0.916	0.008	0.992	0.058	< .001	< .001		< .001	< .001	< .001	< .001	< .001	0.016	0.008	0.012	< .001	< .001
	Sum of Squares and Cross-products	8.196	-15.206	-0.34	-8.196	0.113	9.206	17.402	18.691	43.505	10.052	11.515	13.928	15.866	16.165	10.33	5.113	6.814	13.454	6.701
	Covariance	0.085	-0.158	-0.004	-0.085	0.001	0.096	0.181	0.195	0.453	0.105	0.12	0.145	0.165	0.168	0.108	0.053	0.071	0.14	0.07
	N	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
Aware of the demands of online teaching	Pearson Correlation	0.111	-0.104	0.033	-0.111	-0.043	.256*	.366**	.241*	.400**	1	.306**	.330**	.370**	.321**	.258*	.462**	0.074	0.176	.430**
	Sig. (2-tailed)	0.279	0.309	0.747	0.279	0.679	0.011	< .001	0.017	< .001		0.002	< .001	< .001	0.001	0.011	< .001	0.474	0.085	< .001
	Sum of Squares and Cross-products	1.959	-5.062	0.598	-1.959	-2.866	7.062	7.021	4.907	10.052	14.515	5.155	6.278	7.66	5.649	6.299	5.134	1.144	3.536	5.01
	Covariance	0.02	-0.053	0.006	-0.02	-0.03	0.074	0.073	0.051	0.105	0.151	0.054	0.065	0.08	0.059	0.066	0.053	0.012	0.037	0.052
	N	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
Adhere to Quality Assurance/ Quality Matters Standards in content delivery	Pearson Correlation	-0.02	-0.153	0.094	0.02	0.081	.332**	.413**	.469**	.395**	.306**	1	.623**	.358**	.368**	.247*	.337**	0.08	.272**	0.156
	Sig. (2-tailed)	0.845	0.135	0.357	0.845	0.43	< .001	< .001	< .001	< .001	0.002		< .001	< .001	< .001	0.015	< .001	0.436	0.007	0.128
	Sum of Squares and Cross-products	-0.412	-8.619	1.979	0.412	6.34	10.619	9.206	11.072	11.515	5.155	19.546	13.784	8.598	7.495	6.99	4.34	1.443	6.361	2.103
	Covariance	-0.004	-0.09	0.021	0.004	0.066	0.111	0.096	0.115	0.12	0.054	0.204	0.144	0.09	0.078	0.073	0.045	0.015	0.066	0.022
	N	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
Maintain instructor presence in various ways during online delivery	Pearson Correlation	0.011	-0.143	0.032	-0.011	0.095	.224*	.452**	.499**	.422**	.330**	.623**	1	.511**	.550**	.324**	.509**	0.176	.441**	.274**
	Sig. (2-tailed)	0.914	0.162	0.754	0.914	0.354	0.027	< .001	< .001	< .001	< .001	< .001		< .001	< .001	0.001	< .001	0.084	< .001	0.007
	Sum of Squares and Cross-products	0.258	-9.113	0.763	-0.258	8.412	8.113	11.371	13.33	13.928	6.278	13.784	25.01	13.876	12.691	10.381	7.412	3.598	11.649	4.186
	Covariance	0.003	-0.095	0.008	-0.003	0.088	0.085	0.118	0.139	0.145	0.065	0.144	0.261	0.145	0.132	0.108	0.077	0.037	0.121	0.044
	N	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
Use interactive methods of online content delivery	Pearson Correlation	0.195	-0.11	-0.006	-0.195	0.126	.220*	.569**	.518**	.443**	.370**	.358**	.511**	1	.547**	.414**	.509**	0.082	.425**	.288**
	Sig. (2-tailed)	0.055	0.281	0.953	0.055	0.22	0.03	< .001	< .001	< .001	< .001	< .001	< .001		< .001	< .001	< .001	0.423	< .001	0.004
	Sum of Squares and Cross-products	4.907	-7.639	-0.155	-4.907	12.052	8.639	15.546	15.041	15.866	7.66	8.598	13.876	29.485	13.711	14.423	8.052	1.825	12.206	4.773
	Covariance	0.051	-0.08	-0.002	-0.051	0.126	0.09	0.162	0.157	0.165	0.08	0.09	0.145	0.307	0.143	0.15	0.084	0.019	0.127	0.05
	N	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97

Provide clear instructions for online assessments	Pearson Correlation	0.153	-0.061	-0.041	-0.153	0.008	0.168	.683**	.653**	.531**	.321**	.368**	.550**	.547**	1	.391**	.419**	0.056	.555**	.527**
	Sig. (2-tailed)	0.135	0.551	0.693	0.135	0.94	0.1	< .001	< .001	< .001	0.001	< .001	< .001	< .001		< .001	< .001	0.583	< .001	< .001
	Sum of Squares and Cross-products	3.268	-3.598	-0.887	-3.268	0.629	5.598	15.866	16.103	16.165	5.649	7.495	12.691	13.711	21.278	11.557	5.629	1.062	13.515	7.433
	Covariance	0.034	-0.037	-0.009	-0.034	0.007	0.058	0.165	0.168	0.168	0.059	0.078	0.132	0.143	0.222	0.12	0.059	0.011	0.141	0.077
	N	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
Use announcements in course modules in the LMS to prompt/ encourage learners	Pearson Correlation	.220*	-0.027	0.106	-.220*	-0.086	.263**	.363**	.385**	.244*	.258*	.247*	.324**	.414**	.391**	1	.281**	0.119	.267**	0.146
	Sig. (2-tailed)	0.03	0.794	0.301	0.03	0.403	0.009	< .001	< .001	0.016	0.011	0.015	0.001	< .001	< .001		0.005	0.245	0.008	0.153
	Sum of Squares and Cross-products	6.536	-2.196	3.227	-6.536	-9.742	12.196	11.732	13.206	10.33	6.299	6.99	10.381	14.423	11.557	41.113	5.258	3.124	9.031	2.866
	Covariance	0.068	-0.023	0.034	-0.068	-0.101	0.127	0.122	0.138	0.108	0.066	0.073	0.108	0.15	0.12	0.428	0.055	0.033	0.094	0.03
	N	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
Organize my course content logically for ease of understanding	Pearson Correlation	-0.125	-0.068	0.037	0.125	0.087	.310**	.603**	.398**	.266**	.462**	.337**	.509**	.509**	.419**	.281**	1	0.077	.388**	.497**
	Sig. (2-tailed)	0.221	0.506	0.717	0.221	0.395	0.002	< .001	< .001	0.008	< .001	< .001	< .001	< .001	< .001	0.005		0.453	< .001	< .001
	Sum of Squares and Cross-products	-1.691	-2.536	0.515	1.691	4.495	6.536	8.845	6.196	5.113	5.134	4.34	7.412	8.052	5.629	5.258	8.495	0.918	5.979	4.423
	Covariance	-0.018	-0.026	0.005	0.018	0.047	0.068	0.092	0.065	0.053	0.053	0.045	0.077	0.084	0.059	0.055	0.088	0.01	0.062	0.046
	N	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
Avoid information overload during content delivery	Pearson Correlation	0.05	0.104	-0.091	-0.05	0.013	-0.048	-0.023	0.052	.253*	0.074	0.08	0.176	0.082	0.056	0.119	0.077	1	0.077	0.061
	Sig. (2-tailed)	0.626	0.31	0.378	0.626	0.902	0.639	0.823	0.613	0.012	0.474	0.436	0.084	0.423	0.583	0.245	0.453		0.451	0.552
	Sum of Squares and Cross-products	0.948	5.423	-1.753	-0.948	0.918	-1.423	-0.474	1.134	6.814	1.144	1.443	3.598	1.825	1.062	3.124	0.918	16.68	1.67	0.763
	Covariance	0.01	0.056	-0.018	-0.01	0.01	-0.015	-0.005	0.012	0.071	0.012	0.015	0.037	0.019	0.011	0.033	0.01	0.174	0.017	0.008
	N	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
Use visual graphics in online course delivery	Pearson Correlation	0.091	-0.032	0.042	-0.091	0.128	.213*	.540**	.524**	.386**	0.176	.272**	.441**	.425**	.555**	.267**	.388**	0.077	1	.476**
	Sig. (2-tailed)	0.373	0.757	0.68	0.373	0.211	0.036	< .001	< .001	< .001	0.085	0.007	< .001	< .001	< .001	0.008	< .001	0.451		< .001
	Sum of Squares and Cross-products	2.237	-2.144	1.062	-2.237	11.979	8.144	14.381	14.784	13.454	3.536	6.361	11.649	12.206	13.515	9.031	5.979	1.67	27.918	7.691
	Covariance	0.023	-0.022	0.011	-0.023	0.125	0.085	0.15	0.154	0.14	0.037	0.066	0.121	0.127	0.141	0.094	0.062	0.017	0.291	0.08
	N	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
Use presentation slides in online delivery	Pearson Correlation	0.045	0.05	0.051	-0.045	0.026	0.138	.564**	.425**	.332**	.430**	0.156	.274**	.288**	.527**	0.146	.497**	0.061	.476**	1
	Sig. (2-tailed)	0.66	0.625	0.623	0.66	0.798	0.179	< .001	< .001	< .001	< .001	0.128	0.007	0.004	< .001	0.153	< .001	0.552	< .001	
	Sum of Squares and Cross-products	0.639	1.959	0.732	-0.639	1.423	3.041	8.68	6.938	6.701	5.01	2.103	4.186	4.773	7.433	2.866	4.423	0.763	7.691	9.34
	Covariance	0.007	0.02	0.008	-0.007	0.015	0.032	0.09	0.072	0.07	0.052	0.022	0.044	0.05	0.077	0.03	0.046	0.008	0.08	0.097
	N	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Further analysis of the qualitative data provided by instructors indicate more challenges such as those related to designing and developing learning activities that are collaborative, designing of instructional videos, coming up with authentic online assessments and their rubrics and lack of time to develop quality online learning materials among others. From the findings of this study it is clear that faculty members in both institutions need help in time management in online education content development and delivery, institutional support and capacity building in the design, development and delivery of online content.

Success factors for content development and delivery

The third objective of this study was to establish the success factors for online content development and delivery. Faculty members were asked to respond to statements that allude to success factors and their responses (Tables 27 and 28).

Table 27. *Success factors for online content development and delivery*

Success factors for online content development and delivery							
		Very little extent	Little extent	Moderate	Large extent	Very large extent	Total
Use of student centered approach	USU-A	3.1	3.1	12.5	40.6	40.6	100
	KNUST	5.3	13.2	28.9	34.2	18.4	100
Use of activities that keep students engaged	USU-A	3.1	0	6.3	31.3	59.4	100
	KNUST	2.6	13.2	28.9	31.6	23.7	100
Motivation of students	USU-A	0	3.1	12.5	40.6	43.8	100
	KNUST	5.3	15.8	28.9	31.6	18.4	100
Students' mentorship	USU-A	3.1	3.1	18.8	40.6	34.4	100
	KNUST	0	15.8	36.8	36.8	10.5	100
Eloquence in communication	USU-A	3.1	0	9.4	40.6	46.9	100
	KNUST	2.6	18.4	28.9	39.5	10.5	100
Articulation of points from basic to complex	USU-A	3.1	0	3.1	50	43.8	100
	KNUST	2.6	21.1	21.1	39.5	15.8	100
Use of relevant examples	USU-A	3.1	3.1	0	31.3	62.5	100
	KNUST	7.9	10.5	26.3	34.2	21.1	100
Accommodation of student participation	USU-A	0	3.1	3.1	46.9	46.9	100
	KNUST	5.3	15.8	26.3	36.8	15.8	100
Proper choice of assessments	USU-A	3.1	3.1	12.5	37.5	43.8	100
	KNUST	2.6	13.2	26.3	39.5	18.4	100
Understanding of LMS used.	USU-A	3.1	3.1	9.4	53.1	31.3	100
	KNUST	5.3	10.5	23.7	44.7	15.8	100
Technological skills	USU-A	3.1	0	12.5	37.5	46.9	100
	KNUST	2.6	10.5	18.4	36.8	31.6	100
Reliable internet connectivity	USU-A	0	3.1	9.4	34.4	53.1	100
	KNUST	2.6	15.8	23.7	21.1	36.8	100
Use of the right digital tools	USU-A	3.1	0	9.4	53.1	34.4	100
	KNUST	2.6	18.4	18.4	42.1	18.4	100
Orientation of the students to the course	USU-A	3.1	3.1	9.4	37.5	46.9	100
	KNUST	2.6	21.1	15.8	47.4	13.2	100
Continuous online support to the students	USU-A	3.1	0	9.4	37.5	50	100
	KNUST	2.6	10.5	39.5	28.9	18.4	100
Prompt provision of feedback	USU-A	3.1	0	12.5	34.4	50	100
	KNUST	2.6	15.8	34.2	34.2	13.2	100
Reminders for assignment due dates	USU-A	6.3	0	15.6	46.9	31.3	100
	KNUST	2.6	18.4	28.9	42.1	7.9	100
Use of announcements tool to convey important course	USU-A	3.1	0	6.3	46.9	43.8	100
	KNUST	5.3	18.4	39.5	23.7	13.2	100
Use of appropriate tone and voice modulation	USU-A	3.1	0	9.4	46.9	40.6	100
	KNUST	2.6	13.2	39.5	34.2	10.5	100
Open to diverse views from students	USU-A	3.1	0	6.3	53.1	37.5	100
	KNUST	5.3	7.9	23.7	50	13.2	100
Better understanding of student profiles	USU-A	3.1	3.1	6.3	53.1	34.4	100
	KNUST	0	10.5	42.1	31.6	15.8	100

The findings indicate that there are many success factors that can be improved for quality online content development. These present opportunities especially in the area of capacity building in training faculty for quality online content development. Outstanding areas of improvement in online content development and delivery as revealed in this study are; keeping in mind the students and using student approaches when developing and delivering online content, using activities that engage students, effective communication during content delivery and understanding of the capabilities of the LMS used among others. These present training opportunities towards high quality online education in these institutions and beyond. The next four tables summarize success factors and their correlations.

Table 28. Success factors for content development statistics

Descriptive Statistics	Mean	Std. Deviation	N
Institutional Affiliation	1.33	.473	97
Teaching Experience	2.49	1.300	97
Online Teaching Experience	1.22	.484	97
Learning Management System (LMS) used	1.67	.473	97
STEM Related Discipline	2.93	1.804	97
SOCDEV Access to library reference resources	2.31	.884	26
SOCDEV Choice of course texts	2.19	.849	26
SOCDEV Understanding of learning outcomes	2.27	.919	26
SOCDEV Choice of learning activities	2.23	.951	26
SOCDEV Alignment to Blooms taxonomy	2.04	.824	26
SOCDEV Choice of assessment tools	2.38	.804	26
SOCDEV Knowledge of the right digital tools	2.15	.881	26
SOCDEV Engaging content	2.27	.919	26
SOCDEV Use of conventional academic language	2.00	.894	26
SOCDEV Choice of assessment tools at each level	2.27	.874	26
SOCDEV Understanding of student profiles	2.31	.788	26
SOCDEV Adequacy of training needs analysis	2.31	.788	26
SOCDEV Understanding of the learning environment	2.31	.884	26
SOCDEV Consideration of learner diversity	2.15	.834	26
SOCDEV Consideration of diverse student needs	2.12	.816	26

Table 29: Success factors for content development correlations

Correlations		Institutional Affiliation	Teaching Experience	Online Teaching Experience	Learning Management System (LMS) used	STEM Related Discipline	SOCDEV Access to library reference resources	SOCDEV Choice of course texts	SOCDEV Understanding of learning outcomes	SOCDEV Choice of learning activities	SOCDEV Alignment to Blooms taxonomy	SOCDEV Choice of assessment tools	SOCDEV Knowledge of the right digital tools	SOCDEV Engaging content	SOCDEV Use of conventional academic language	SOCDEV Choice of assessment tools at each level	SOCDEV Understanding of student profiles	SOCDEV Adequacy of training needs analysis	SOCDEV Understanding of the learning environment	SOCDEV Consideration of learner diversity	SOCDEV Consideration of diverse student needs
Institutional Affiliation	Pearson Correlation	1	0.189	-0.088	-1.000**	-0.179	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	Sig. (2-tailed)		0.063	0.392	0	0.079	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	Sum of Squares and Cross-products	21.443	11.165	-1.928	-21.443	-14.691	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Covariance	0.223	0.116	-0.02	-0.223	-0.153	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	N	97	97	97	97	97	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
Teaching Experience	Pearson Correlation	0.189	1	0.159	-0.189	0.069	-0.061	-0.283	-0.326	-0.226	-0.148	-0.324	-0.302	-0.326	-0.123	-0.259	-0.162	-0.208	-0.269	-0.143	-0.042
	Sig. (2-tailed)	0.063		0.119	0.063	0.504	0.768	0.161	0.104	0.267	0.471	0.106	0.134	0.104	0.548	0.201	0.43	0.307	0.184	0.487	0.84
	Sum of Squares and Cross-products	11.165	162.247	9.608	-11.165	15.464	-1.462	-6.538	-8.154	-5.846	-3.308	-7.077	-7.231	-8.154	-3	-6.154	-3.462	-4.462	-6.462	-3.231	-0.923
	Covariance	0.116	1.69	0.1	-0.116	0.161	-0.058	-0.262	-0.326	-0.234	-0.132	-0.283	-0.289	-0.326	-0.12	-0.246	-0.138	-0.178	-0.258	-0.129	-0.037
	N	97	97	97	97	97	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
Online Teaching Experience	Pearson Correlation	-0.088	0.159	1	0.088	0.054	-0.18	-0.346	-0.293	-0.262	-0.181	-0.328	-0.311	-0.293	-0.362	-0.234	-0.284	-0.12	-0.327	-0.096	-0.073
	Sig. (2-tailed)	0.392	0.119		0.392	0.6	0.378	0.083	0.147	0.196	0.375	0.101	0.122	0.147	0.069	0.251	0.159	0.559	0.103	0.642	0.722
	Sum of Squares and Cross-products	-1.928	9.608	22.454	1.928	4.515	-2.462	-4.538	-4.154	-3.846	-2.308	-4.077	-4.231	-4.154	-5	-3.154	-3.462	-1.462	-4.462	-1.231	-0.923
	Covariance	-0.02	0.1	0.234	0.02	0.047	-0.098	-0.182	-0.166	-0.154	-0.092	-0.163	-0.169	-0.166	-0.2	-0.126	-0.138	-0.058	-0.178	-0.049	-0.037
	N	97	97	97	97	97	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
Learning Management System (LMS) used	Pearson Correlation	-1.000**	-0.189	0.088	1	0.179	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	Sig. (2-tailed)	0	0.063	0.392		0.079	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	Sum of Squares and Cross-products	-21.443	-11.165	1.928	21.443	14.691	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Covariance	-0.223	-0.116	0.02	0.223	0.153	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	N	97	97	97	97	97	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26

STEM Related Discipline	Pearson Correlation	-0.179	0.069	0.054	0.179	1	0.231	0.014	0.13	0.101	0.053	0.157	-0.246	0.13	-0.046	0.066	0.102	-0.054	0.091	0.258	0.261
	Sig. (2-tailed)	0.079	0.504	0.6	0.079		0.257	0.946	0.527	0.622	0.798	0.443	0.226	0.527	0.824	0.749	0.619	0.793	0.658	0.203	0.199
	Sum of Squares and Cross-products	-14.691	15.464	4.515	14.691	312.495	9.923	0.577	5.808	4.692	2.115	6.154	-10.538	5.808	-2	2.808	3.923	-2.077	3.923	10.462	10.346
	Covariance	-0.153	0.161	0.047	0.153	3.255	0.397	0.023	0.232	0.188	0.085	0.246	-0.422	0.232	-0.08	0.112	0.157	-0.083	0.157	0.418	0.414
	N	97	97	97	97	97	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
SOCDEV Access to library reference resources	Pearson Correlation	.[b]	-0.061	-0.18	.[b]	0.231	1	.664**	.632**	.721**	.532**	.671**	.605**	.682**	.405*	.561**	.433*	.490*	.591**	.639**	.725**
	Sig. (2-tailed)	.	0.768	0.378	.	0.257		<.001	<.001	<.001	0.005	<.001	0.001	<.001	0.04	0.003	0.027	0.011	0.001	<.001	<.001
	Sum of Squares and Cross-products	0	-1.462	-2.462	0	9.923	19.538	12.462	12.846	15.154	9.692	11.923	11.769	13.846	8	10.846	7.538	8.538	11.538	11.769	13.077
	Covariance	0	-0.058	-0.098	0	0.397	0.782	0.498	0.514	0.606	0.388	0.477	0.471	0.554	0.32	0.434	0.302	0.342	0.462	0.471	0.523
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
SOCDEV Choice of course texts	Pearson Correlation	.[b]	-0.283	-0.346	.[b]	0.014	.664**	1	.853**	.884**	.789**	.766**	.761**	.853**	.684**	.735**	.565**	.625**	.824**	.634**	.601**
	Sig. (2-tailed)	.	0.161	0.083	.	0.946	<.001		<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	0.003	<.001	<.001	<.001	0.001
	Sum of Squares and Cross-products	0	-6.538	-4.538	0	0.577	12.462	18.038	16.654	17.846	13.808	13.077	14.231	16.654	13	13.654	9.462	10.462	15.462	11.231	10.423
	Covariance	0	-0.262	-0.182	0	0.023	0.498	0.722	0.666	0.714	0.552	0.523	0.569	0.666	0.52	0.546	0.378	0.418	0.618	0.449	0.417
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
SOCDEV Understanding of learning outcomes	Pearson Correlation	.[b]	-0.326	-0.293	.[b]	0.13	.632**	.853**	1	.887**	.778**	.883**	.787**	.953**	.681**	.852**	.764**	.654**	.928**	.727**	.703**
	Sig. (2-tailed)	.	0.104	0.147	.	0.527	<.001	<.001		<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
	Sum of Squares and Cross-products	0	-8.154	-4.154	0	5.808	12.846	16.654	21.115	19.385	14.731	16.308	15.923	20.115	14	17.115	13.846	11.846	18.846	13.923	13.192
	Covariance	0	-0.326	-0.166	0	0.232	0.514	0.666	0.845	0.775	0.589	0.652	0.637	0.805	0.56	0.685	0.554	0.474	0.754	0.557	0.528
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
SOCDEV Choice of learning activities	Pearson Correlation	.[b]	-0.226	-0.262	.[b]	0.101	.721**	.884**	.887**	1	.754**	.821**	.768**	.887**	.658**	.788**	.702**	.648**	.911**	.760**	.737**
	Sig. (2-tailed)	.	0.267	0.196	.	0.622	<.001	<.001	<.001		<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
	Sum of Squares and Cross-products	0	-5.846	-3.846	0	4.692	15.154	17.846	19.385	22.615	14.769	15.692	16.077	19.385	14	16.385	13.154	12.154	19.154	15.077	14.308
	Covariance	0	-0.234	-0.154	0	0.188	0.606	0.714	0.775	0.905	0.591	0.628	0.643	0.775	0.56	0.655	0.526	0.486	0.766	0.603	0.572
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
SOCDEV Alignment to Blooms taxonomy	Pearson Correlation	.[b]	-0.148	-0.181	.[b]	0.053	.532**	.789**	.778**	.754**	1	.762**	.708**	.778**	.652**	.818**	.720**	.597**	.752**	.748**	.767**
	Sig. (2-tailed)	.	0.471	0.375	.	0.798	0.005	<.001	<.001	<.001		<.001	<.001	<.001	<.001	<.001	<.001	0.001	<.001	<.001	<.001
	Sum of Squares and Cross-products	0	-3.308	-2.308	0	2.115	9.692	13.808	14.731	14.769	16.962	12.615	12.846	14.731	12	14.731	11.692	9.692	13.692	12.846	12.885
	Covariance	0	-0.132	-0.092	0	0.085	0.388	0.552	0.589	0.591	0.678	0.505	0.514	0.589	0.48	0.589	0.468	0.388	0.548	0.514	0.515
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26

SOCDEV Choice of assessment tools	Pearson Correlation	.[b]	-0.324	-0.328	.[b]	0.157	.671**	.766**	.883**	.821**	.762**	1	.761**	.937**	.723**	.928**	.816**	.626**	.840**	.744**	.722**
	Sig. (2-tailed)	.	0.106	0.101	.	0.443	<.001	<.001	<.001	<.001	<.001		<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
	Sum of Squares and Cross-products	0	-7.077	-4.077	0	6.154	11.923	13.077	16.308	15.692	12.615	16.154	13.462	17.308	13	16.308	12.923	9.923	14.923	12.462	11.846
	Covariance	0	-0.283	-0.163	0	0.246	0.477	0.523	0.652	0.628	0.505	0.646	0.538	0.692	0.52	0.652	0.517	0.397	0.597	0.498	0.474
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
SOCDEV Knowledge of the right digital tools	Pearson Correlation	.[b]	-0.302	-0.311	.[b]	-0.246	.605**	.761**	.787**	.768**	.708**	.761**	1	.787**	.711**	.775**	.621**	.621**	.759**	.620**	.587**
	Sig. (2-tailed)	.	0.134	0.122	.	0.226	0.001	<.001	<.001	<.001	<.001	<.001		<.001	<.001	<.001	<.001	<.001	<.001	<.001	0.002
	Sum of Squares and Cross-products	0	-7.231	-4.231	0	-10.538	11.769	14.231	15.923	16.077	12.846	13.462	19.385	15.923	14	14.923	10.769	10.769	14.769	11.385	10.538
	Covariance	0	-0.289	-0.169	0	-0.422	0.471	0.569	0.637	0.643	0.514	0.538	0.775	0.637	0.56	0.597	0.431	0.431	0.591	0.455	0.422
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
SOCDEV Engaging content	Pearson Correlation	.[b]	-0.326	-0.293	.[b]	0.13	.682**	.853**	.953**	.887**	.778**	.937**	.787**	1	.730**	.902**	.764**	.709**	.928**	.779**	.757**
	Sig. (2-tailed)	.	0.104	0.147	.	0.527	<.001	<.001	<.001	<.001	<.001	<.001	<.001		<.001	<.001	<.001	<.001	<.001	<.001	<.001
	Sum of Squares and Cross-products	0	-8.154	-4.154	0	5.808	13.846	16.654	20.115	19.385	14.731	17.308	15.923	21.115	15	18.115	13.846	12.846	18.846	14.923	14.192
	Covariance	0	-0.326	-0.166	0	0.232	0.554	0.666	0.805	0.775	0.589	0.692	0.637	0.845	0.6	0.725	0.554	0.514	0.754	0.597	0.568
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
SOCDEV Use of conventional academic language	Pearson Correlation	.[b]	-0.123	-0.362	.[b]	-0.046	.405*	.684**	.681**	.658**	.652**	.723**	.711**	.730**	1	.767**	.624**	.511**	.708**	.590**	.548**
	Sig. (2-tailed)	.	0.548	0.069	.	0.824	0.04	<.001	<.001	<.001	<.001	<.001	<.001	<.001		<.001	<.001	0.008	<.001	0.002	0.004
	Sum of Squares and Cross-products	0	-3	-5	0	-2	8	13	14	14	12	13	14	15	20	15	11	9	14	11	10
	Covariance	0	-0.12	-0.2	0	-0.08	0.32	0.52	0.56	0.56	0.48	0.52	0.56	0.6	0.8	0.6	0.44	0.36	0.56	0.44	0.4
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
SOCDEV Choice of assessment tools at each level	Pearson Correlation	.[b]	-0.259	-0.234	.[b]	0.066	.561**	.735**	.852**	.788**	.818**	.928**	.775**	.902**	.767**	1	.803**	.687**	.820**	.764**	.739**
	Sig. (2-tailed)	.	0.201	0.251	.	0.749	0.003	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001		<.001	<.001	<.001	<.001	<.001
	Sum of Squares and Cross-products	0	-6.154	-3.154	0	2.808	10.846	13.654	17.115	16.385	14.731	16.308	14.923	18.115	15	19.115	13.846	11.846	15.846	13.923	13.192
	Covariance	0	-0.246	-0.126	0	0.112	0.434	0.546	0.685	0.655	0.589	0.652	0.597	0.725	0.6	0.765	0.554	0.474	0.634	0.557	0.528
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26

SOCDEV Understanding of student profiles	Pearson Correlation	.[b]	-0.162	-0.284	.[b]	0.102	.433*	.565**	.764**	.702**	.720**	.816**	.621**	.764**	.624**	.803**	1	.678**	.834**	.716**	.751**
	Sig. (2-tailed)	.	0.43	0.159	.	0.619	0.027	0.003	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001		<.001	<.001	<.001	<.001
	Sum of Squares and Cross-products	0	-3.462	-3.462	0	3.923	7.538	9.462	13.846	13.154	11.692	12.923	10.769	13.846	11	13.846	15.538	10.538	14.538	11.769	12.077
	Covariance	0	-0.138	-0.138	0	0.157	0.302	0.378	0.554	0.526	0.468	0.517	0.431	0.554	0.44	0.554	0.622	0.422	0.582	0.471	0.483
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
SOCDEV Adequacy of training needs analysis	Pearson Correlation	.[b]	-0.208	-0.12	.[b]	-0.054	.490*	.625**	.654**	.648**	.597**	.626**	.621**	.709**	.511**	.687**	.678**	1	.777**	.655**	.751**
	Sig. (2-tailed)	.	0.307	0.559	.	0.793	0.011	<.001	<.001	<.001	0.001	<.001	<.001	<.001	0.008	<.001	<.001		<.001	<.001	<.001
	Sum of Squares and Cross-products	0	-4.462	-1.462	0	-2.077	8.538	10.462	11.846	12.154	9.692	9.923	10.769	12.846	9	11.846	10.538	15.538	13.538	10.769	12.077
	Covariance	0	-0.178	-0.058	0	-0.083	0.342	0.418	0.474	0.486	0.388	0.397	0.431	0.514	0.36	0.474	0.422	0.622	0.542	0.431	0.483
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
SOCDEV Understanding of the learning environment	Pearson Correlation	.[b]	-0.269	-0.327	.[b]	0.091	.591**	.824**	.928**	.911**	.752**	.840**	.759**	.928**	.708**	.820**	.834**	.777**	1	.801**	.780**
	Sig. (2-tailed)	.	0.184	0.103	.	0.658	0.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001		<.001	<.001
	Sum of Squares and Cross-products	0	-6.462	-4.462	0	3.923	11.538	15.462	18.846	19.154	13.692	14.923	14.769	18.846	14	15.846	14.538	13.538	19.538	14.769	14.077
	Covariance	0	-0.258	-0.178	0	0.157	0.462	0.618	0.754	0.766	0.548	0.597	0.591	0.754	0.56	0.634	0.582	0.542	0.782	0.591	0.563
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
SOCDEV Consideration of learner diversity	Pearson Correlation	.[b]	-0.143	-0.096	.[b]	0.258	.639**	.634**	.727**	.760**	.748**	.744**	.620**	.779**	.590**	.764**	.716**	.655**	.801**	1	.913**
	Sig. (2-tailed)	.	0.487	0.642	.	0.203	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	0.002	<.001	<.001	<.001	<.001		<.001
	Sum of Squares and Cross-products	0	-3.231	-1.231	0	10.462	11.769	11.231	13.923	15.077	12.846	12.462	11.385	14.923	11	13.923	11.769	10.769	14.769	17.385	15.538
	Covariance	0	-0.129	-0.049	0	0.418	0.471	0.449	0.557	0.603	0.514	0.498	0.455	0.597	0.44	0.557	0.471	0.431	0.591	0.695	0.622
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
SOCDEV Consideration of diverse student needs	Pearson Correlation	.[b]	-0.042	-0.073	.[b]	0.261	.725**	.601**	.703**	.737**	.767**	.722**	.587**	.757**	.548**	.739**	.751**	.751**	.780**	.913**	1
	Sig. (2-tailed)	.	0.84	0.722	.	0.199	<.001	0.001	<.001	<.001	<.001	<.001	0.002	<.001	0.004	<.001	<.001	<.001	<.001	<.001	
	Sum of Squares and Cross-products	0	-0.923	-0.923	0	10.346	13.077	10.423	13.192	14.308	12.885	11.846	10.538	14.192	10	13.192	12.077	12.077	14.077	15.538	16.654
	Covariance	0	-0.037	-0.037	0	0.414	0.523	0.417	0.528	0.572	0.515	0.474	0.422	0.568	0.4	0.528	0.483	0.483	0.563	0.622	0.666
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

b. Cannot be computed because at least one of the variables is constant.

Table 30 shows how different factors are related to each other and the level of significance of such relationships. For example, faculty knowledge and awareness of diverse student needs is related to their understanding of learning outcomes and use of appropriate learning activities, alignment of content to bloom's taxonomy, choice of assessment tools, coming up with engaging content, understanding of the learning environment, and consideration of the learner diversity in online education. All these holding the institution constant thus meaning that the relationships are true regardless of the institution where faculty come from.

Table 30. Success factors for content delivery statistics

Descriptive Statistics	Mean	Std. Deviation	N
Institutional Affiliation	1.33	.473	97
Teaching Experience	2.49	1.300	97
Online Teaching Experience	1.22	.484	97
Learning Management System (LMS) used	1.67	.473	97
STEM Related Discipline	2.93	1.804	97
SOCDEL Use of student centered approach	2.56	.708	96
SOCDEL Use of activities that keep students engaged	2.63	.684	96
SOCDEL Motivation of students	2.55	.709	96
SOCDEL Students' mentorship	2.49	.711	96
SOCDEL Eloquence in communication	2.60	.703	96
SOCDEL Articulation of points from basic to complex	2.61	.716	96
SOCDEL Use of relevant examples	2.63	.700	96
SOCDEL Accommodation of student participation	2.60	.688	96
SOCDEL Proper choice of assessments	2.57	.692	96
SOCDEL Understanding of LMS used	2.58	.691	96
SOCDEL Technological skills	2.65	.665	96
SOCDEL Reliable internet connectivity	2.57	.707	96
SOCDEL Use of the right digital tools	2.64	.682	96
SOCDEL Orientation of the students to the course	2.56	.751	96
SOCDEL Continuous online support to the students	2.59	.658	96

SOCDEL Prompt provision of feedback	2.56	.693	96
SOCDEL Reminders for assignment due dates	2.53	.725	96
Use of announcements tool to convey important course information	2.52	.711	96
Use of appropriate tone and voice modulation	2.53	.695	96
Open to diverse views from students	2.65	.649	96
Better understanding of student profiles	2.57	.645	96

Table 31. Success factors for content delivery correlations

Correlations		Institutional Affiliation	Teaching Experience	Online Teaching Experience	Learning Management System (LMS) used	STEM Related Discipline	SO CDEL Use of student centered approach	SO CDEL Use of activities that keep students engaged	SO CDEL Motivation of students	SO CDEL Students' mentorship	SO CDEL Eloquence in communication	SO CDEL Articulation of points from basic to complex	SO CDEL Use of relevant examples	SO CDEL Accommodation of student participation	SO CDEL Proper choice of assessments	SO CDEL Understanding of LMS used	SO CDEL Technological skills	SO CDEL Reliable internet connectivity	SO CDEL Use of the right digital tools	SO CDEL Orientation of the students to the course	SO CDEL Continuous online support to the students	SO CDEL Prompt provision of feedback	SO CDEL Reminders for assignment due dates	Use of announcements tool to convey important course information	Use of appropriate tone and voice modulation	Open to diverse views from students	Better understanding of student profiles
Institutional Affiliation	Pearson Correlation	1	0.189	-0.088	-1.000**	-0.179	0.188	.260*	.261*	0.198	.242*	.289**	.254*	.312**	0.182	.204*	0.178	.272**	.217*	.207*	.270**	.256*	0.184	.354**	.320**	.251*	.264**
	Sig. (2-tailed)		0.063	0.392	0	0.079	0.066	0.011	0.01	0.053	0.017	0.004	0.013	0.002	0.076	0.047	0.082	0.007	0.034	0.043	0.008	0.012	0.073	< .001	0.002	0.014	0.009
	Sum of Squares and Cross-products	21.443	11.165	-1.928	-21.443	-14.691	6	8	8.333	6.333	7.667	9.333	8	9.667	5.667	6.333	5.333	8.667	6.667	7	8	8	6	11.333	10	7.333	7.667
	Covariance	0.223	0.116	-0.02	-0.223	-0.153	0.063	0.084	0.088	0.067	0.081	0.098	0.084	0.102	0.06	0.067	0.056	0.091	0.07	0.074	0.084	0.084	0.063	0.119	0.105	0.077	0.081
	N	97	97	97	97	97	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96
Teaching Experience	Pearson Correlation	0.189	1	0.159	-0.189	0.069	-0.085	0.059	-0.021	-0.081	-0.107	-0.053	0.128	-0.002	0.109	0.021	-0.075	0.119	-0.007	-0.036	0.041	-0.051	-0.022	0.134	0.143	-0.013	0.105
	Sig. (2-tailed)	0.063		0.119	0.063	0.504	0.411	0.571	0.836	0.431	0.298	0.605	0.215	0.983	0.288	0.84	0.468	0.249	0.945	0.726	0.692	0.621	0.834	0.194	0.165	0.896	0.31
	Sum of Squares and Cross-products	11.165	162.247	9.608	-11.165	15.464	-7.312	4.875	-1.844	-7.031	-9.187	-4.656	10.875	-0.188	9.219	1.75	-6.062	10.219	-0.594	-3.312	3.281	-4.312	-1.906	11.563	12.094	-1.062	8.219
	Covariance	0.116	1.69	0.1	-0.116	0.161	-0.077	0.051	-0.019	-0.074	-0.097	-0.049	0.114	-0.002	0.097	0.018	-0.064	0.108	-0.006	-0.035	0.035	-0.045	-0.02	0.122	0.127	-0.011	0.087
	N	97	97	97	97	97	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96
Online Teaching Experience	Pearson Correlation	-0.088	0.159	1	0.088	0.054	0.189	0.154	0.165	0.174	0.102	0.094	0.151	0.167	0.124	0.18	0.112	0.122	0.116	0.092	0.182	0.131	0.145	0.185	2.13*	0.148	0.167
	Sig. (2-tailed)	0.392	0.119		0.392	0.6	0.065	0.133	0.108	0.089	0.322	0.364	0.142	0.103	0.228	0.079	0.277	0.238	0.26	0.373	0.076	0.203	0.159	0.071	0.037	0.149	0.104
	Sum of Squares and Cross-products	-1.928	9.608	22.454	1.928	4.515	6.188	4.875	5.406	5.719	3.313	3.094	4.875	5.312	3.969	5.75	3.437	3.969	3.656	3.188	5.531	4.188	4.844	6.063	6.844	4.438	4.969
	Covariance	-0.02	0.1	0.234	0.02	0.047	0.065	0.051	0.057	0.06	0.035	0.033	0.051	0.056	0.042	0.061	0.036	0.042	0.038	0.034	0.058	0.044	0.051	0.064	0.072	0.047	0.052
	N	97	97	97	97	97	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96
Learning Management System (LMS) used	Pearson Correlation	-1.000**	-0.189	0.088	1	0.179	-0.188	-.260*	-.261*	-0.198	-.242*	-.289**	-.254*	-.312**	-0.182	-.204*	-0.178	-.272**	-.217*	-.207*	-.270**	-.256*	-0.184	-.354**	-.320**	-.251*	-.264**
	Sig. (2-tailed)	0	0.063	0.392		0.079	0.066	0.011	0.01	0.053	0.017	0.004	0.013	0.002	0.076	0.047	0.082	0.007	0.034	0.043	0.008	0.012	0.073	< .001	0.002	0.014	0.009
	Sum of Squares and Cross-products	-21.443	-11.165	1.928	21.443	14.691	-6	-8	-8.333	-6.333	-7.667	-9.333	-8	-9.667	-5.667	-6.333	-5.333	-8.667	-6.667	-7	-8	-8	-6	-11.333	-10	-7.333	-7.667
	Covariance	-0.223	-0.116	0.02	0.223	0.153	-0.063	-0.084	-0.088	-0.067	-0.081	-0.098	-0.084	-0.102	-0.06	-0.067	-0.056	-0.091	-0.07	-0.074	-0.084	-0.084	-0.063	-0.119	-0.105	-0.077	-0.081
	N	97	97	97	97	97	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96

STEM Related Discipline	Pearson Correlation	-0.179	0.069	0.054	0.179	1	-0.082	-0.097	-0.041	-0.03	-0.121	-0.069	-0.045	0.029	0.12	0.129	0.025	-0.131	-0.097	0.016	-0.121	-0.067	-0.066	-0.093	0.074	-0.074	0.047
	Sig. (2-tailed)	0.079	0.504	0.6	0.079		0.427	0.346	0.688	0.775	0.24	0.503	0.664	0.778	0.246	0.21	0.811	0.203	0.349	0.877	0.239	0.517	0.521	0.367	0.475	0.475	0.651
	Sum of Squares and Cross-products	-14.691	15.464	4.515	14.691	312.495	-9.937	-11.375	-5.031	-3.594	-14.563	-8.469	-5.375	3.437	14.156	15.25	2.813	-15.844	-11.281	2.063	-13.656	-7.937	-8.219	-11.312	8.781	-8.187	5.156
	Covariance	-0.153	0.161	0.047	0.153	3.255	-0.105	-0.12	-0.053	-0.038	-0.153	-0.089	-0.057	0.036	0.149	0.161	0.03	-0.167	-0.119	0.022	-0.144	-0.084	-0.087	-0.119	0.092	-0.086	0.054
	N	97	97	97	97	97	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96
SOCDEL Use of student centered approach	Pearson Correlation	0.188	-0.085	0.189	-0.188	-0.082	1	.787**	.780**	.660**	.748**	.764**	.770**	.678**	.603**	.592**	.562**	.338**	.516**	.665**	.721**	.657**	.642**	.583**	.520**	.645**	.670**
	Sig. (2-tailed)	0.066	0.411	0.065	0.066	0.427		< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001
	Sum of Squares and Cross-products	6	-7.312	6.188	-6	-9.937	47.625	36.25	37.188	31.563	35.375	36.812	36.25	31.375	28.062	27.5	25.125	16.063	23.687	33.625	31.938	30.625	31.313	27.875	24.313	28.125	29.062
	Covariance	0.063	-0.077	0.065	-0.063	-0.105	0.501	0.382	0.391	0.332	0.372	0.387	0.382	0.33	0.295	0.289	0.264	0.169	0.249	0.354	0.336	0.322	0.33	0.293	0.256	0.296	0.306
	N	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96
SOCDEL Use of activities that keep students engaged	Pearson Correlation	.260*	0.059	0.154	-.260*	-0.097	.787**	1	.800**	.728**	.673**	.647**	.736**	.620**	.614**	.512**	.584**	.492**	.538**	.517**	.733**	.627**	.576**	.687**	.556**	.670**	.587**
	Sig. (2-tailed)	0.011	0.571	0.133	0.011	0.346	< .001		< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001
	Sum of Squares and Cross-products	8	4.875	4.875	-8	-11.375	36.25	44.5	36.875	33.625	30.75	30.125	33.5	27.75	27.625	23	25.25	22.625	23.875	25.25	31.375	28.25	27.125	31.75	25.125	28.25	24.625
	Covariance	0.084	0.051	0.051	-0.084	-0.12	0.382	0.468	0.388	0.354	0.324	0.317	0.353	0.292	0.291	0.242	0.266	0.238	0.251	0.266	0.33	0.297	0.286	0.334	0.264	0.297	0.259
	N	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96
SOCDEL Motivation of students	Pearson Correlation	.261*	-0.021	0.165	-.261*	-0.041	.780**	.800**	1	.774**	.781**	.776**	.761**	.712**	.700**	.604**	.710**	.538**	.660**	.755**	.802**	.733**	.714**	.719**	.595**	.659**	.544**
	Sig. (2-tailed)	0.01	0.836	0.108	0.01	0.688	< .001	< .001		< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001
	Sum of Squares and Cross-products	8.333	-1.844	5.406	-8.333	-5.031	37.188	36.875	47.74	37.052	36.979	37.427	35.875	32.979	32.635	28.083	31.771	25.635	30.323	38.187	35.531	34.188	34.844	34.396	27.844	28.771	23.635
	Covariance	0.088	-0.019	0.057	-0.088	-0.053	0.391	0.388	0.503	0.39	0.389	0.394	0.378	0.347	0.344	0.296	0.334	0.27	0.319	0.402	0.374	0.36	0.367	0.362	0.293	0.303	0.249
	N	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96
SOCDEL Students' mentorship	Pearson Correlation	0.198	-0.081	0.174	-0.198	-0.03	.660**	.728**	.774**	1	.708**	.685**	.733**	.573**	.644**	.527**	.638**	.462**	.437**	.681**	.587**	.610**	.573**	.553**	.576**	.654**	.530**
	Sig. (2-tailed)	0.053	0.431	0.089	0.053	0.775	< .001	< .001	< .001		< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001
	Sum of Squares and Cross-products	6.333	-7.031	5.719	-6.333	-3.594	31.563	33.625	37.052	47.99	33.604	33.115	34.625	26.604	30.073	24.583	28.646	22.073	20.135	34.563	26.094	28.563	28.031	26.521	27.031	28.646	23.073
	Covariance	0.067	-0.074	0.06	-0.067	-0.038	0.332	0.354	0.39	0.505	0.354	0.349	0.364	0.28	0.317	0.259	0.302	0.232	0.212	0.364	0.275	0.301	0.295	0.279	0.285	0.302	0.243
	N	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96

SOCDEL Eloquence in communication	Pearson Correlation	.242*	-0.107	0.102	-.242*	-0.121	.748**	.673**	.781**	.708**	1	.927**	.851**	.761**	.558**	.589**	.666**	.397**	.596**	.745**	.695**	.635**	.603**	.670**	.499**	.659**	.552**
	Sig. (2-tailed)	0.017	0.298	0.322	0.017	0.24	< .001	< .001	< .001	< .001		< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001
	Sum of Squares and Cross-products	7.667	-9.187	3.313	-7.667	-14.563	35.375	30.75	36.979	33.604	46.958	44.354	39.75	34.958	25.771	27.167	29.542	18.771	27.146	37.375	30.563	29.375	29.188	31.792	23.187	28.542	23.771
	Covariance	0.081	-0.097	0.035	-0.081	-0.153	0.372	0.324	0.389	0.354	0.494	0.467	0.418	0.368	0.271	0.286	0.311	0.198	0.286	0.393	0.322	0.309	0.307	0.335	0.244	0.3	0.25
	N	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96
SOCDEL Articulation of points from basic to complex	Pearson Correlation	.289**	-0.053	0.094	-.289**	-0.069	.764**	.647**	.776**	.685**	.927**	1	.864**	.798**	.620**	.651**	.705**	.441**	.592**	.779**	.669**	.569**	.561**	.605**	.542**	.655**	.552**
	Sig. (2-tailed)	0.004	0.605	0.364	0.004	0.503	< .001	< .001	< .001	< .001	< .001		< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001
	Sum of Squares and Cross-products	9.333	-4.656	3.094	-9.333	-8.469	36.812	30.125	37.427	33.115	44.354	48.74	41.125	37.354	29.198	30.583	31.896	21.198	27.51	39.812	29.969	26.813	27.656	29.271	25.656	28.896	24.198
	Covariance	0.098	-0.049	0.033	-0.098	-0.089	0.387	0.317	0.394	0.349	0.467	0.513	0.433	0.393	0.307	0.322	0.336	0.223	0.29	0.419	0.315	0.282	0.291	0.308	0.27	0.304	0.255
	N	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96
SOCDEL Use of relevant examples	Pearson Correlation	.254*	0.128	0.151	-.254*	-0.045	.770**	.736**	.761**	.733**	.851**	.864**	1	.716**	.709**	.653**	.685**	.460**	.526**	.746**	.603**	.570**	.542**	.609**	.565**	.655**	.621**
	Sig. (2-tailed)	0.013	0.215	0.142	0.013	0.664	< .001	< .001	< .001	< .001	< .001	< .001		< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001
	Sum of Squares and Cross-products	8	10.875	4.875	-8	-5.375	36.25	33.5	35.875	34.625	39.75	41.125	46.5	32.75	32.625	30	30.25	21.625	23.875	37.25	26.375	26.25	26.125	28.75	26.125	28.25	26.625
	Covariance	0.084	0.114	0.051	-0.084	-0.057	0.382	0.353	0.378	0.364	0.418	0.433	0.489	0.345	0.343	0.316	0.318	0.228	0.251	0.392	0.278	0.276	0.275	0.303	0.275	0.297	0.28
	N	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96
SOCDEL Accommodation of student participation	Pearson Correlation	.312**	-0.002	0.167	-.312**	0.029	.678**	.620**	.712**	.573**	.761**	.798**	.716**	1	.592**	.668**	.703**	.493**	.721**	.741**	.618**	.582**	.468**	.620**	.686**	.579**	.540**
	Sig. (2-tailed)	0.002	0.983	0.103	0.002	0.778	< .001	< .001	< .001	< .001	< .001	< .001	< .001		< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001
	Sum of Squares and Cross-products	9.667	-0.188	5.312	-9.667	3.437	31.375	27.75	32.979	26.604	34.958	37.354	32.75	44.958	26.771	30.167	30.542	22.771	32.146	36.375	26.563	26.375	22.188	28.792	31.188	24.542	22.771
	Covariance	0.102	-0.002	0.056	-0.102	0.036	0.33	0.292	0.347	0.28	0.368	0.393	0.345	0.473	0.282	0.318	0.321	0.24	0.338	0.383	0.28	0.278	0.234	0.303	0.328	0.258	0.24
	N	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96
SOCDEL Proper choice of assessments	Pearson Correlation	0.182	0.109	0.124	-0.182	0.12	.603**	.614**	.700**	.644**	.558**	.620**	.709**	.592**	1	.703**	.698**	.484**	.514**	.730**	.609**	.572**	.583**	.564**	.608**	.598**	.531**
	Sig. (2-tailed)	0.076	0.288	0.228	0.076	0.246	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001		< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001
	Sum of Squares and Cross-products	5.667	9.219	3.969	-5.667	14.156	28.062	27.625	32.635	30.073	25.771	29.198	32.625	26.771	45.49	31.917	30.479	22.49	23.052	36.063	26.344	26.062	27.781	26.354	27.781	25.479	22.49
	Covariance	0.06	0.097	0.042	-0.06	0.149	0.295	0.291	0.344	0.317	0.271	0.307	0.343	0.282	0.479	0.336	0.321	0.237	0.243	0.38	0.277	0.274	0.292	0.277	0.292	0.268	0.237
	N	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96

SOCDEL Understanding of LMS used	Pearson Correlation	.204*	0.021	0.18	-.204*	0.129	.592**	.512**	.604**	.527**	.589**	.651**	.653**	.668**	.703**	1	.661**	.515**	.702**	.639**	.527**	.451**	.531**	.511**	.663**	.607**	.589**
	Sig. (2-tailed)	0.047	0.84	0.079	0.047	0.21	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001		< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001
	Sum of Squaresand Crossproducts	6.333	1.75	5.75	-6.333	15.25	27.5	23	28.083	24.583	27.167	30.583	30	30.167	31.917	45.333	28.833	23.917	31.417	31.5	22.75	20.5	25.25	23.833	30.25	25.833	24.917
	Covariance	0.067	0.018	0.061	-0.067	0.161	0.289	0.242	0.296	0.259	0.286	0.322	0.316	0.318	0.336	0.477	0.304	0.252	0.331	0.332	0.239	0.216	0.266	0.251	0.318	0.272	0.262
	N	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96
SOCDEL Technological skills	Pearson Correlation	0.178	-0.075	0.112	-0.178	0.025	.562**	.584**	.710**	.638**	.666**	.705**	.685**	.708**	.698**	.661**	1	.526**	.641**	.740**	.582**	.551**	.504**	.529**	.594**	.512**	.380**
	Sig. (2-tailed)	0.082	0.468	0.277	0.082	0.811	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001		< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001
	Sum of Squaresand Crossproducts	5.333	-6.062	3.437	-5.333	2.813	25.125	25.25	31.771	28.646	29.542	31.896	30.25	30.542	30.479	28.833	41.958	23.479	27.604	35.125	24.187	24.125	23.062	23.708	26.063	20.958	15.479
	Covariance	0.056	-0.064	0.036	-0.056	0.03	0.264	0.266	0.334	0.302	0.311	0.336	0.318	0.321	0.321	0.304	0.442	0.247	0.291	0.37	0.255	0.254	0.243	0.25	0.274	0.221	0.163
	N	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96
SOCDEL Reliable internet connectivity	Pearson Correlation	.272**	0.119	0.122	-.272**	-0.131	.338**	.492**	.538**	.462**	.397**	.441**	.460**	.493**	.484**	.515**	.526**	1	.590**	.398**	.528**	.324**	.324**	.489**	.574**	.401**	.335**
	Sig. (2-tailed)	0.007	0.249	0.238	0.007	0.203	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001		< .001	< .001	< .001	0.001	0.001	< .001	< .001	< .001	< .001
	Sum of Squaresand Crossproducts	8.667	10.219	3.969	-8.667	-15.844	16.063	22.625	25.635	22.073	18.771	21.198	21.625	22.771	22.49	23.917	23.479	47.49	27.052	20.062	23.344	15.063	15.781	23.354	26.781	17.479	14.49
	Covariance	0.091	0.108	0.042	-0.091	-0.167	0.169	0.238	0.27	0.232	0.198	0.223	0.228	0.24	0.237	0.252	0.247	0.5	0.285	0.211	0.246	0.159	0.166	0.246	0.282	0.184	0.153
	N	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96
SOCDEL Use of the right digital tools	Pearson Correlation	.217*	-0.007	0.116	-.217*	-0.097	.516**	.538**	.660**	.437**	.596**	.592**	.526**	.721**	.514**	.702**	.641**	.590**	1	.568**	.651**	.550**	.523**	.656**	.634**	.538**	.480**
	Sig. (2-tailed)	0.034	0.945	0.26	0.034	0.349	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001		< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001
	Sum of Squaresand Crossproducts	6.667	-0.594	3.656	-6.667	-11.281	23.687	23.875	30.323	20.135	27.146	27.51	23.875	32.146	23.052	31.417	27.604	27.052	44.24	27.687	27.781	24.687	24.594	30.229	28.594	22.604	20.052
	Covariance	0.07	-0.006	0.038	-0.07	-0.119	0.249	0.251	0.319	0.212	0.286	0.29	0.251	0.338	0.243	0.331	0.291	0.285	0.466	0.291	0.292	0.26	0.259	0.318	0.301	0.238	0.211
	N	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96
SOCDEL Orientation of the students to the course	Pearson Correlation	.207*	-0.036	0.092	-.207*	0.016	.665**	.517**	.755**	.681**	.745**	.779**	.746**	.741**	.730**	.639**	.740**	.398**	.568**	1	.616**	.579**	.605**	.510**	.510**	.564**	.501**
	Sig. (2-tailed)	0.043	0.726	0.373	0.043	0.877	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001		< .001	< .001	< .001	< .001	< .001	< .001	< .001
	Sum of Squaresand Crossproducts	7	-3.312	3.188	-7	2.063	33.625	25.25	38.187	34.563	37.375	39.812	37.25	36.375	36.063	31.5	35.125	20.062	27.687	53.625	28.938	28.625	31.313	25.875	25.313	26.125	23.062
	Covariance	0.074	-0.035	0.034	-0.074	0.022	0.354	0.266	0.402	0.364	0.393	0.419	0.392	0.383	0.38	0.332	0.37	0.211	0.291	0.564	0.305	0.301	0.33	0.272	0.266	0.275	0.243
	N	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96
SOCDEL Continuous online support to the students	Pearson Correlation	.270**	0.041	0.182	-.270**	-0.121	.721**	.733**	.802**	.587**	.695**	.669**	.608**	.618**	.609**	.527**	.582**	.528**	.651**	.616**	1	.737**	.744**	.727**	.569**	.621**	.579**
	Sig. (2-tailed)	0.008	0.692	0.076	0.008	0.239	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001		< .001	< .001	< .001	< .001	< .001	< .001
	Sum of Squaresand Crossproducts	8	3.281	5.531	-8	-13.656	31.938	31.375	35.531	26.094	30.563	29.969	26.375	26.563	26.344	22.75	24.187	23.344	27.781	28.938	41.156	31.938	33.719	32.312	24.719	25.187	23.344
	Covariance	0.084	0.035	0.058	-0.084	-0.144	0.336	0.33	0.374	0.275	0.322	0.315	0.278	0.28	0.277	0.239	0.255	0.246	0.292	0.305	0.433	0.336	0.355	0.34	0.26	0.265	0.246
	N	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96

SOCDEL Prompt provision of feedback	Pearson Correlation	.256*	-0.051	0.131	-.256*	-0.067	.657**	.627**	.733**	.610**	.635**	.569**	.570**	.582**	.572**	.451**	.551**	.324**	.550**	.579**	.737**	1	.824**	.767**	.640**	.729**	.614**
	Sig. (2-tailed)	0.012	0.621	0.203	0.012	0.517	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	0.001	<.001	<.001	<.001		<.001	<.001	<.001	<.001	<.001
	Sum of Squares and Cross-products	8	-4.312	4.188	-8	-7.937	30.625	28.25	34.188	28.563	29.375	26.813	26.25	26.375	26.062	20.5	24.125	15.063	24.687	28.625	31.938	45.625	39.313	35.875	29.313	31.125	26.062
	Covariance	0.084	-0.045	0.044	-0.084	-0.084	0.322	0.297	0.36	0.301	0.309	0.282	0.276	0.278	0.274	0.216	0.254	0.159	0.26	0.301	0.336	0.48	0.414	0.378	0.309	0.328	0.274
	N	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96
SOCDEL Reminders for assignment due dates	Pearson Correlation	0.184	-0.022	0.145	-0.184	-0.066	.642**	.576**	.714**	.573**	.603**	.561**	.542**	.468**	.583**	.531**	.504**	.324**	.523**	.605**	.744**	.824**	1	.724**	.562**	.696**	.581**
	Sig. (2-tailed)	0.073	0.834	0.159	0.073	0.521	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	0.001	<.001	<.001	<.001	<.001		<.001	<.001	<.001	<.001
	Sum of Squares and Cross-products	6	-1.906	4.844	-6	-8.219	31.313	27.125	34.844	28.031	29.188	27.656	26.125	22.188	27.781	25.25	23.062	15.781	24.594	31.313	33.719	39.313	49.906	35.438	26.906	31.063	25.781
	Covariance	0.063	-0.02	0.051	-0.063	-0.087	0.33	0.286	0.367	0.295	0.307	0.291	0.275	0.234	0.292	0.266	0.243	0.166	0.259	0.33	0.355	0.414	0.525	0.373	0.283	0.327	0.271
	N	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96
Use of announcements tool to convey important course information	Pearson Correlation	.354**	0.134	0.185	-.354**	-0.093	.583**	.687**	.719**	.553**	.670**	.605**	.609**	.620**	.564**	.511**	.529**	.489**	.656**	.510**	.727**	.767**	.724**	1	.627**	.587**	.606**
	Sig. (2-tailed)	<.001	0.194	0.071	<.001	0.367	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001		<.001	<.001	<.001
	Sum of Squares and Cross-products	11.333	11.563	6.063	-11.333	-11.312	27.875	31.75	34.396	26.521	31.792	29.271	28.75	28.792	26.354	23.833	23.708	23.354	30.229	25.875	32.312	35.875	35.438	47.958	29.438	25.708	26.354
	Covariance	0.119	0.122	0.064	-0.119	-0.119	0.293	0.334	0.362	0.279	0.335	0.308	0.303	0.303	0.277	0.251	0.25	0.246	0.318	0.272	0.34	0.378	0.373	0.505	0.31	0.271	0.277
	N	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96
Use of appropriate tone and voice modulation	Pearson Correlation	.320**	0.143	.213*	-.320**	0.074	.520**	.556**	.595**	.576**	.499**	.542**	.565**	.686**	.608**	.663**	.594**	.574**	.634**	.510**	.569**	.640**	.562**	.627**	1	.679**	.535**
	Sig. (2-tailed)	0.002	0.165	0.037	0.002	0.475	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001		<.001	<.001
	Sum of Squares and Cross-products	10	12.094	6.844	-10	8.781	24.313	25.125	27.844	27.031	23.187	25.656	26.125	31.188	27.781	30.25	26.063	26.781	28.594	25.313	24.719	29.313	26.906	29.438	45.906	29.063	22.781
	Covariance	0.105	0.127	0.072	-0.105	0.092	0.256	0.264	0.293	0.285	0.244	0.27	0.275	0.328	0.292	0.318	0.274	0.282	0.301	0.266	0.26	0.309	0.283	0.31	0.483	0.306	0.24
	N	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96
Open to diverse views from students	Pearson Correlation	.251*	-0.013	0.148	-.251*	-0.074	.645**	.670**	.659**	.654**	.659**	.655**	.655**	.579**	.598**	.607**	.512**	.401**	.538**	.564**	.621**	.729**	.696**	.587**	.679**	1	.641**
	Sig. (2-tailed)	0.014	0.896	0.149	0.014	0.475	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001		<.001
	Sum of Squares and Cross-products	7.333	-1.062	4.438	-7.333	-8.187	28.125	28.25	28.771	28.646	28.542	28.896	28.25	24.542	25.479	25.833	20.958	17.479	22.604	26.125	25.187	31.125	31.063	25.708	29.063	39.958	25.479
	Covariance	0.077	-0.011	0.047	-0.077	-0.086	0.296	0.297	0.303	0.302	0.3	0.304	0.297	0.258	0.268	0.272	0.221	0.184	0.238	0.275	0.265	0.328	0.327	0.271	0.306	0.421	0.268
	N	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96
Better understanding of student profiles	Pearson Correlation	.264**	0.105	0.167	-.264**	0.047	.670**	.587**	.544**	.530**	.552**	.552**	.621**	.540**	.531**	.589**	.380**	.335**	.480**	.501**	.579**	.614**	.581**	.606**	.535**	.641**	1
	Sig. (2-tailed)	0.009	0.31	0.104	0.009	0.651	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	
	Sum of Squares and Cross-products	7.667	8.219	4.969	-7.667	5.156	29.062	24.625	23.635	23.073	23.771	24.198	26.625	22.771	22.49	24.917	15.479	14.49	20.052	23.062	23.344	26.062	25.781	26.354	22.781	25.479	39.49
	Covariance	0.081	0.087	0.052	-0.081	0.054	0.306	0.259	0.249	0.243	0.25	0.255	0.28	0.24	0.237	0.262	0.163	0.153	0.211	0.243	0.246	0.274	0.271	0.277	0.24	0.268	0.416
	N	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 31 shows how different success factors towards online content delivery are related. For example, the use of student centered approach when delivering online content helps instructors to; motivate students and keep them engaged, articulate content from simple to complex, use relevant examples, make proper choice of digital tools for teaching, provide prompt feedback to students and stay open to diverse student views. Once more these relationships are true holing the institution and the learning technologies used constant.

DISCUSSION

The study done by Mallison & Krull (2013) suggested a capacity building intervention to enable academic staff to successfully support online learning. This is what the Mastercard Foundation e-Learning Initiative has attempted to do in the past one and a half years. This study emanated from the e-Learning intervention by MasterCard foundation. The first objective of the study was to establish the state of online content development and delivery in the participating institutions. The study established that online education is developing as a result of the ERT&L that took place during the pandemic. Thus, online learning experience and exposure is limited to the post-pandemic experience that faculty members and students have had in this area.

The second objective of the study was to establish the challenges of developing and delivering online learning in STEM related areas at KNUST and USIU-Africa. Some of the challenges that stood out were; understanding the capabilities of the LMSs and other teaching and learning technologies used in the institutions that took part in the study, designing and developing learning activities that are collaborative and engaging, coming up with authentic online assessment activities and rubric among others as seen in the findings section of this study. All the challenges identified closely relate to training and capacity building in the area of online content development and delivery. This confirms the findigs of Wa-Mbaleka (2020) and Cheawjindakarn et al (2013) that training and capacity building is a must to alleviate challenges associated with content development and delivery in online education.

This study also sought to establish the success factors for online content development and delivery. Success lies in proper infrastructure, designing online content and developing it for students with their needs and expectations in mind, using the LMS and associated learning technologies optimally to engage students in collaborative learning activities.

The findings of this research established a myriad of opportunities and confirm what Mallison & Krull (2013) suggested, that capacity building interventions to enable academic staff to successfully support online learning is an absolute necessity for those building online education from scratch. The findings from the students' respondents in this study also confirms what Zawacki-Richter & Qayyum, (2019) found, that, among the opportunities in online education is the immense need to respond to the huge need for flexible, affordable and quality education. Improvements in online content development and delivery can meet this need.

Challenges in any area of growth bring about opportunities for different stakeholders. The challenges established in this study provide opportunities in online education for the different

stakeholders. It is therefore upon all stakeholders in online education to take up the emerging opportunities and play their key roles to bring about optimum conditions for successful online education.

CONCLUSION

Online content development and delivery in the two institutions in this study is relatively a young adventure which was triggered by the COVID-19 pandemic. The discoveries in this study indicate that the situation may be similar in many developing countries. There are many challenges as well as opportunities in online education in developing nations. Governments, government agencies, learning institutions, telecommunications and other non-governmental organizations interested in the different aspects of online education must pull together to achieve high quality online education in these nations as none of them is independently able to surmount all the challenges and exploit all the opportunities. The most basic need for the achievement of online content development and delivery is infrastructure and capacity building especially among faculty members in higher learning institutions. Once these are achieved, the other challenges can be tacked one at a time until optimum conditions for online content development and delivery are achieved.

RECOMMENDATIONS

All participating institutions could carry out similar studies as a way of monitoring and evaluation of the first phase of the e-Learning initiative since it was an intervention that should leave the participating institutions better than they were before the intervention.

There may be a need to replicate the study with more institutions in the two countries in future to establish the impact of the e-Learning Initiative intervention and check whether there has been any spillover effect as expected with such interventions. This could also inform on the need for more such interventions in developing nations such as Kenya and Ghana where this study took place.

This study recommends capacity building for instructional designers who can help faculty overcome some of the challenges in online content development and delivery. This is because majority of faculty members are SMEs in their areas of specialization and professional instructional designers may help them alleviate some of their perennial challenges especially

those related to appropriate and high-quality content development. This is because the findings of this study confirmed that instructors do not make use of instructional designers.

RESEARCH CONTRIBUTIONS AND LIMITATIONS

Limitations

This study compared a private university in Nairobi, Kenya to a public university in Ghana. USIU-Africa in Nairobi is a relatively small institution of higher learning compared to KNUST which is a very big public university. Whereas the two institutions were participants in the MasterCard Scholars Program e-Learning Initiative, there were institutional and country dynamics that may not make the results of this study generalized for institutions in the two countries. The two institutions operate in different environments where from a general perspective private universities in Africa tend to be more resourced even for online learning than public universities who are financed by the government of the day.

Research contribution and alignment to the four thematic areas of MCF e-Learning initiative

Ecosystem Design

The Mastercard Foundation e-Learning initiative ecosystem has a number of interdependent players that contribute to the overall success of the e-Learning intervention. The outcome of this study provides valuable information to governments, accrediting institutions and telecommunication, software and hardware companies. The information provided in relation to the challenges and opportunities in content development and delivery can contribute to the success of e-Learning.

Knowledge mobilization and Training

This study provides base information on the opportunities and challenges in online content development and pedagogy. This information should be made available to all institutions in the Mastercard Foundation e-Learning Initiative so as to give further impetus to implementation of e-Learning.

Scaling

This study provides a sample of how research can be used as a monitoring and evaluation tool for e-Learning initiatives such as the Mastercard Foundation e-Learning Initiative. Such research should be adopted especially after a period of time where these institutions are given to implement what they have learnt from such an initiative.

Innovative approaches to Monitoring, evaluation and Research in the context of e-Learning

Research in this case is a monitoring and evaluation exercise that indicates where the two participating institutions in this study are in relation to e-Learning content development and delivery.

Contribution to e-Learning research, practice, policy

This study contributes towards building resilient institutions that can manage educational disruptions such as those caused by the pandemic and other crises that may arise in future. This directly addresses Sustainable Development Goal number four on Quality Education.

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APPENDICES

Appendix I: Research Project timeline

Activity	Dec 2021-Jan 2022	Jan/Feb 2022	Mar 2022	April 2022	May 2022	June/July 2022	July-Sept 2022		Oct/Nov 2022
Abstract development									
Full proposal development									
Research permits acquisition									
Research instruments development									
Piloting research instruments									
Data collection									
Data analysis									
Summary of findings and recommendations									
Development of scalable model and guide									
Draft and final report writing									
Logistics meetings									
Final report writing and submission									

Appendix II: Research Project Budget

BUDGET				
Item	**Unit**	**Cost per unit in USD $**	**Months**	**Amount in USD $**

Internet bundles	4	80	11	3520
Developing research instruments	2	400	1	800
Piloting research instruments	2	100	1	200
Data collection and analysis	2	500	4	4000
Report writing	1	100	1	100
Uptake: Best practice manual, workshops, policy briefs to share findings and recommendations	4	950	1	3800
Time for meetings	4	10	22	880
Research ethics permits	2	800	1	1600
Contingency fund	1	100	1	100
TOTAL				15000
currency conversion rate (USD $ to KSHS)	113.65			
Thus: 15000 USD = 1704750 KSHS				

Appendix III: USIU-Africa support letter

United States International University-Africa

17th February, 2022

MasterCard foundation Scholars Program
eLearning Championship Initiative
Small Grants Awards Division

Dear Sir/Madam,

RE: SUPPORT LETTER FOR DR. BERNADETTE KIARIE AND DR. JULIANA

Appendix IV: Informed Consent

Research Topic

Towards best practices in online content development and pedagogy: A comparative study of opportunities and challenges in USIU-Africa and KNUST.

The Purpose

We, Bernadette Kiarie and Juliana Namada, staff and faculty respectively at the United States International University-Africa (USIU-A); together with Courage Logah and Nana Ewusi based in Kwame Nkrumah Univerity of Science and Technology (KNUST), intent to undertake a collaborative study on the above research topic. The purpose of this study will be to examine current practices in online content development and delivery in the two institutions in order to come up with best practices in these two areas of online education. The study seeks to establish the current state of online content development and delivery in the two institutions, investigate the challenges and critical success factors as well as highlight the opportunities in online content development and delivery. The study will be useful to stakeholders in online education such as administrators, faculty members and students in both USIU-A and KNUST as well as other institutions of higher education.

Procedures

Participants in this study will be required to answer questions on status of online content development and delivery, the challenges involved, success factors and foreseeable opportunities in online education. Majority of the participants will answer a questionnaire while some participants will be interviewed or asked to take part in a focus group discussion. Participants should feel free to ask questions related to the study at any time. There will be no consequences for failure to respond to questions in the questionnaire or during the interviews and focus group discussions.

Discomforts and risks

There will be minimal risk for your involvement in this research. In addition, the questions asked are not sensitive in nature and may not make one uncomfortable. However, if this happens participants are free to decline or withdraw their participation in the study. The interviews will take about 30 minutes, filling of the questionnaire will take approximately 20 minutes and focus group discussions will take about 60 minutes.

Benefits

The information generated by this study may be useful to stakeholders in both USIU-A and KNUST to enhance online course content development and delivery. However, there is no direct or monetary benefit to individuals who take part in the study.

Voluntary Participation and Withdrawal

Participation in this study is open to anyone who fits the bill of the set out target population and is voluntary. In case of change of mind, a participant is free to drop out of the study at any given time. There are no penalties for non-completion of questions in the research instruments used.

Confidentiality

The researchers will maintain privacy and confidentiality of all information received from participants in the study. All the information acquired will be sorely used for the purpose of the study. Access codes and log in credentials will be required to access electronic information from the study. Physical documents bearing information on this study will be kept under lock and key, to be accessed by the authorized researchers.

Contact information

Participants who have questions are free to contact any of the following research investigators:

Dr. Bernadette Kiarie bkiarie@usiu.ac.ke

Dr. Juliana Namada jnamada@usiu.ac.ke

Mr. Courage Logah clogah@knust.gh.edu

Dr. Nana Ewusi nanaewusi@yahoo.com

Further enquiries may be done through the MasterCard e-Learning Initiative offices at both USIU-A and KNUST. Your informed consent to participate in this study is now requested through the provision of your signature in the space provided below.

Participant signature…….. Date……

Researcher's signature…… Date……

Appendix V: Research Instruments

Instructor Questionnaire

The purpose of this questionnaire is to collect information on online content development and delivery. The tool will take 20 minutes to fill.

1. Kindly tick the institutions you are affiliated to

   □ Unites States International University - Africa (USIU-A)

   □ Kwame Nkrumah University of Science and Technology (KNUST)

2. State your STEM related discipline

   _____

3. Tick the year range that matches your teaching experience

   □ 1-5 years

   □ 6-10 years

   □ 11-15 years

   □ 16-20 years

   □ 21-25 years

   □ 26 years and above

4. Tick the range that matches your online teaching experience

   □ 1-5 years

   □ 6-10 years

   □ 11-15 years

   □ 16 years and above

5. Select the Learning Management System used at the institution.

   □ Blackboard

   □ Moodle

Basic e-Learning skills

The following are general statements on online teaching knowledge and skills for instructors. For each of the statements, put a tick to indicate your level of agreement.

	Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
6	I have all the basic technical skills for operating computing gadgets					
7	I can access all my courses in the LMS with minimal help					
8	I am comfortable all my courses in an online environment					
9	I can effectively communicate in written form with my students					
10	I can effectively communicate verbally to my students					
11	I know about course content accessibility in online learning					
12	I can do research and get resources for courses that I teach online					

Online content development

The following statements relate to e-Learning content development. For each of the statements, put a tick to indicate your level of agreement.

	Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
13	I have been trained on online content development					
14	I can develop online content					
15	I can use a variety of LMS features to develop online learning resources					
16	I can organize learning materials in the LMS.					
17	I ensure that my courses are accessible to learners with special needs.					
18	I use visual graphics in content development					
19	I prepare my online teaching resources before the semester begins					
20	I create online content based thorough research					
21	I develop content according to the learning outcomes					
22	I align course content to the level of the course					
23	I use subject specific language when developing course content					
24	I maintain a consistent tone in content development					
25	I provide a variety of reference resources when developing course content					
26	I incorporate Quality Matters in content development					

Online content delivery

The following statements relate to online content delivery. For each of the statements, put a tick to indicate your level of agreement.

	Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
27	I have received adequate training in online content delivery					
28	I am able to competently deliver online content					
29	I use variety of learning tools in online content delivery					
30	I provide timely feedback to online learners					
31	I am aware of the demands of online teaching					
32	I adhere to Quality Assurance/Matters Standards in content delivery					
33	I maintain instructor presence in online delivery					
34	I use interactive methods in online delivery					
35	I provide clear instructions for online assessments					
36	I use announcements in course modules in the LMS to prompt learners					
37	I organize my course content logically for ease of understanding					
38	I avoid information overload during content delivery					
39	I use visual graphics in online course delivery					
40	I use presentation slides in online delivery					

Challenges in online content development

The following statements relate challenges experienced during online content development. For each of the challenges, put a tick to indicate the extent to which you experience the particular challenge in online content development.

	Challenges in online content development	Very little extent	Little extent	Moderate	Large extent	Very large extent
41	Technological skills					
42	Designing collaborative activities					
43	Accessibility of course resources					
44	Use of interactive content					
45	Internet connectivity					
46	Coming up with measurable learning outcomes					
47	Designing learning activities					
48	Creation of instructional videos					
49	Online assignments					
50	Online exams					
51	Discussion forums					
52	Communicating with learner					
53	Providing feedback to learners					
54	Student netiquette					
55	Grading assignments and tests					

56	Designing rubrics					
57	Power outages					
58	Accessing e-library					
59	VPN utilization					
60	Time for development of course content					
61	Time for research on course content					

Challenges of online content delivery

The statements in the table below relate to challenges of online content delivery. Tick the extent to which each statement is a challenge in online content delivery for you as an instructor.

	Challenges in online content delivery	Very little extent	Little extent	Moderate	Large extent	Very large extent
62	Time management					
63	Institutional support					
64	Onboarding students					
65	Content organization					
66	Internet connectivity					
67	Teaching technology					
68	Design of teaching materials					
69	Learner engagement challenges					

70	Communication challenges					
71	Instructor presence					

Success factors in online content development

The following are success factors in online content development. Choose an answer for each stated factor to shows the extent to which the factor affects success of online content development.

	Success factor in online content development	Very little extent	Little extent	Moderate	Large extent	Very large extent
72	Access to library reference resources					
73	Choice of course texts					
74	Understanding of learning outcomes					
75	Choice of learning activities					
76	Alignment to Blooms taxonomy					
77	Choice of assessment tools					
78	Knowledge of the right digital tools					
79	Engaging content					
80	Use of conventional academic language					
81	Choice of assessment tools at each level					
82	Understanding of student profiles					
83	Adequacy of training needs analysis					

84	Understanding of the learning environment					
85	Consideration of learner diversity					
86	Consideration of diverse student needs					

Success factors for online content delivery

The following are success factors in online content delivery. Choose an answer for each stated factor to shows the extent to which the factor affects success of online content delivery.

	Success factor in online content delivery	Very little extent	Little extent	Moderate	Large extent	Very large extent
87	Use of student centered approach					
88	Use of activities that keep students engaged					
89	Motivation of students					
90	Students' mentorship					
91	Eloquence in communication					
92	Articulation of points from basic to complex					
93	Use of relevant examples					
94	Accommodation of student participation					
95	Proper choice of assessments					
96	Understanding of LMS used.					
97	Technological skills					

98	Reliable internet connectivity					
99	Use of the right digital tools					
100	Orientation of the students to the course					
101	Continuous online support to the students					
102	Prompt provision of feedback					
103	Reminders for assignment due dates					
104	Use of announcements tool to convey important course information					
105	Use of appropriate tone and voice modulation					
106	Open to diverse views from students					
107	Better understanding of student profiles					

Opportunities in online content development and delivery

108. Outline opportunities that you foresee in the area of online content development

_____
_____
_____
_____

109. Outline all opportunities that you foresee in the area of online content delivery

_____
_____
_____

Student Questionnaire

This questionnaire is meant to solicit information from you about your institution's policies and staff commitment in supporting online teaching and learning. Your response to the questions will help to assist the KNUST and USIU institutions to plan their online programs/course modules well to achieve the intended purposes for which virtual teaching and learning was established as

an alternate mode to conventional mode. You are assured of confidentiality and anonymity as you fill this questionnaire.
Thank you for your cooperation.

Please respond by ticking the appropriate box.

1. Name of Institution
   - □ KNUST
   - □ USIU

2. Name of Department (Please Indicate): ……

3. Gender
   - □ Female
   - □ Male
   - □ Prefer not to say

4. Age range
   - □ Below 18 years
   - □ 18 – 25 years
   - □ 26 – 30 years
   - □ Above 30 years

5. How will you rate your digital skills in online learning?
   - □ Advanced (Can perform complex tasks with online digital tools)
   - □ Intermediate (Can use online digital tools comfortably with no support)
   - □ Basic (Can use online learning digital tools with occasional require support)
   - □ No experience

6. Which of the following devices do you use to access the online course? (Please tick all that apply.)
   - □ Smartphone
   - □ Tablet
   - □ Laptop
   - □ Desktop Computer
   - □ Other: ……

7. Marital Status
   - □ Single
   - □ Married

8. What degree program are pursing?
   - □ Diploma
   - □ Undergraduate Degree
   - □ Masters/MPhil
   - □ Doctorate

9. What is your program of study? (e.g., BSc. Mathematic, MSc. Physics etc.)

……..

10. What year are you?
    - □ Year One
    - □ Year Two
    - □ Year Three
    - □ Year Four
    - □ Year Five
    - □ Year Six
    - □ Other:……

11. Do you have any prior experience with online learning?
    - □ Yes
    - □No

12. Which of the following features of the LMS and associated e-resource platforms do you find most useful in for your online learning? (Please tick those which apply.)
    - □ Live Classes
    - □ Chatrooms
    - □ E-library
    - □ Turnitin
    - □ Other: ……

13. The online learning platforms available at my institution are user friendly.
    - □ Strongly Disagree
    - □ Disagree
    - □ Neutral
    - □ Agree
    - □ Strongly Agree

14. I access the institutional Learning Management System at least.
    - □ Once a day
    - □ Twice a week
    - □ Once a month
    - □ Occasionally
    - □ Never

15. The institutional Learning Management System is reliable and helps me to participate in online courses effectively.
    - □ Strongly Disagree
    - □ Disagree
    - □ Moderate
    - □ Agree Strongly
    - □ Agree

16. The design and delivery of online instructions suits my learning style.
    - □ Strongly Disagree
    - □ Disagree
    - □ Moderate
    - □ Agree

- □ Strongly Agree

17. It is easy to navigate course modules on the institutional Learning Management System.
    - □ Strongly Disagree
    - □ Disagree
    - □ Moderate
    - □ Agree
    - □ Strongly Agree
18. The structure and location of materials in the Learning Management System is similar and consistent for all my course modules?
    - □ Strongly Disagree
    - □ Disagree
    - □ Moderate
    - □ Agree
    - □ Strongly Agree
19. I am motivated to use my institutional Learning Management System for online learning.
    - □ Strongly Disagree
    - □ Disagree
    - □ Moderate
    - □ Agree
    - □ Strongly Agree
20. Online course modules provide adequate and timely feedback to facilitate learning.
    - □ Strongly Disagree
    - □ Disagree
    - □ Moderate
    - □ Agree
    - □ Strongly Agree
21. There are specific guidelines that support students' progression and success in online learning.
    - □ Strongly Disagree
    - □ Disagree
    - □ Moderate
    - □ Agree
    - □ Strongly Agree
22. The current mode of online assessment (quizzes/long and short essays, etc) in my institution is appropriate.
    - □ Strongly Disagree
    - □ Disagree
    - □ Moderate
    - □ Agree
    - □ Strongly Agree
23. The time given to students for assignments/long essays, etc is adequate for online course modules.
    - □ Strongly Disagree
    - □ Disagree

- □ Moderate
- □ Agree Strongly
- □ Agree

24. Online technical support for all course modules is adequate.
    - □ Strongly Disagree
    - □ Disagree
    - □ Moderate
    - □ Agree Strongly
    - □ Agree

25. Online academic support for online course modules is adequate.
    - □ Strongly Disagree
    - □ Disagree
    - □ Moderate
    - □ Agree
    - □ Strongly Agree

26. Studying online is more convenient and flexible.
    - □ Yes
    - □ No
    - □ Somewhat
    - □ Not sure

27. It is easy to access internet for my online learning materials.
    - □ Strongly Disagree
    - □ Disagree
    - □ Moderate
    - □ Agree
    - □ Strongly Agree

28. Students receive adequate support/training on how to use available institutional LMS and e-resources.
    - □ Strongly Disagree
    - □ Disagree
    - □ Moderate
    - □ Agree
    - □ Strongly Agree

29. Sense of online learning community created among students is adequate.
    - □ Strongly Disagree
    - □ Disagree
    - □ Moderate
    - □ Agree
    - □ Strongly Agree

30. Institutional digital tools and Learning Management System is able to facilitate interactive communication between instructor and student relative face-to-face learning.
    - □ Strongly Disagree
    - □ Disagree
    - □ Moderate

- □ Agree
- □ Strongly Agree

31. I receive useful prompts from the institutional LMS regarding time management for students are helpful.
    - □ Strongly Disagree
    - □ Disagree
    - □ Moderate
    - □ Agree
    - □ Strongly Agree

32. I am able to adequately prepare before an online class.
    - □ Strongly Disagree
    - □ Disagree
    - □ Moderate
    - □ Agree
    - □ Strongly Agree

33. Online course materials for modules are provided on time.
    - □ Strongly Disagree
    - □ Disagree
    - □ Moderate
    - □ Agree
    - □ Strongly Agree

34. Online materials for course modules are appropriate and aid learning.
    - □ Strongly Disagree
    - □ Disagree
    - □ Moderate
    - □ Agree
    - □ Strongly Agree

35. The online course modules are easy to understand and encourages self-paced learning.
    - □ Strongly Disagree
    - □ Disagree
    - □ Moderate
    - □ Agree
    - □ Strongly Agree

36. The online course modules encourage collaborative work.
    - □ Strongly Disagree
    - □ Disagree
    - □ Moderate
    - □ Agree
    - □ Strongly Agree

37. Online live class sessions are flexible and feasible.
    - □ Strongly Disagree
    - □ Disagree

- □ Moderate
- □ Agree
- □ Strongly Agree

38. Online live class video recordings are available and posted on time to facilitate learning.
    - □ Strongly Disagree
    - □ Disagree
    - □ Moderate
    - □ Agree
    - □ Strongly Agree

39. The quizzes/assignments for all course modules are flexible and allow me enough time for revision.
    - □ Strongly Disagree
    - □ Disagree
    - □ Moderate
    - □ Agree
    - □ Strongly Agree

40. Online quizzes/assignments questions are clear, easy to comprehend and meet my expectations.
    - □ Strongly Disagree
    - □ Disagree
    - □ Moderate
    - □ Agree Strongly
    - □ Agree

41. I am comfortable with the length of time slated for online quizzes/assignments.
    - □ Strongly Disagree
    - □ Disagree
    - □ Moderate
    - □ Agree Strongly
    - □ Agree

42. I am satisfied with the number of quizzes/assignments for course modules.
    - □ Strongly Disagree
    - □ Disagree
    - □ Moderate
    - □ Agree
    - □ Strongly Agree
43. I have access to online library at my institution.
    - □ Strongly Disagree
    - □ Disagree
    - □ Moderate
    - □ Agree
    - □ Strongly Agree

44. Online instructors provide adequate feedback for course module.
    - □ Strongly Disagree
    - □ Disagree
    - □ Moderate

- □ Agree
- □ Strongly Agree

45. Instructors are easily accessible online.
    - □ Strongly Disagree
    - □ Disagree
    - □ Moderate
    - □ Agree
    - □ Strongly Agree

46. I feel comfortable relating with online course instructors and other staff in discussing issues relating to course modules.
    - □ Strongly Disagree
    - □ Disagree
    - □ Moderate
    - □ Agree
    - □ Strongly Agree

47. How would you rate your overall experience of online learning in your university?
    - □ Excellent
    - □ Very Good
    - □ Good
    - □ Satisfactory
    - □ Poor

48. What are your biggest technological problems that you have run into (or can imagine)? (Please indicate)
    ……
    ……
49. What factors would lead you to choose online educational programs rather than traditional in-class instruction?
    ……
    ……
50. How would you describe your entire experience with your institutional learning management system for teaching and learning?

    ……
    ……

Appendix VI: Debrief Form

UNITED STATES INTERNATIONAL UNIVERSITY-AFRICA
and
KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

Towards best practices in online content development and pedagogy: A comparative study of opportunities and challenges in USIU-Africa and KNUST.

Thank you for your participation in this research study. For this study, we did not withhold any information from you or provide you with incorrect information about any aspects of the study or your participation. Now that your participation is completed, we confirm and

describe that there is no withheld or incorrect information to you and hence we provide you with the opportunity to make a decision on whether you would like to have your data included in this study.

Right to withdraw data
You may choose to withdraw the data you provided prior to debriefing, without penalty or loss of benefits to which you are otherwise entitled. Please write your initials below if you do, or do not, give permission to have your data included in the study:
I give permission for the data collected from or about me to be included in the study.
……
I do not give permission for the data collected from or about me to be included in the study.
……

If you have questions
The main Investigators conducting this study are **Bernadette Kiarie and Juliana Namada**, employees at the United States International University-Africa. Please ask any questions you may have. If you have questions later, you may contact any of the four researchers involved in this study via their email addresses as follows: Bernadette Kiarie - bkiarie@usiu.ac.ke**,** Juliana Namada - jnamada@usiu.ac.ke or Courage Logah - clogah@knust.gh.edu, Nana Ewusi - nanaewusi@yahoo.com . If you have any questions or concerns regarding your rights as a research participant in this study, you may also contact the Mastercard Foundation e-Learning Initiative office at USIU-Africa.
Your signature below indicates that you have been debriefed, and have had all of your questions answered.

_____	_____	_____
Name of Participant	**Signature**	**Date**
_____	_____	_____
Name of Researcher	**Signature**	**Date**

Please sign both copies, keep one and return one to the researcher.

Appendix VII: NACOSTI Research Permit

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: 882273

Date of Issue: 09/June/2022

RESEARCH LICENSE

This is to Certify that Dr.. Bernadette Kamene Klarie of United States International University Africa, has been licensed to conduct research in Nairobi on the topic: Towards best practices in online content development and pedagogy: A comparative study of opportunities and challenges in USIU-Africa and KNUST. for the period ending : 09/June/2023.

License No: NACOSTI/P/22/17809

882273

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION

Verification QR Code

NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application.

Appendix VIII: KNUST IRB Approval Letter

Kwame Nkrumah
University of Science
and Technology, Kumasi

College of Humanities & Social Sciences

HUMANITIES AND SOCIAL SCIENCES RESEARCH ETHICS COMMITTEE

Our Ref: HuSSREC/AP/23/VOL. 1

18th May, 2022

Courage Julius Logah (Co-P.I.)
Vice Chancellors Office
KNUST - Kumasi.

Dear Sir

LETTER OF APPROVAL

Protocol Title: Towards Best Practices in Online Content Development and Pedagogy-A comparative Study of Opportunities and Challenges in USIU-Africa and KNUST

Proposed Site: Africa

Sponsor: Mastercard Foundation

Your submission to the Committee on Humanities and Social Sciences Research and Ethics Committee on the above-named title refers.

The Committee reviewed the following documents:

- A notification letter of **9th May, 2022**
- A completed HuSSREC Application Form
- Participant Information Leaflet and Consent Form
- Research Protocol
- Questionnaire

The Committee has considered the ethical merit of your submission and approved the protocol. The approval is for a fixed period of one year, beginning **18th May, 2022 to 18th May, 2023** renewable thereafter. The Committee may however, suspend or withdraw ethical approval at any time if your study is found to contravene the approval protocol.

Data gathered for the study should be used for the approved purpose only. Permission should be sought from the Committee if any amendment to the protocol or use, other than submitted, is made of your research data.

The Committee should be notified of the actual start date of the project and would expect a report on your study, annually or at the close of the project, whichever one comes first. It should also be informed of any publication arising from the study.

Thank you for your application.

Prof. Oswald K. Seneadza
CHAIRMAN

PMB UPO, KNUST, Kumasi **Tel:** +233 32 249 9705 **Email:** hussrec@knust.edu.gh **Website:** www.knust.edu.gh
Bankers: Ecobank, KNUST **Account Name:** CASS Research Fund **No.** 1441000860606

United States International University-Africa

REF: USIU-A/IRB/213-2022 *19th May*, 2022

TO: BERNADATTE KAMENE KIARIE

Dear Sir/Madam

RE: TOWARDS BEST PRACTICES IN ONLINE CONTENT DEVELOPMENT AND PEDAGOGY: A COMPARATIVE STUDY OF OPPORTUNITIES AND CHALLENGES IN USIU-AFRICA AND KNUST.

This is to inform you that ***IRB*** has reviewed and approved your above research proposal. Your application approval number is **USIU-A/IRB/213-2022.** The approval period is from ***19th May 2022*** to ***19th May 2023.***

This approval is subject to compliance with the following requirements;

i. Only approved documents including (informed consents, study instruments, MTA) will be used.
ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by ***IRB.***
iii. Death and life-threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to ***IRB*** within 72 hours of notification.
iv. Any changes, anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to ***IRB*** within 72 hours
v. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal.
vi. Submission of an executive summary report within 90 days upon completion of the study to ***IRB***

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology and Innovation (NACOSTI) https://research-portal.nacosti.go.ke and also obtain other clearances needed.

Yours sincerely

Juliana M. Namada, Ph.D.
Institutional Review Board (IRB) Chair
Email: irb@usiu.ac.ke

Appendix XI: USIU-Africa IRB Approval letter