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T-TEL Covid-19 Impact Assessment Study

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Abbreviations and acronyms

B.Ed.	Bachelor of Education
CL	Confidence Level
CoE	College of Education
CPD	Continuous professional development
GTEC	Ghana Tertiary Education Commission
HI	Hearing-impaired
KII	Key Informant Interview
KNUST	Kwame Nkrumah University of Science and Technology
LMS	Learning management system or systems
MoE	Ministry of Education
MR	Multiple responses
NaCCA	National Council for Curriculum and Assessment
NaSIA	National School Inspectorate Authority
NCTE	National Council for Tertiary Education
NTS	National Teachers' Standards
ODK	Open Data Kit
SD	Secure Digital
SDL	Self-directed learning
SEN	Special education needs
SHS	Senior High School
T-TEL	Transforming Teaching, Education and Learning (formerly Transforming Teacher Education and Learning)
UCC	University of Cape Coast
UDS	University of Development Studies
UEW	University of Education, Winneba
UG	University of Ghana
VI	Visually Impaired

1. Introduction

This research assesses an intervention in Ghana that supports remote initial teacher training. There is a gap in the current literature on the specific use of eLearning for teacher training (rather than for Higher Education in general), making it an important contribution to the evidence base.

1.1. Background and context

Following the closure of Colleges of Education (Colleges of Education) in March 2020, the Ghana Tertiary Education Commission (GTEC) and Transforming Teacher Education and Learning (T-TEL) supported tutors to adapt their lessons and teaching to take account of the specific demands of online teaching and learning. Tutors were enrolled in an online certificate programme in design, teaching, and learning. The needs of student teachers were also considered, especially those with special education needs (SEN) and from low-income backgrounds. Smartphones and SD cards were supplied to these student teachers to enable them to participate in online teaching and learning. Psycho-social and emotional well-being support were also provided for student teachers.

1.2. Purpose

The purpose of this study is to generate evidence on whether the approaches adopted during the closure of Colleges of Education in Ghana due to Covid-19 has led to improvements in teaching and learning for student teachers, and the impact of these approaches on different groups of students (including female students and students with SEN). The study also examines the resilience and sustainability of Ghana's teacher training system.

1.3. Methods

A cross-sectional survey approach was adopted for this study. Structured interviews were conducted with 462 tutors and 356 student teachers while lessons of 211 tutors were observed on the virtual learning platforms of 30 sampled Colleges of Education. Qualitative data was collected from all 46 College of Education principals, 10 tutors, 43 student teachers (including 28 with SEN), 5 mentoring university leads and 2 staff from GTEC, a national regulatory agency. Data collection was done remotely via telephone and WhatsApp.

1.4. Key findings

1. Tutors have high levels of awareness of virtual learning platforms (97%) and tend to use several platforms to deliver lessons. Telegram (used by 78% of tutors) and WhatsApp (63%) were the most commonly used platforms, followed by Google Classroom (35%) and Zoom (33%).

2. The majority of tutors found the online certificate programme and support useful and demonstrated increased understanding of, and confidence in, eLearning. Of the tutors, 85% were satisfied with the online training course, with 62% demonstrating a stronger understanding of eLearning and confidence about teaching online in the event of future institutional closures.

3. Key challenges faced by tutors included difficulties with internet connectivity (experienced by 91% of tutors), lack of student cooperation (32%) and lack of adequate teaching materials (28%). Tutors who were not confident teaching online indicated that they did not find it easy to transition from teaching in physical classrooms to virtual platforms due to the lack of face-to-face interaction with student teachers.

4. The majority (66%) of student teachers are confident to undertake online learning in the event of future institutional closures and 70% are becoming independent and responsible in their learning. However, a large minority (40%) of student teachers were not able to attend lessons synchronously, often due to internet connectivity.

5. The number of female student teachers who are becoming independent and responsible[1] was lower than males though the difference was not significant. Information gathered through qualitative interviews suggests that this might be because many female student teachers have to balance multiple roles such as being student teachers, mothers, marriage partners, and household caregivers, especially during the period where they are living at home and scheduled to attend lessons virtually. They therefore have less time to complete school tasks. We think that this issue requires further research.

6. eLearning has improved the participation of most student teachers with SEN, making lessons more inclusive, and creating autonomy for SEN student teachers who previously depend on their colleagues to read lesson materials for them.

[1] Independent and responsible are defined in this study as: reading the course materials loaded on smartphones and SD cards, completing and submitting assignments, and conducting further research.

7. Student teachers would like to see changes to the mode of examination used in the current blended learning approach adopted by the Colleges of Education. Currently, they have to do examinations online at a time when they are scheduled to attend remote classes. However, the erratic nature of internet connectivity in many communities makes it difficult for them to do their examinations effectively.

8. More tutors employed instructional strategies that encourage student participation and critical thinking in their online classes in 2020 than they did during an equivalent 2019 survey when teaching took place face-to-face (a 9 percentage point increase between 2019 and 2021). Of tutors teaching Year 2 and 3 Bachelor of Education (B.Ed.) student teachers, 61% employed these instructional strategies compared to 52% of tutors in 2019. The least commonly applied strategies include 'use of storytelling during lessons (19%)', 'use of role-play during lessons (18%)', and 'use of games during lessons (16%)', indicating that more guidance is needed to support the use of these instructional strategies in online teaching. While female tutors appear to be more self-critical than male tutors when reporting their understanding of eLearning, lesson observations show that they generally do better at encouraging student participation and critical thinking during virtual lessons than their male counterparts.

9. Prior to the closure of Colleges of Education due to the Covid-19 pandemic, none of the Colleges of Education had policy guidelines regarding eLearning, however, Colleges of Education were able to rapidly initiate virtual learning with the assistance of GTEC, the mentoring universities, and T-TEL. This suggests that a policy was a necessary precondition to the successful uptake of eLearning. Given that many student teachers only see eLearning as a temporary solution, mainly due to the challenges of internet connectivity, an eLearning policy and continued investment in connectivity to sustain eLearning may be required if Colleges of Education and GTEC plan to persist with the blended learning approach in future years.

10. The majority (93%) of the Colleges of Education have confidence that the national regulatory agency (GTEC) can continue to oversee the effective transition to online education.

1.5. Policy implications

The research findings have two main implications for policy and practice on eLearning:

1. *Internet connectivity is a major barrier to eLearning which must be tackled*. This is a broader contextual issue that requires the appropriate ministry in Ghana (e.g., Ministry of Communication) to work on how best to improve internet connectivity nationwide. GTEC and the Ministry of Education are already working to tackle the issue of internet connectivity across the Colleges of Education but this will not address the situation of poor connectivity in student teachers' homes. An alternative shorter-term solution would be for an agreed amount of money for data to be added to the monthly allowances of student teachers.

2. *Capacity building for tutors to understand how to manage eLearning and identify which platforms are helpful in supporting synchronous and asynchronous sessions is important*. Colleges of Education need to build the capacity of tutors and student teachers to make the transition to eLearning easier in the following areas:

    - Making tutors more accessible and available to support student teachers.
    - Making access to eLearning platforms easier for student teachers.
    - Building the capacity of tutors to have a deeper understanding of eLearning and how to interact with student teachers on eLearning and virtual platforms.

1.6. Purpose of this report

This research aims to generate evidence on whether or not the approaches adopted during the closure of Colleges of Education due to Covid-19 have led to an improvement in teaching by tutors and learning among student teachers, specifically:

1. To ascertain whether student teachers (especially those from low-income backgrounds and those with visual and hearing impairments) are becoming independent and responsible in their learning.
2. To determine whether College of Education tutors have a strong understanding of eLearning and are confident teaching online in the event of future institutional closures or the persistence of the blended learning approach which is being used in the 2020/21 academic year.
3. To determine whether Colleges of Education can cope with any future institutional closures by making the transition to online education.

4. To explore whether Ghana's teacher education regulatory agency can support the transition to online education.

5. To determine whether student teachers have a stronger understanding of eLearning and whether they are confident of undertaking online learning in the event of future institutional closures.

1.7. Context of the study

In response to the closure of all 46 Colleges of Education in March 2020 due to Covid-19, GTEC, with the support of T-TEL (a Ghanaian not-for-profit company) established a Virtual Learning Task force for Teacher Education. This task force included all five mentoring universities[2] and engaged key stakeholders such as the Principals of Colleges of Education, College of Education tutors, non-teaching staff, and student teachers. The task force met regularly to ensure that teacher education continued through virtual and online learning[3] until such a time when the institutions could re-open. The task force was clear that the approach being used was 'Emergency Remote Teaching & Learning', which is defined as "a temporary shift to an alternate delivery model due to

[2] As part of the teacher education reform policy in Ghana, cabinet has approved the reform policy, which requires all 46 Colleges of Education that were previously under one university (UCC) to be affiliated to 5 universities (Kwame Nkrumah University of Science and Technology (KNUST), University of Ghana (UG), University of Cape Coast (UCC), University of Education, Winneba (UEW), and University of Development Studies (UDS). In practice, some Universities have 5 Colleges of Education and others have as many as 14. These 5 Universities supervise teaching and learning and assessment in the Colleges of Education. It is important to note that the mentoring Universities do not directly engage with the students of the Colleges of Education in terms of teaching or supervising practicum. Their support is largely in building the capacity of management and tutors of the Colleges of Education to implement the B.Ed. They also monitor to ensure that the Colleges of Education are performing in line with the roadmap they have developed with their Universities. The Colleges of Education were assigned based on the programme specialisations of each university. For example,. three of the Universities offer B.Ed programmes in early childhood, so all those Colleges of Education who offer early childhood as a specialism were divided among these three Universities for mentoring. Also, one university offers a technical / vocational programme, so all the Colleges of Education offering TVET programmes are affiliated to that university. In practice therefore, some Colleges of Education may be in the northern or middle regions of Ghana but affiliated to a university in the coastal zone.

[3] Online is one aspect of virtual learning. For online learning, the student teachers have to use the internet in real time to meet with tutors and fellow students e.g., using zoom, google classroom and V-Class used by some Universities (UEW, KNUST). With virtual learning, the task force prepared the College of Education tutors to discuss the most convenient way to teach student teachers (e.g., using Telegram, WhatsApp, etc.) where the student teachers can attend lessons synchronously and asynchronously. Often, in context, people tend to use virtual and online learning coterminously.

crisis circumstances" (↑Hodges et al., 2020). The primary objective was to provide temporary access[4] to instruction and instructional support in a manner that was quick to set up and is reliably available during an emergency or crisis.

In collaboration with the GTEC, T-TEL took the following steps in response to the Covid-19 outbreak and the closure of Colleges of Education.

1. Worked with the five mentoring Universities and GTEC to create an online B.Ed. curriculum resources hub for both student teachers and tutors, containing all course materials for Year 1 and Year 2.

2. Provided support to each of the 46 Colleges of Education to enable them to deliver lessons using Google Classroom, Telegram and WhatsApp to complement virtual learning platforms (see point 5 below).

3. Worked closely with Colleges of Education to ensure that the needs of all learners were considered, especially those with visual and hearing impairments and those from low-income backgrounds. A total of 2,750 smartphones[5] and 4,750 SD cards were supplied to student teachers at a

[4] In an attempt to follow the Covid-19 protocols and ensure that the number of cases in Ghana continues to reduce, the Ministry of Education (MoE) together with the regulatory agencies and Colleges of Education agreed to combine face-to-face lessons with virtual learning for the 2020/2021 academic year. Year 1 student teachers had face-to-face training throughout the year. Year 2 and Year 3 student teachers had a mixture of face-to-face and remote learning: when Year 2 students were in the colleges, Year 3 students remained at home, and vice versa. The classes switched from face-to-face to virtual learning every six weeks.

[5] During the closure of Colleges of Education, T-TEL worked with GTEC to estimate the number of students who were unable to access virtual learning and to find out why. As per our initial estimate, approximately 15% of students were unable to access virtual learning opportunities because of a combination of one or more of the following factors:

1. Lack of access to an internet enabled device such as a smartphone, laptop, or tablet.

2. Residing in an area of the country where there is limited network coverage to enable them to access virtual learning platforms.

3. Lack of funds to purchase data bundles and airtime.

T-TEL worked with the 46 public Colleges of Education to compile a list of students who do not have smartphones and or are living in areas without internet connectivity. This list was used to procure 2,750 smartphones and 4,750 SD cards for the students. The smartphones were procured at a unit cost of GHC 990 (USD 173) but offered to the student teachers for GHC 400 ($70). The SD cards were procured at a unit cost of GHC 96 (USD 17) but offered to the student teachers for GHC 50 (USD 9). The Colleges of Education agreed a 12-month payment plan with the student teachers.

subsidised price and on a hire purchase basis (Colleges of Education are responsible for retrieving this amount and using it to improve virtual learning in their institutions). T-TEL identified 29 student teachers who were either visually or hearing-impaired and provided them with smartphones, laptops, SD cards, B.Ed. curriculum course materials in braille and text to speech as well as other tools to improve teaching and learning in their respective Colleges of Education.

4. Supported tutors to adapt their lessons and teaching to take account of specific demands of online teaching and learning and switch to 'Emergency Remote Teaching.'[6] Over 1,900 tutors, university and government staff enrolled in a specially offered online Certificate in Design, Teaching and Learning delivered by the Amsterdam University of Applied Sciences.

5. Worked with each of the five mentoring Universities to extend their virtual learning environments so that student teachers in their affiliated Colleges of Education could participate fully in online classes. Over 95% of B.Ed. student teachers across the 46 Colleges of Education registered on these virtual learning platforms. Ghana's major telecom operators zero-rated these learning platforms so there were no data charges to access them.

6. Provided psycho-social and emotional well-being support for student teachers. A counsellor and psychotherapist volunteered to support students going through stress, frustration, etc., arising from the need for them to stay at home by running weekly sessions over Zoom.

7. Established the College of Education eLearning Fund for the improvement of Wi-Fi connectivity in 36 Colleges of Education. T-TEL worked with GTEC to provide funds of approximately USD 4,000 each in 36 Colleges of Education, which they used to improve Wi-Fi connectivity and thus enhanced Emergency Remote Teaching and Learning in these Colleges of Education.

The payment for the devices was to be made directly to the Colleges of Education to enable the Colleges of Education establish an eLearning Fund to improve their internet connectivity and enhance tutor capacity to deliver elearning.

[6] Beyond the Amsterdam University course in Design, Teaching and Learning. T-TEL, GTEC and the five mentoring Universities have ensured that all Colleges of Education continue to conduct weekly professional development sessions (on the virtual platforms). The sessions cover topics that will enable the tutors to deliver the new B.Ed. Curriculum.

1.8. Research questions

This study evaluates the effectiveness of the support put in place with T-TEL and GTEC with a focus on the following research questions.

1. Are student teachers (especially those from low-income backgrounds and those with visual and hearing impairments) becoming independent and responsible[7] in their learning?
2. Do College of Education tutors have a strong understanding of eLearning and are they confident teaching online due to the persistence of the blended learning approach that is being used in the 2020/21 academic year?[8]
3. Can Colleges of Education cope with any future institutional closures by making the transition to online education?
4. Can Ghana's teacher education regulatory agency support the transition to online education?
5. Do student teachers have a stronger understanding of eLearning and are they confident about undertaking online learning due to the persistence of the blended learning approach which is being used in the 2020/2021 academic year?

[7] Independent and responsible are defined as: 'reading the course materials loaded on smartphones and SD cards, completing, and submitting assignments, and conducting further research.'

[8] In an attempt to follow Covid-19 protocols and ensure that the number of cases in Ghana continues to reduce, the Ministry of Education (MoE) together with the regulatory agencies and Colleges of Education agreed to combine face-to-face lessons with virtual learning for the 2020/2021 academic year. Year 1 student teachers had face-to-face training throughout the year. Year 2 and Year 3 student teachers had a mixture of face-to-face and remote learning: when Year 2 students were in the colleges, Year 3 students remained at home, and vice versa. The classes switched from face-to-face to virtual learning every six weeks.

2. Literature review

In this section, we review relevant literature for this research. The review of literature draws on the adaptation and implementation of eLearning in Higher Education from different contexts. It is important to mention that the majority of literature on eLearning is focused generally on Higher Education, with little or no evidence that is specific to teacher training. This study — with its focus on eLearning for teacher training — adds an important element to existing literature. The literature review section is organised into six sub-sections. The first five sub-sections relate to the five research objectives. The literature review section concludes with highlights from diffusion of innovation theory as a framework for analysing levels of adoption of eLearning — innovation in the context of Ghana's teacher education programme. The diffusion of innovation theory, therefore, presents a framework for the analysis of the evidence generated in the study.

2.1. eLearning

eLearning can be seen as a teaching and learning system using electronic resources (↑Abed, 2019). Teaching can be based in or out of a classroom and the use of computers, smartphones, and the internet is a major part of eLearning (↑Suresh Babu & Sridevi, 2018). In whatever form, the delivery of eLearning permits the possibility of active interaction and holds the promise of providing an opportunity for a flexible way of learning that allows students to learn at their own pace (↑Chakraborty, 2017). In addition, eLearning can be used to encourage independent student learning (↑Aboagye et al., 2020). While eLearning can be used in basic and secondary education, the focus of this study is on the use of eLearning in Higher Education.

There are diverse ways of viewing and or classifying eLearning. For instance, ↑Valverde-Berrocoso et al. (2020) define eLearning from three different categorical perspectives: the distance learning perspective, the technological perspective and from the perspective of eLearning as pedagogy. Additionally, ↑Sangrà et al. (2012) have highlighted four general categories of definitions of eLearning,

1. *technology-driven:* use of technology to deliver learning and training programmes;
2. *delivery-system-oriented:* the delivery of a learning, training, or education programme by electronic means;

3. *communication-oriented:* learning facilitated by the use of digital tools and content that involves some form of interactivity, which may include online interaction between the learner and their teacher or peers;

4. *educational-paradigm-oriented:* information and communication technologies used to support students to improve their learning.

Also, some classifications are based on the extent of engagement between teachers and learners and the timing of interaction. Virtual learning is characterised by the use of software, the internet, or both to deliver lessons to students in Higher Education, reducing the need for physical interaction (↑Coman et al., 2020). When virtual lessons are delivered synchronously, it means the lessons are happening in real time, often with a set class schedule. Asynchronous lessons do not require real-time interaction; instead, content is available online for students to access when it best suits their schedules (↑Scheiderer, 2020). eLearning activities are typically technology-based and self-directed and often occur in an environment where students in Higher Education may have difficulty getting timely feedback. It is therefore essential for instructors to anticipate the needs of Higher Education students and provide clarity and detailed information to guide them (↑Carter et al., 2020).

Although eLearning can provide opportunities for flexible learning in Higher Education (↑Chakraborty, 2017), in practice this is often challenging, particularly in contexts where structures for supporting the adaptation and implementation of eLearning are limited. For instance, from a developing country perspective, ↑Almaiah et al. (2020) suggested that several factors need to be considered before eLearning can be implemented in Higher Education. They highlight that issues related to staff development are crucial, especially in times when new approaches to teaching and learning in Higher Education are introduced. Also, training and dialogue about these new approaches should be taken seriously: the introduction of eLearning in traditional educational settings is likely to affect the organisational landscape and its practices on many levels (↑Almaiah et al., 2020). For any eLearning system to be effective, the acceptance and willingness of students and teachers to use it are key (↑Almaiah & Jalil, 2014; ↑Almaiah & Alismaiel, 2019). ↑Aboagye et al. (2020) identify how these challenges impact Higher Education institutions and highlight that teachers and students in Higher Education face different obstacles in taking up eLearning in their educational practice. Obstacles include lack of sufficient resources in terms of computers and better access to technology and lack of capacity (↑Aboagye et al., 2020). As eLearning activities are typically technology-based and self-directed, their implementation in contexts or environments where students may have difficulty getting timely feedback should be looked at seriously. One way to ensure this in the

Ghanaian context is the establishment of clear guidelines as a framework for regulating eLearning delivery in teacher education institutions (↑Anamuah-Mensah et al., 2020).

2.1.1. eLearning in response to school closures

One of the global responses to reducing the spread of Covid-19 was school closure. According to data from UNESCO, the peak in school closures was registered at the beginning of April 2020, when around 1.6 billion learners were affected across 194 countries, accounting for more than 90% of total enrolled learners (↑UNESCO, 2021).

Despite school closures being a desirable option to curb the spread of the virus, no education or learning during the closure periods would have caused major interruptions in student learning, with possible long-lasting consequences for the affected cohorts (↑Burgess, 2020; ↑Hanushek & Woessmann, 2020). The sudden switch to eLearning during school closures globally has led to some interesting results when compared to face-to-face instruction (↑Iivari et al., 2020) although there have also been situations where it has not been effective. Teachers and students in Higher Education had to unexpectedly adjust to a new situation of teaching and learning, which has led to some concerns.

First, online learning is only available to students in Higher Education who have access to internet connectivity at home that is fast enough to support online learning. While internet service providers have ensured quality service in urban areas, most remote areas have limited or no access to the internet (↑OECD, 2020). Beyond access, the difficulty of some students in quickly adopting and using learning management systems or any other digital platforms for eLearning have been noted (↑Plitnichenko, 2020). Some students get distracted when they have to take ownership of their learning, and having to schedule when to attend lessons, read course materials and complete their assignments (↑Dontre, 2021).

Second, teachers in Higher Education have had to move their classes online during school closures, mostly with limited or no additional training or extra budget. Most of the training conducted for these teachers to enable them to switch to eLearning during school closures was rushed and not comprehensive enough to enable them to adopt the techniques needed to deliver lessons online (↑MacIntyre et al., 2020; ↑Winthrop, 2020).

Third, learning management systems are very expensive. Not many Higher Education institutions can afford them, especially not those in developing countries. This meant that most teachers in Higher Education had to use

numerous social media platforms and digital tools such as WhatsApp and Telegram to deliver eLearning (↑Appiah-Boateng, 2019; ↑Plitnichenko, 2020). Additionally, while eLearning requires that students in Higher Education institutions use smartphones or computers to access lessons, many learners, especially in developing countries, do not have these devices (↑Plitnichenko, 2020).

Fourth, the shift to eLearning makes the assessment of students (a critical aspect of learning) more complicated as it needs to be conducted online (↑Adedoyin & Soykan, 2020), yet the training offered to teachers to conduct assessments online has been described as inadequate (↑MacIntyre et al., 2020; ↑Winthrop, 2020).

Fifth, the shift from face-to-face learning to eLearning during school closure will have had larger impacts on some groups of students. For some students with SEN, namely those who benefit from interpreters and other support during face-to-face lessons to facilitate learning, may now have difficulty adjusting to remote learning that has not been tailored to their specific learning challenges. Given that eLearning poses some form of challenge for students without SEN, there is an increased risk that they will fall behind their peers (↑Plitnichenko, 2020).

Several other challenges have been discussed in recent studies on eLearning during the Covid-19 pandemic. For instance, it has been found that virtual learning during the pandemic has created more stress, frustration, and isolation for Higher Education students who have lost the opportunity for direct peer interactions and engagement (↑Daniel, 2020; ↑Gillett-Swan, 2017). Other concerns regarding cybersecurity, cyberbullying, online violence and exploitation, and other psychological issues caused by difficulties and uncertainties associated with online learning during the Covid-19 pandemic have been found (↑Daniel, 2020; ↑Yan, 2020).

2.1.2. Regulation of eLearning

As Higher Education institutions have been operating a regulatory framework for their face-to-face operations, the shift to eLearning will equally require some form of regulatory framework and policy to guide instructors and students and for the purpose of quality assurance (given the difference in the nature of eLearning set out above). For instance, interactions between and among learners in Higher Education need to be tracked and stored to monitor learning processes and outcomes. Learners may accumulate student-centred learning experiences and create learning portfolios, while teachers provide timely feedback in accordance with learning outcomes (↑Alvarez et al., 2013).

↑Borokhovski et al. (2011) and ↑Roumell Erichsen & Salajan (2014) suggested criteria that eLearning regulation and policies should focus on. This has the following five dimensions.

1. "infrastructure" — the hardware, software, and internet connectivity for eLearning;
2. "curriculum integration" — the re-interpretation of school curricula and development of pedagogical practices for eLearning;
3. "students learning" — students' development of domain knowledge and 21st-century skills through eLearning;
4. "teacher professional development"— teachers' pedagogical competency and training activities for eLearning;
5. "leadership and capacity building" — school leadership, research support, and community involvement for eLearning are very critical areas that need to be included in an eLearning policy.

The regulation of eLearning in Higher Education is wider than policy and will involve infrastructure, leadership and management, teachers, and students. According to the ↑Hong Kong Education Bureau (2015) the provision of ICT infrastructure, development of digital resources, the goal and means of implementation, capacity, and leadership are critical for supporting and ensuring a unified approach to eLearning. It is also desirable that eLearning processes emphasize not only the formal learning initiated in digital classrooms on campus but also the extended learning in which students in Higher Education continue peer discussions on social media platforms after class (↑Appiah-Boateng, 2019).

Considering that students in Higher Education come from diverse backgrounds, it is critical that a policy framework that caters for the diversity of learners but ensures uniformity of eLearning is developed and implemented. It has been recommended that for eLearning, instructors should follow bespoke guidance to ensure that students learning experiences are uniform (↑Anamuah-Mensah et al., 2020). This is especially important as students become independent learners and require uniformity in the support they get from instructors. According to ↑Anamuah-Mensah et al. (2020), with the support of their mentoring universities, all teacher training institutions in Ghana are expected to follow eLearning guidance to ensure uniformity of learning experiences during emergency remote online learning and assessment.

2.1.3. Students in Higher Education as independent learners

An independent learner is one who can take responsibility for their own learning, and this comes easier to some students than others (↑InnerDrive, no date). As students in Higher Education become independent learners, they become more motivated, thus improving their academic performance (↑Al Maani, 2019). According to ↑InnerDrive (no date), becoming independent learners allows Higher Education students to have more control over their time and, with the right support, they tend to spend their time more efficiently, which results in increased responsibility, accountability, and autonomy for personal success and failure. However, making this transition to become independent learners has been a challenge for many students in Higher Education (↑Dalas et al., 2020).

↑Reinders (2010) suggests a framework consisting of nine stages for fostering independent learning skills. The nine stages include "identifying needs", "setting goals", "planning learning", "selecting resources", "selecting learning strategies", "practice", "monitoring progress", and "assessment and revision." Given that students in Higher Education may find it difficult to adopt independent learning behaviours, this progressive framework supports their journey to becoming independent learners.

Zimmerman's self-regulated learning model — made specifically for eLearning experiences, also sets out ways to develop independent learners including in self-regulation and increasing self-directed learning (SDL) (↑Zimmerman, 2015). A critical component of the model is when learners construct their own attainable learning goals that consist of an appropriate amount of time for completion and opportunities for self-pacing. Learners can apply different strategies to achieve the learning goals and they can continually refer to the learning goals for guidance and direction when assessing the efficacy of their strategies (↑Zimmerman, 2015).

As learners reflect on their own learning experiences and evaluate their performance, they are able to plan for any needed improvement and future learning experiences (↑Ebner, 2020) — another vital aspect of becoming an independent learner. eLearning promotes independent learning because it encourages Higher Education students to learn at their own pace and level (↑Wahyuni, 2018), take control of their learning, reflect on their own thinking, and grapple with essential questions with some guidance from instructors to enhance their SDL skills (↑Zimmerman, 2015). The trajectory of eLearning and SDL are important for promoting independent learning in Higher Education. It is therefore critical that educators and all stakeholders interested in eLearning

focus on supporting learners from diverse backgrounds, especially people with SEN and those from vulnerable and excluded groups, to become independent learners (↑OECD, 2020).

2.1.4. Students' understanding, confidence, and willingness to adopt eLearning

Successful implementation of eLearning systems requires an understanding of the factors that affect the adoption and acceptance of eLearning systems. User adoption and acceptance of eLearning is significantly influenced by individual, social, and organisational contexts (↑Kanwal & Rehman, 2017). Learners' acceptance is influenced by diverse factors such as demographics, organisational impact, and social influence, along with the perceived usefulness and ease of use of eLearning systems (↑Salloum et al., 2019).

One proxy that is often used to measure acceptance is computer access, ownership, and computer skills, based on the assumption that they contribute to computer literacy that in turn influences the adoption of eLearning (↑Adarkwah, 2020). In a context where access to devices that support eLearning is low and the degree of familiarity with virtual learning concepts is not high, the adoption of eLearning is impeded. For instance, in a study with distance education students in the Ghanaian context, access to ICT was found to influence the students' willingness to adopt online or blended learning (↑Arthur-Nyarko & Kariuki, 2019).

In exploring key determinants of success within eLearning, in their work with faculty, ICT experts, students, and researchers from developing countries, ↑Bhuasiri et al. (2012) asked participants to identify their four top success factors. The ICT experts ranked computer training, perceived usefulness, attitude towards eLearning, and computer self-efficacy as success factors. Faculty members ranked perceived usefulness, attitude towards eLearning, programme flexibility, and clear direction as top success factors. In their conclusion,↑Bhuasiri et al. (2012) argued that students in Higher Education in developing countries are less familiar with technology and are therefore more critical of eLearning.

The views of students and teachers can be viewed from the perspective of diffusion of innovation theory, as we demonstrate in the next subsection.

2.1.5. Diffusion of innovation theory

The diffusion of innovations theory (↑Rogers, 2003) posits how new innovations spread in society. According to ↑Rogers (2003, p. 11), diffusion can be defined as "the process by which an innovation — technology is communicated through

certain channels over time among the members of a social system." It is argued that Rogers' diffusion of innovations theory is the most appropriate framework for analysing the adoption of technology in Higher Education and educational environments (↑Appiah-Boateng, 2019). For ↑Rogers (2003), adoption is a decision of "full use of an innovation as the best course of action available" and rejection is a decision "not to adopt an innovation" (p. 177).

The diffusion of innovation theory recognises five qualities that determine the success of an innovation. First, an innovation is easily adopted when it is perceived to have a relative advantage over others. Second, the innovation's compatibility with existing values and practices as well as past experiences of users makes it easy to adopt. The simplicity and ease of use of an innovation make its adoption more rapid compared to others that require the development of new skills and understanding. The degree of an innovation's trialability (i.e. the degree to which it has been tested by others) encourages adoption by decreasing uncertainty. Lastly, the more observable the result of an innovation, the higher the likelihood of it being adopted. Visible results lower uncertainty and stimulate peer discussion of a new idea (↑Rogers, 2003). These five qualities are a useful framework for analysing and understanding how an innovation is adopted (↑Robinson, 2009).

The theory considers change as the reinvention of products and behaviours, so the products become best suited for the needs of individual groups instead of forcing individuals to change. ↑Rogers (2003) argues that based on its propensity to adopt a specific innovation, any given population can be divided into five different categories:

1. innovators
2. early adopters
3. early majority,
4. late majority
5. laggards.

The relevance of the theory for this study lies in how these five different categories typify the tutors and student teachers who are making the transition from face-to-face teaching and learning to eLearning. When an innovation is adopted, individuals in a social system adopt innovation at different rates based on the five qualities recognised by the innovation of diffusion theory.

In terms of eLearning in this study, the discourse of Roger's (2003) diffusion of innovation theory provides an analytical framework for discussing how tutors and student teachers adopt eLearning to transition from face-to-face to virtual learning. The manifestation of tutors and student teachers in Roger's five categories of innovators, early adopters, early majority, late majority, and laggards depends on the five qualities that shape the success of the innovation. As such, the degree to which eLearning is adopted depends on its comparative advantage, whether it fits within existing values and practices, its simplicity and ease of use, its trialability and its observable results.

3. Methodology

We adopted a cross-sectional survey approach for this study, using a mixed-methods design and a multi-stage random sampling approach for sampling. In the first stage of this sampling approach, the 46 public Colleges of Education were categorised based on their mentoring universities.[9] The Colleges of Education were further stratified based on their sex composition (i.e., female-only Colleges of Education, male-only Colleges of Education, and mixed Colleges of Education) to ensure representation of all categories. In total, 25 mixed-sex Colleges of Education, 4 females-only Colleges of Education and 1 male-only College of Education were randomly selected and included in the sample.

Sampling of College of Education tutors for structured interviews

A 95% confidence level (CL) was used to sample tutors from a population of 1,900. This is the recommended CL for social research (↑Hazra, 2017). Also, a response distribution of 50% was assumed given the distribution of tutors in the Colleges of Education. The minimum recommended sample size was 320 but a deliberate effort was made to sample female tutors in particular (out of the 1,900 tutors, only 24% are females). Overall, 462 tutors were sampled and interviewed to generalise the findings from all tutors across Ghana with a 100% response rate.

Sampling of tutors for lesson observation

In each College of Education, an average of five tutors were randomly sampled from Year 2 and Year 3 classes. Due to the low numbers of female tutors in Colleges of Education, a deliberate effort was made to sample as many female

[9] Note that cabinet approved the reform policy, which requires that all 46 Colleges of Education that were previously under one university (UCC) be affiliated to five universities (UCC, UG, KNUST, UEW, and UDS). In practice, some Universities have five Colleges of Education and others have as many as 14 Colleges of Education. These five Universities supervise teaching and learning and assessment in the Colleges of Education. We categorised the Colleges of Education by the mentoring universities they are linked to to capture the key population characteristics in the sample. In order words, it allowed us to produce characteristics in the sample that are proportional to the overall population.

tutors as possible. Lesson observation[10] for tutors teaching Year 2 student teachers virtually were conducted synchronously, and for Year 3 student teachers asynchronously.[11] Overall, a sample of 211 tutors was observed. To triangulate the responses from the tutor lesson observations, four student teachers (two male and two female, from co-educational Colleges of Education or four from single-sexed Colleges of Education) from a classroom of an observed tutor were randomly selected to participate in a key informant interview (KII).

Sampling of student teachers for structured interviews

Student teachers were selected using purposive sampling. The student teachers were purposively sampled because they had received smartphones and / or SD cards distributed by T-TEL in July and August 2020, during the closure of Colleges of Education due to Covid-19. Given that a total of 2,750 smartphones and 4,750 SD cards were distributed to student teachers across the 46 Colleges of Education, a total of 356 student teachers were sampled given a ±5% margin of error and a confidence level of 95%. Sampled student teachers were drawn proportionally from the year of study (Year 2 and Year 3) and sex. Also, a deliberate effort was made to purposively sample all the 28 student teachers with special education needs (SEN) who were supported to enable them to participate in virtual lessons. All 356 student teachers sampled for the structured interviews were interviewed with a 100% response rate.

[10] A virtual lesson observation tool designed around Ghana's National Teachers' Standards (NTS), which is an official Government of Ghana document produced by the National Teaching Council,and which sets out the behaviours and practices expected of teachers in Ghana's basic school classrooms was used to observe the virtual lessons. The lesson observation tool was developed from the NTS and approved by GTEC to be used to conduct lesson observations during T-TEL's annual evaluation surveys (2015 to 2020). Please use this link to access a copy of one of our annual evaluation surveys (↑T-TEL, 2019).

[11] Note that the MoE, the regulatory agency, and Colleges of Education agree to combine face-to-face lessons with virtual learning in the 2020/2021 academic year. This is limited to Year 2 and Year 3 student teachers only and scheduled to take place every six weeks. The Year 2 student teachers were undergoing virtual learning during the data collection period while Year 3 student teachers were attending face-to-face lessons. We therefore observed lessons of Year 2 student teachers synchronously on the virtual learning platforms. We were also fortunate to be able to observe lessons of Year 3 student teachers asynchronously as these were conducted 6 weeks earlier and were available on the virtual learning platforms.

Table 1. *Summary of sample allocation for the quantitative survey.*

Target Stakeholder	Research Tool	Target	Actual	Assumed Confidence Level (CL) and Margin of Error
Tutor	Tutor lesson observation tool	150	211	(CL = 95%, CI = ±6.4%)
	Tutor structured interview tool	320	462	(CL= 95%, CI = ±4.0%)
Student Teacher	Student teacher lesson triangulation tool	600	844	(CL= 95%, CI = ±3.4%)
	Student teacher structured interview tool	356	356	(CL= 95%, CI = ±5.0%)

Sampling of principals and educational stakeholders

All principals or their representatives — vice principal / College of Education secretary — were sampled and interviewed for information to address Research Objective 3 ("to determine whether the Colleges of Education can cope with any future institutional closures by making the transition to online education"). Further, two senior staff from GTEC and the five university leads[12] were interviewed to address Research Objective 4 ("to explore whether Ghana's teacher education regulatory agency can oversee the effective transition to online learning").

Table 2. *Summary of sample reached for qualitative data.*

Target Stakeholder	Research Tool	Target	Actual
Tutors	Tutor KII tool	10	10
Student Teachers	Student KII tool	15	15
	Visually impaired student teachers KII tool	16	16
	hearing-impaired student teachers KII tool	12	12

[12] The university leads are the representatives of the mentoring universities to the Colleges of Education. They plan, lead, and coordinate activities that have to do with the capacity building of College of Education management and tutors. They also lead on the monitoring of the implementation of the B.Ed. curriculum in Initial Teacher Education

College of Education Leaders	CoE Principal KII tool	46	46
University Leads	University Leads KII tool	5	5
Regulatory Agency	Regulatory Agency (GTEC) KII tool	2	2

3.1. Data collection process

3.1.1. Enumerator training

The enumerators selected for the study had a minimum of three years' experience in conducting research. A total of 20 enumerators were used for this assignment: 9 conducted lesson observation and tutor interviews, 7 conducted student teacher interviews, and 4 conducted the qualitative interviews.

A one-day training session was organised for the enumerators, the training was conducted on Zoom in accordance with T-TEL's Covid-19 risk assessment and safety protocols. The enumerators were briefed on the purpose of the research and taken through the ethics and quality assurance protocols.

The enumerators were also taken through the research tools to ensure that they had a common understanding in terms of the modalities, phraseology, and technical terms used. The enumerators were introduced to the SurveyCTO[13] configuration processes to download the research tools (electronic forms) on their tablets. T-TEL sought permission from one of the Colleges of Education and provided contacts of some student teachers and tutors to be interviewed as part of a mock exercise.

Sample audio recordings of lessons delivered online by tutors were also used as case studies during the training of lesson observers.

The enumerators who participated in the qualitative data collection training were also briefed on the study implementation processes. The enumerators discussed the research tools and marked specific areas where probing was required as well as the expectations from the participants. The training also included a mock exercise to align the team's overall understanding of the requirements of the research tools. The enumerators were also shown a debriefing template, which was to be used to synthesise the qualitative transcripts for analysis and reporting.

[13] The quantitative research tools were converted into an electronic form using Open Data Kit (ODK). The electronic forms were hosted on the SurveyCTO platform to aggregate the data.

3.1.2. The quantitative data collection process

All interviews were conducted via telephone and the responses were recorded on tablets and submitted to the SurveyCTO platform.

As mentioned earlier, a total of nine enumerators conducted lesson observations and structured tutor interviews. The contacts, links to lesson observation platforms (Telegram, WhatsApp, and Google Classroom), and timetables of sampled tutors were provided by the Colleges of Education. Each enumerator observed a maximum of 25 lessons[14] within the data collection period (four weeks). The enumerators also conducted an average of 50 structured tutor interviews within this period.

With regards to the structured student teacher interviews, each of the 7 enumerators completed 50 interviews (an average of 5 interviews a day). We observed that the structured student teacher interview took an average of 45 minutes to complete. The structured student teacher interviews were completed within the data collection period.

3.1.3. The qualitative data collection process

The qualitative interviews were also conducted via telephone and WhatsApp for some hearing-impaired (HI) student teachers. The interviewers called the principals, university leads, tutors, student teachers, and GTEC staff to schedule a convenient time for the interview. Permission was sought to record the interviews, after which the audios were transcribed, coded, and anonymised.

3.2. Approach to data analysis

The quantitative data was analysed using STATA version 16 software. For all key variables, descriptive analysis was conducted and disaggregated by the sex of stakeholders. Also, chi-square tests were carried out to determine statistically significant ($p \leq 0.05$) differences between male and female stakeholders. For all differences noted in the report, an asterisk (**) has been used to indicate statistically significant differences between results. Also, a note (MR) has been placed below tables to indicate that the results are multiple responses.

For the analysis of the lesson observation, a scoring rubric developed and used during T-TEL annual evaluation surveys (2015 to 2019) was used to compute

[14] The average length of a lesson was one-hour forty-five minutes. The enumerators observed a maximum of three lessons and conducted three structured tutor interviews each day.

the lesson observation data. This involved triangulating responses from observations, KIIs, and student teacher interviews.

Thematic analysis was employed as a process of identifying patterns or themes within the qualitative data. The qualitative transcripts were coded, anonymised, and organised using Excel. Recurring patterns within the transcripts were identified, highlighted, and summarised into themes for each stakeholder.

3.3. Stakeholders

Table 3 below lists the stakeholders engaged during the research.

Table 3. *List of stakeholders engaged during the research.*

Stakeholders	Engagement activities
Senior-level GTEC staff	These stakeholders were interviewed as part of the qualitative data collection process to help gather broad and deep insights into how teaching and learning took place during the Covid-19 outbreak and closure of Colleges of Education. They will also be invited to participate in a dissemination workshop (to be organised remotely via Zoom) where the findings of the study will be shared, and key decisions made to strengthen eLearning.
University Leads	
CoE Principals	
CoE tutors	The CoE tutors and student teachers were our key stakeholders in the data collection process (both quantitative and qualitative). Some CoE tutors and student teachers will be invited to participate in the dissemination workshop while a one-page infographic of the key findings and the link to the full report will be circulated across tutor and student teacher platforms, websites and on CoE notice boards to inform a wider audience.
CoE students	
GTEC	The dissemination of the findings from this study will be led by GTEC with support from T-TEL. GTEC will inform the various government agencies of the proposed dissemination workshop and share the link.
Ministry of Education (MoE) senior staff	These include the Minister for Education or his representative, the Chief Director of the MoE, and heads of units at the MoE. At the dissemination workshop, MoE staff will lead the discussion on the development of an online learning policy based on the findings from this research.
Heads of agencies (GES, GTEC, NTC, NaCCA, NaSIA)	The heads of the various agencies such as Ghana Education Service (GES), National Teaching Council (NTC), National Council for Curriculum and Assessment (NaCCA), National School Inspectorate Authority (NaSIA) or their representatives will be invited to participate in the dissemination workshop and lead the discussion on how the findings from the research will inform the policy on how virtual learning will be implemented or scaled-up across all schools (basic, secondary, and other tertiary institutions).
Development Partners (FCDO, Mastercard, UNICEF, USAID, etc.)	The findings will also be shared with development partners such as FCDO, Mastercard, UNICEF etc. These partners will be invited to the dissemination workshop.

3.4. Ethical considerations

3.4.1. Local permission to conduct in-person fieldwork

We sought ethical clearance for this study from GTEC and the five mentoring Universities. The regulatory authority and five mentoring Universities were informed through a letter that all interviews would be conducted via telephone calls with no in-person visits to the Colleges of Education and Universities. The enumerators were asked to refer to the letter and explain the purpose of the study to each respondent.

3.4.2. Confidentiality

The enumerators were trained not to collect or retain any information about respondents' identities. Participants were also informed during data collection that no personal information would be collected from them and that the data could not be traced back to them. A deliberate effort was made not to include questions that could make respondents easily identifiable. During the data collection, the enumerators informed the respondents that all information collected would be used for reporting purposes only.

3.4.3. Right to refuse or withdraw

The objective of the study was explained to the respondents and the respondents were informed that the decision to participate in the study was entirely voluntary. The respondents were informed of their right to refuse or take part in the study without affecting the relationship they have with T-TEL. The respondents were also told of their right not to answer any question, as well as to withdraw completely from the interview at any point during the process should they feel uncomfortable. Additionally, they were told of their right to request that the interviewer not use any of their interview material.

3.4.4. Consent

T-TEL prepared a consent form for this study detailing our research ethics for respondents to read (and to be read to visually impaired (VI) student teachers) and sign indicating their decision to volunteer as research participants, and that they had read and understood the information provided. Given that the data collection was virtual, soft copies of the consent form were shared with respondents electronically in addition to being read over the phone to them. For visually and hearing-impaired student teachers, verbal consent was obtained in the presence of the Special Education Needs Coordinators

(College of Education tutors assigned to the visually and hearing-impaired student teachers).

3.5. Challenges

We conducted this study remotely, with no physical visits to the Colleges of Education, GTEC or the mentoring universities to ensure that there was no risk of spreading Covid-19. This method of data collection led to two challenges, set out below.

Slow uptake of data collection during the first week

During the first week of data collection, the process was stalled due to some of the Colleges of Education conducting mid-semester exams. These Colleges of Education agreed to shift the data collection to the weekend for student teachers and tutors to participate in the exercise. This improved data completion rates significantly.

Difficulty interviewing hearing-impaired student teachers via the phone

Normally, to interview students with hearing impairments a sign language interpreter would be used. Given that our remote data collection was being conducted via phone calls, it was difficult to interview the hearing-impaired student teachers. We know that all the hearing-impaired student teachers have smartphones and are active on WhatsApp. We discussed this issue with the EdTech Hub team and agreed to conduct the interviews for the hearing-impaired student teachers using WhatsApp.

4. Results

4.1. Findings from tutors

Tutors play a critical role in imparting the required knowledge, skills and training student teachers need to be teachers. In this section, we present findings on the effect of the shift to remote learning for these tutors.

4.1.1. Tutors' experience with the online Certificate in Design, Teaching and Learning Course

Tutors were enrolled in a specially offered online Certificate in Design, Teaching and Learning delivered by the Amsterdam University of Applied Sciences in April 2020. The course consisted of eight modules, each of which had a one-hour Zoom class followed by a selection of online exercises and wider reading. It was delivered over a two-week period in the second half of April 2020 and almost 1,900 tutors participated in the course.

Knowledge acquired

All the tutors we surveyed stated that they took part in the online teaching and learning course. Tutors highlighted many benefits of participating in the online delivery. The majority (83%) of tutors indicated that through the online teaching and learning course, they had "Acquired the knowledge and skill required to deliver lessons online." Of the tutors, 27% also indicated that "they have been exposed to the different eLearning tools that can be used to deliver lessons online." Specifically, tutors mentioned being able to design assessments, using google classroom to conduct assessments of student teachers online, while a few also mentioned an ability to use zoom as well as other platforms to deliver lessons.

Challenges faced

Of the tutors, 34% did not face any challenges with the online course. The rest faced a variety of challenges, and these are set out in Table 4, below. The results show that over a third (38%) had issues with data and internet connectivity issues. About a fifth (23%) of the tutors also indicated that the online course was more rushed than preferred, while very few also mentioned that the course content was not as exhaustive as they would have liked. The difference between the male and female tutors is not significant.

Table 4. *Challenges presented by the online certificate course.*

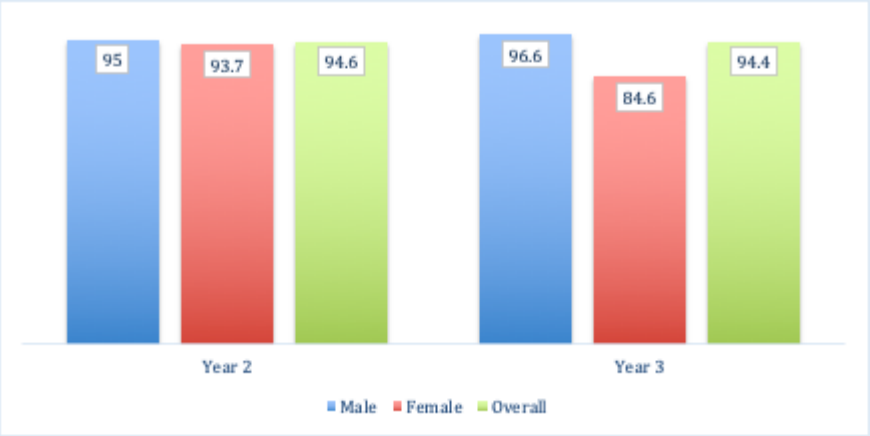
	Male Tutors (%)	Female Tutors (%)	All tutors (%)
Data and internet connectivity issues	38.5	32.8	37.5
The course was more rushed than preferred	23.1	23.9	23.3
The course content was not exhaustive	9.4	8.7	9.2
It was challenging to understand content	1.8	5.4	2.7
There was no new content in the course	1.4	0.0	1.0
It was not clear how to apply the knowledge from the online training to teaching	0.7	2.2	1.1
There were no shortfalls / challenges	35.4	30.4	34.2
N	341	121	462

MR

Adaptation of online lessons

The online certification course aimed to enable tutors to adapt their lessons and teaching to take account of the specific demands of online teaching and learning. The study was also interested in determining if tutors were able to apply the knowledge they had acquired from the online certification course in their virtual lessons. Of the tutors, 95% indicated that they had been able to apply the training they received in their virtual lessons. The difference between male and female tutors was not significant.

Figure 1. *Tutors who applied the knowledge from the online certificate course, by sex and level (%).*



Tutors were also asked to indicate the specific aspects of the online certificate course that they applied in their virtual lessons. The majority (57%) indicated that they had been able to use synchronous and asynchronous models in their lessons. Others (23%) also indicated that they had been able to use multiple media techniques in their lesson delivery. Some tutors (15%) further mentioned that they had been able to use interactive methods to engage their student teachers during virtual lessons. This was supported by the qualitative analysis, as most tutors indicated that they were able to apply what they learnt from the course.

Challenges of teaching specific courses online

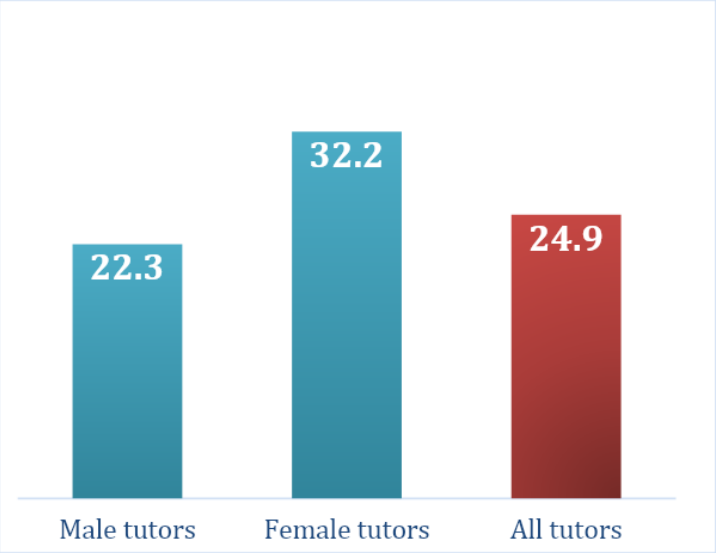
The study also sought to understand the perception of tutors with regards to the subjects and contents that are difficult to teach via eLearning. Overall, a quarter (25%) of tutors indicated that there are specific subjects and content that they find challenging to teach online.

Tutors confirmed that generally, lessons that require demonstrations, practical sessions, calculations, and computation were difficult to teach remotely. The specific subjects tutors mentioned included mathematics, the sciences (including biology, physics, and chemistry), and also home economics. Some tutors clarified further that they always have problems demonstrating these subjects to student teachers without face-to-face interaction. According to the tutors, topics requiring demonstrations are the specific issues their student teachers complain about most often regarding online learning.

A high number of female tutors (32%) were identified as having challenges compared with male tutors (22%). The female tutors indicated that they were experiencing challenges because the courses they teach demand the use of demonstration and other hands-on pedagogical techniques, which are difficult to exhibit during online lessons compared to courses that require the

use of lecturing and discussion methods. The data further shows that half (50%) of female tutors teaching Year 3 complained most about these challenges (see Figure 2).

Figure 2. *Tutors with challenges teaching specific subjects online, by sex (%) — (M = 341, F = 121).*



Understanding and awareness of platforms for online learning

The study further assessed tutors' knowledge about virtual learning platforms and the specific platforms they use for their online lesson delivery. The question was asked unprompted to elicit spontaneous responses from tutors. As shown in Table 5 below, Telegram, WhatsApp, and Zoom are the most popular platforms among tutors. However, 74% of tutors use multiple platforms for their online delivery. Platform choice depends on the subject and topic to be taught. About 96% of tutors confirmed that they are very comfortable with the eLearning platforms currently being used. According to the tutors, Telegram is most preferred because it can accommodate a large number of student teachers and it is also easy to access previous content if they miss the live lesson. Zoom is also preferred by tutors because of live viewing and the ability to share the screen (e.g., a presentation and documents) with student teachers, and also the functionality that allows interaction with student teachers through video feeds.

It is important to note that at the initial stage of the implementation of virtual learning, Colleges of Education tried using their mentoring universities' learning management systems (LMS).[15] This created a lot of traffic on the LMS

[15] These include UG's Sakai system, KNUST's 'Moodle' eLearning system, UDS' eLearning platform, UEW's 'Moodle' eLearning system and UCC's Learning Management System. The Colleges of Education are unable to use their mentoring university's LMS platform for teaching and learning because of the level of traffic. This has led them to adopt WhatsApp, Telegram

as student teachers at the mentoring universities were also using the same LMS. GTEC, the Colleges of Education and T-TEL therefore agreed to find an alternative cost-effective solution that would work for both student teachers and tutors. It was agreed that Telegram, WhatsApp and Zoom will be used to complement the mentoring universities' LMS.

Table 5. *Tutors awareness and usage of virtual platforms.*

	Percentage of tutors aware of platform	Percentage of tutors using the platform
Telegram	92.4	77.7
WhatsApp	87.9	63.2
Zoom	81.6	33.1
Google Classroom	78.6	34.6
Skype	14.7	0.7

MR

4.1.2. Tutors' understanding of eLearning and confidence in online teaching

Understanding of eLearning

Table 6 below, presents the proportion of tutors who indicated that they understand eLearning. The results show that 63% of tutors indicated that they have a strong understanding of eLearning while 33% also indicated that they understand eLearning 'somewhat'. Only a few of the tutors indicated that they do not understand eLearning. The difference between the male and female tutors was not statistically significant. For the few tutors who indicated that they do not fully understand eLearning, they explained that it was difficult for them to teach topics that deal with calculations and demonstrations as part of their courses.

etc., for lesson delivery. However, student teachers are required to register and select courses on the LMS at the beginning of each semester.

Table 6. *Proportion of tutors who understand eLearning, by sex of tutors (%).*

	Male Tutors	Female Tutors	All tutors
Strong Understanding	67.2	49.6	62.6
Understand it somewhat	29.3	44.6	33.3
Neutral	0.6	5.8	2.0
Don't understand it much	0.6	0.0	0.4
Do not understand it at all	2.4	0.0	1.7
N	341	121	462

Confidence in online teaching

Table 7 below, presents tutors' level of confidence in delivering lessons online in the event of future institutional closures. The results show that 68% of tutors indicated that they were 'very confident'. A little over a quarter (28%) also indicated that they were 'somewhat confident'. Only a few of the tutors indicated that they were 'not confident at all' in delivering online lessons in the future. The difference between the male and female tutors is not statistically significant. For tutors who were less confident in delivering online lessons, they explained that challenges such as network unavailability and some student teachers' lack of interest in participating in the online class are factors that contribute to their lack of confidence. They further explained that if these challenges were resolved they would be confident to teach online in future lessons.

Table 7. *Level of confidence of tutors in delivering lessons online in the event of a future institutional closure, by sex of tutors.*

	Male Tutors (%)	Female Tutors (%)	All tutors (%
Very confident	70.7	59.5	67.8
Somewhat confident	25.5	36.4	28.4
Neither / Nor	1.2	4.1	2.0
Not confident	0.6	0.0	0.4
Not confident at all	2.1	0.0	1.5
N	341	121	462

One of the key objectives of this study is to determine whether tutors have a strong understanding of eLearning and are confident about teaching online. In measuring this aspect, tutors sampled for the survey were asked specifically to rate their level of understanding of eLearning. Tutors were also asked to indicate their level of confidence[16] in teaching online in the event of future institutional closures.

The results show that a little over half of tutors (62.3%) demonstrated understanding of eLearning and confidence in future online teaching. The results also show a significantly high proportion of male tutors satisfying the requirements of the indicator compared with female tutors. We believe that the difference could be attributed to the fact that the female tutors were more critical in their self-reporting of their understanding of eLearning and confidence in teaching online (see Table 8).

Table 8. *Proportion of tutors who report having a strong understanding of eLearning and are confident to continue teaching online.*

	Male Tutors (%)	Female Tutors (%)	All tutors (%
Year 2	63.7	52.4	60.6
Year 3	79.4	33.3**	69.8
Overall	**66.9**	**49.6****	**62.3**
N	341	121	462

**p≤0.05

As seen from Table 8, above, 37.7% of the tutors felt that they did not have a strong understanding of eLearning and were not confident about continuing with online learning. Qualitative insights revealed that these tutors do not find it easy to transition from the physical classroom to teaching on virtual platforms. These tutors indicated that they were struggling because they are not able to see their student teachers in person and assist them through difficulties during lessons.

According to these tutors, the virtual platforms are just not the same as real-time, face-to-face interaction or classroom teaching, which they are used

[16] Using the responses to these questions, tutors who selected 'strong understanding' to depict their level of understanding of eLearning and also selected either 'very confident' or 'somewhat confident' were deemed to have satisfied the requirements of the objective. This implies that if a tutor selected 'strong understanding' in the Likert scale and also selected 'not confident', that tutor does not satisfy the requirement of the objective.

to and enjoy. Unlike face-to-face interaction, they felt unable to pick nonverbal cues from student teachers and unable to implement classroom management strategies as human presence is missing in the online setting.

Again, tutors who are involved in teaching subjects that require demonstration did not find online teaching effective enough. They were forced to teach in abstractions as they were unable to precisely illustrate certain concepts during online teaching.

According to some of these tutors, once online lessons are over, there is no opportunity for student teachers to get in touch in-person or visit them at their offices for extra or further explanations. Student teachers can only have access to their tutors by spending additional money on data, which is not a possibility for many student teachers.

Again, some tutors indicated that they find it challenging and time-consuming to develop materials for virtual learning compared to face-to-face sessions. They feel materials for face-to-face lessons can be developed easily using materials in their environment, unlike those for virtual learning. Some quotes from tutors are shown below.

"For me, this whole business of online teaching is not for me. I will always like to see my students in person when teaching. I like to see their body language to be sure whatever I am teaching is being assimilated well. I don't get this during online teaching."

– Male tutor, March 2021

"For me, I don't feel as confident or competent about how I teach virtually as I do when the students are in front of me. This adaptation is not easy."

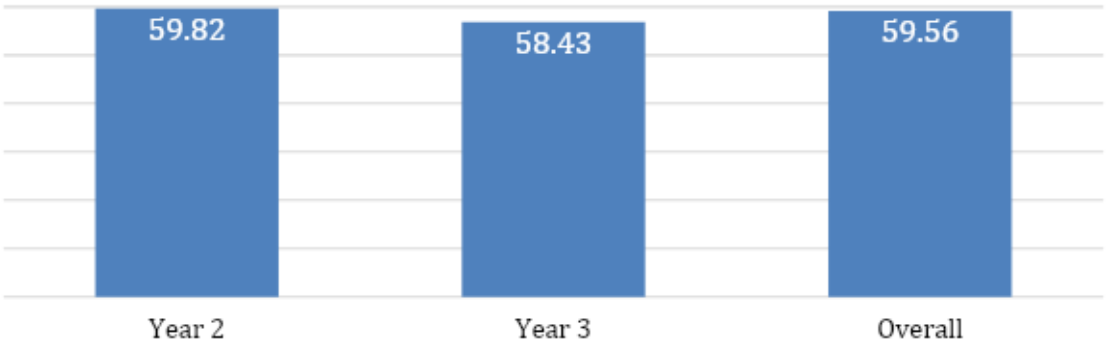
– Female tutor, March 2021

4.1.3. Support for student teachers to improve learning and online participation

In this section we explore the support tutors provide to student teachers who have difficulties understanding what is taught on the virtual platforms.

First, the survey asked the tutors about student teacher participation in online lessons (synchronous). Specifically, tutors were asked for the percentage of their student teachers who regularly participate in the online classes synchronously. As shown in Figure 3, tutors reported that an average of 60% of their student teachers participates in online lessons synchronously, this was supported by the qualitative analysis.

Figure 3. *Average proportion of students who regularly participate in online lessons synchronously (%).*



Similar results were recorded across both levels and subjects. There was no significant difference in the participation rate of male and female student teachers. Tutors pointed to two main challenges that might explain the lack of full participation by student teachers. The first reason relates to internet connectivity. Tutors explained that most of the student teachers come from geographically disadvantageous locations where internet access is poor.

The second reason provided is the lack of funds for purchasing internet data. According to the tutors, some student teachers complain of a lack of access to funds to purchase data, especially since they need to stay online for the duration of an online lesson. Rarer reasons cited by tutors include an 'inability to navigate the lesson platforms' and 'lack of access to smartphones.'

Student teachers who struggle during online lessons

The study also asked tutors if they could identify student teachers who struggle during online lessons. An overwhelming proportion of tutors (97%) indicated that they could identify struggling student teachers in their online classes. Key ways tutors identify struggling student teachers are when student

teachers are unable to answer a question or do not contribute during lessons (56% of tutors identified these as key identification methods). (See Table 17 in the Annex).

Types of support provided

Table 9 below, presents the type of support tutors provide student teachers they perceive to be struggling in their online classes. The results show that the majority (63%) of tutors give special attention to such student teachers during lesson delivery and 59% also indicated that they call such students after an online class to enquire about their challenges and to help resolve them. Other tutors also encourage collaborative learning since it is another effective method to help students understand lessons. Tutors do this by creating groups and assigning exercises to be completed. There was no significant difference in the type of support provided by male and female tutors to struggling student teachers.

Table 9. *Type of support tutors provide to struggling students in their class, by sex of tutors.*

	Male Tutors (%)	Female Tutors (%)	All tutors (%)
Give them special attention during lessons	63.6	59.5	62.6
Call them after the lessons to enquire about their challenges	57.8	59.5	58.2
Encourage other students in the class to support them	46.6	48.8	47.2
Call them before sessions to encourage them to be present	28.7	37.2	31.0
Provide no support to them	2.1	2.5	2.2

MR

Qualitative findings from tutors indicated that to promote access to resources, almost all course materials are placed on the platforms for students to have access to them. Links to resources, websites, video and audio content are also put on the platform for them to download and use for their learning. Some quotes follow.

"The students have their own groups, which I am a part of. So, I encourage them to ask me questions on their groups and I assist them."

– Male tutor, March 2021

"I ask my students to always get in touch with me through my personal phone by text or call when they want further understanding of something I taught online and they did not understand. Some get in touch and others do not. I leave my number on the platform for any students with difficulty to contact me and the course representatives also have my number so they call sometimes."

– Female tutor, March 2021

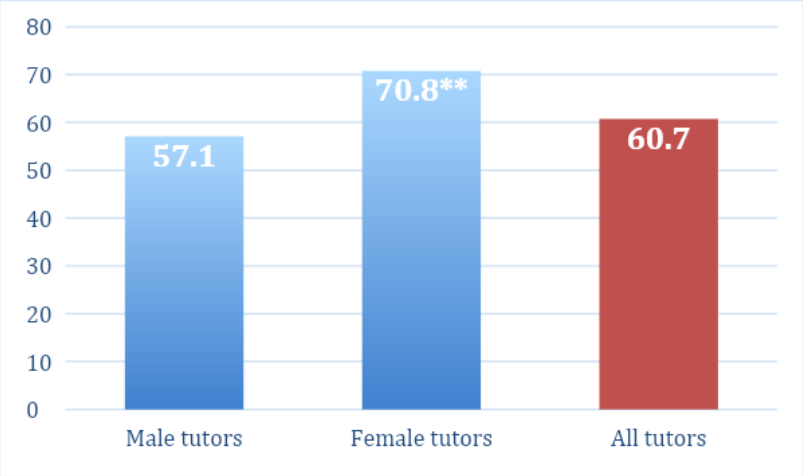
"In order to be sure they are always busy, I give them assignments in groups and when they meet, they are more active and feel free to share ideas."

– Female tutor, March 2021

4.1.4. Problems and challenges experienced by tutors

In this section, we explore the various challenges tutors face in the delivery of lessons online. Figure 4 below, shows the proportion of tutors who indicated that they face challenges in the delivery of online lessons. Based on the results, 61% of tutors said they face challenges. The results further show that significantly more female tutors face challenges compared with male tutors. We think that this issue requires further research.

Figure 4. *Proportion of tutors who face challenges in the delivery of online lessons, by sex (%) (M=341, F=121).*



**p≤0.05

Table 10 below, presents the challenges tutors face in the delivery of online lessons. The results show that the main challenges tutors face relate to network and internet access. This is followed by about a third (32%) of tutors who mentioned lack of cooperation as another challenge and 28% also mentioned lack of adequate teaching materials. Also, 20% indicated that the study devices they use do not function properly.

Table 10. *Challenges tutors face in the delivery of online lessons, by sex.*

	Male Tutors (%)	Female Tutors (%)	All tutors (%)
Network / internet access challenges	90.2	92.9	91.0
Students do not cooperate during online lesson delivery	28.4	41.2	32.3
Lack of adequate teaching materials	26.8	30.6	28.0
Devices I use do not function properly	18.6	22.4	19.7
I lack the skills required for online lesson delivery	2.6	7.1	3.9

MR

4.1.5. Instructional strategies to encourage participation and critical thinking

Lesson observations were conducted to determine how tutors are applying a variety of instructional strategies that encourage student participation and critical thinking in their online lessons.

To measure the tutors' application of these strategies in their online lessons, three methods were employed to provide one composite indicator: lesson observations, follow-up interviews with tutors, and interviews with four of the observed tutors' student teachers based on scoring rubrics.[17] Table 11, below presents the findings on tutors employing a variety of instructional strategies that employ student participation. The results show that 61% of tutors assessed demonstrated application of a variety of instructional strategies that encourage student teacher participation and critical thinking. The difference between male and female tutors was not significant.

To determine whether teaching has improved in the 2020/2021 academic year, we compared the tutor lesson observation findings of this survey with the 2019 annual evaluation survey,[18] which showed tutor behaviour in face-to-face classes before Covid-19. As seen in Table 12 below,in 2019, 52% of tutors were observed demonstrating the application of a variety of instructional strategies that encourage student teacher participation and critical thinking skills in face-to-face classes. This is nine percentage points less than the 2021 result. This suggests that the online Certificate in Design, Teaching and Learning and the weekly professional development sessions organised by Colleges of Education for tutors have enabled tutors to effectively implement strategies in their online lessons.

[17] In computing the scores for this objective, three different tools were triangulated to arrive at the score obtained by a tutor. The first tool — 'the lesson observation tool' — details the strategies tutors were supposed to demonstrate when delivering online lessons. The tutors were scored on a scale of 0 to 3 (i.e., 0 = Not demonstrated, 1 = Poor demonstration, 2 = Satisfactory demonstration, and 3 = Excellent demonstration). The second tool — 'the tutor interview tool' — asked specific questions in relation to strategies used in the delivery of the lessons. The third tool is the 'student teacher interview tool', used to triangulate the tutor responses. For each tutor, four different students (2 male; 2 female) were randomly selected from his / her class to respond to questions pertaining to how tutors implemented strategies to enhance their online learning. These three tools were used to determine whether a tutor exhibited the said strategy.

[18] T-TEL conducted annual evaluation surveys for the years 2015, 2017, 2018, and 2019 to ascertain whether change was taking place in the Colleges of Education. These annual evaluation surveys included lesson observation of tutors across a list of competencies in the NTS.

Table 11. *Tutors employing a variety of instructional strategies that encourage student participation and critical thinking.*

	Male Tutors (%)	Female tutors (%)	All tutors (%)
Year 2	62.2	61.1	62.0
Year 3	55.2	54.6	55.0
Overall	**61.0**	**59.6**	**60.7**
N	164	47	211

Table 12. *Tutors employing variety of instructional strategies that encourage student participation and critical thinking (face-to-face lessons, 2019 and virtual lessons, 2021).*

	June 2019 (face-to-face) (%)	March 2021 (virtual platform) (%)	Δ from 2019 to 2021 (%)
Male	51.9	61.0	+9.1
Female	52.0	59.6	+7.6
Overall	**51.9**	**60.7**	+8.8
N	368	211	

We present specific competency attributes on instruction strategies that encourage student participation and critical thinking in Table 18 in the annex. The results show that the competencies tutors were observed exhibiting during the lesson observation include, 'tutors' use of question and answers to gauge understanding', 'tutors' use of strategies to challenge student teachers to think hard' and 'tutors' use of dialogue, such as discussions, debates, and brainstorming'. The results further show that tutors did not do particularly well in a few attributes; these include tutors' use of storytelling, role-play and games during lessons.

We also compared the competency attributes for this study with our 2019 annual evaluation survey (face-to-face lesson observation). We see significant differences for the majority of the competencies exhibited by tutors during virtual lessons compared to those exhibited during the face-to-face lessons (see Table 19 in the Annex).

4.2. Findings from student teachers

Student teachers have diverse needs, and T-TEL and GTEC worked closely with Colleges of Education to ensure that the needs of all learners were considered in the support provided to learners from low-income backgrounds and with SEN. In this section, we present findings on the effect of the shift to remote learning for these student teachers.

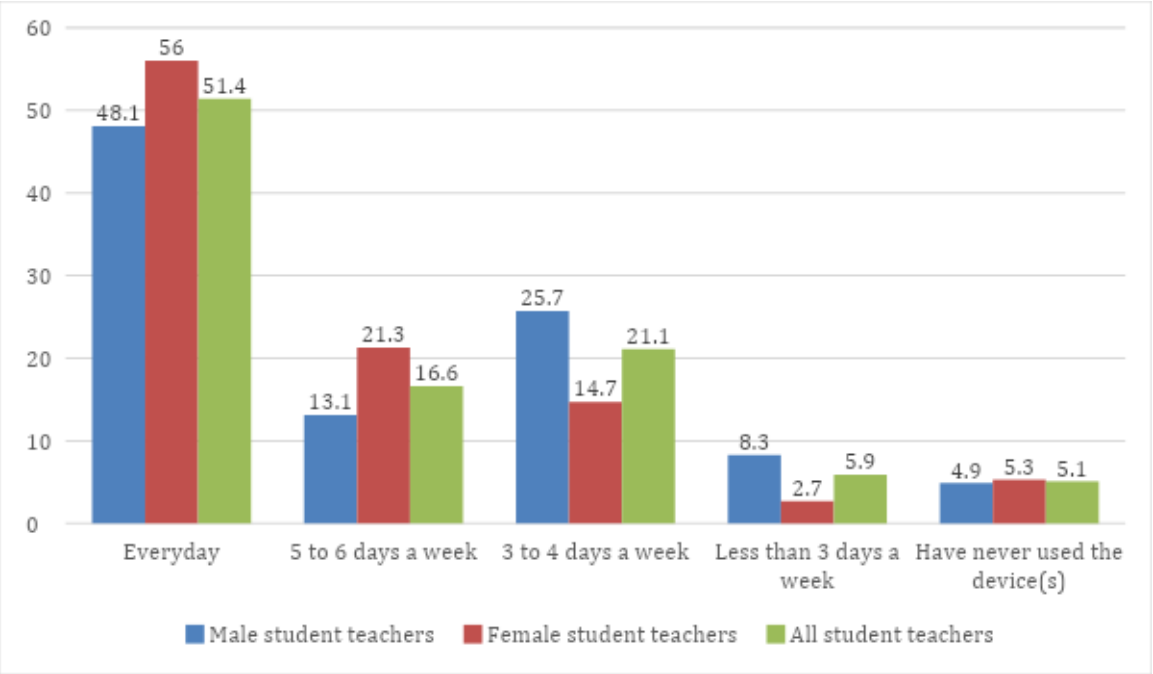
4.2.1. Student teachers' use of devices to access virtual learning platforms

T-TEL and GTEC worked closely with Colleges of Education to ensure that the needs of all learners were considered, especially those with visual and hearing impairments or those from low-income backgrounds. Student teachers sampled for this study are those with SEN and those from low-income backgrounds who were supported during the closure of Colleges of Education.

The student teachers were asked the frequency with which they used their devices for virtual learning. Figure 5 shows that more than half (51%) of student teachers surveyed use their devices daily, with a higher proportion of female student teachers (56%) than their male cohorts (48%). About 21% of student teachers revealed that they use their devices between 3 to 4 days a week while 17% use the devices between 5 to 6 days a week for virtual learning. The results also indicate that about 6% of student teachers make use of their devices less than 3 days a week, with another 5% claiming that they have never used their devices. Student teachers who have never used their devices explained that their study devices went missing and so they had to purchase an affordable one for their use.

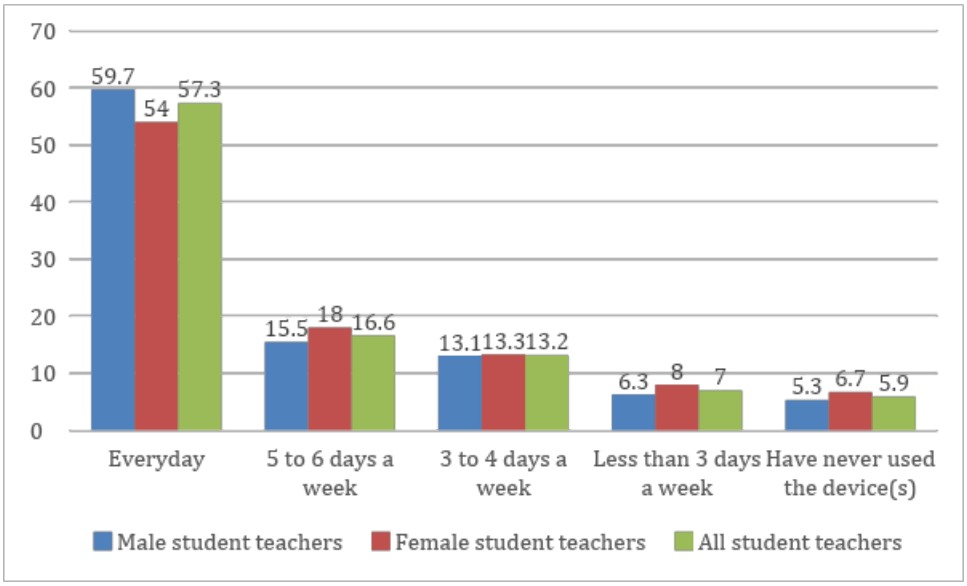
The overall difference in device usage during virtual learning between male and female student teachers is not significant.

Figure 5. *Usage of devices during virtual learning (%).*



The study also sought to ascertain whether the usage of the devices varies during virtual learning and face-to-face learning (i.e., whether usage varies between the six weeks block they spend on campus and the six-week block where they have to undertake virtual classes). Figure 6 below, presents the frequency of usage of devices during face-to-face learning. Of the student teachers surveyed, 57% use devices every day during face-to-face learning, with slightly more male student teachers (60%) than female student teachers (54%) doing so, the difference was not significant. The results further show that 17% of student teachers use devices between 5 to 6 days in a week, with another 13% using devices between 3 to 4 days in a week during face-to-face learning. It was observed that close to 6% of student teachers have never used the devices during face-to-face learning. The data does not show that device usage increases during face-to-face learning. The differences between the overall results between virtual and face-to-face are not statistically significant.

Figure 6. *Usage of devices during face-to-face learning (%).*



4.2.2. Student teachers becoming independent and responsible in their learning

Another key objective of this study is to determine whether student teachers are becoming independent and responsible in their learning.[19] The results show that about 70% of the student teachers are becoming independent and responsible in their learning. The results further show that 71% of male student teachers are becoming independent and responsible in their learning while this is true for 69% of female student teachers. The difference is not statistically significant.

The findings from the quantitative analysis were similar to those of the qualitative result where most student teachers revealed that learning, in general, has become personalised, learner-centred, open, accessible, and more interactive.

Most of the student teachers acknowledged that using the devices to access the internet has broadened their horizons and improved their research skills. They disclosed that they have become more knowledgeable in their various fields of study. With a click of a button or voice initialisation for student

[19] As indicated earlier, Independent, and responsible is defined as 'reading the course materials loaded on smartphones and SD cards, completing, and submitting assignments and conducting further research'. The student teacher tool contained questions that address the above definition of independent and responsible. The questions were asked to student teachers and their responses recorded spontaneously. A student teacher is deemed as 'independent and responsible' if they responded in the affirmative in all the three questions. If a student teacher responded positively for two out of the three categories of questions, that student teacher is not deemed to have satisfied the requirement of the objective.

teachers with SEN, student teachers are able to access information more easily and faster. The student teachers indicated that they now have supplementary educational resources to learn, complete assignments and prepare for general quizzes and examinations.

> **"I am now able to look for any information I want. When I have questions, I ask Google and not my tutor."**
>
> **– Visually impaired student teacher, March 2021**

> **"Ok. In fact, during the time when we were at home and I was given the SD card when we are doing zoom discussion. Sometimes I record and moreover too I download tutorials from Google classroom"**
>
> **– Female student teacher, March 2021**

Some student teachers with SEN also revealed that their typing skills and speed have improved significantly through regular interaction with online course materials, completing and submitting assignments. They also indicated that they had become more versatile using their smartphones and laptops, from using Microsoft Office suites to creating and sharing audio content.

> **"One of the positive impacts of eLearning is that I can type faster now. I type my own notes and assignments, transfer it on the SD card or send with ease"**
>
> **– Visually impaired student teacher, March 2021**

Some student teachers further indicated they have now allocated time for their own personal study using their devices. They are scheduling on average, between 3 to 6 hours in a day to study. On days when no lessons are organised, the self-study period hours may increase.

"One of the positive sides is that once I can get all the slides from my Tutors, I can learn anywhere and anytime on my own. I can go online and access the reading materials."

– Visually impaired student teacher, March 2021

"With eLearning, you can study on your own, you can schedule your own time to do research on your own and make your own notes, so eLearning has helped us a lot"

– Female student teacher, March 2021

Some visually impaired student teachers explained how their reliance on sighted friends has decreased with eLearning. Hitherto, they used to spend long hours on their mobile phones, just to catch up on lessons that have been organised. Although sighted friends are still relevant to the visually impaired, some explained that compared to the past, where sighted friends had to read out course notes to them, they are now able to read and study on their own using electronic devices and software.

"Okay for the positive aspect of eLearning, it has helped me to learn without the assistance of my friends and tutors, I am totally blind."

– Visually impaired student teacher

"At first, I used to 'mash-up' (bundle airtime credit) so that I can talk to my friends for a very long time ... they take me through what the tutor has taught and explain some other things to me"

– Visually impaired student teacher, March 2021

“Now I can be in my room alone and use my phone to read my notes”

–Visually impaired student teacher, March 2021

Device usage

Table 13 below, explores the specific activities for which the student teachers use their devices. Student teachers mostly use devices to read course materials (82%), conduct independent research (74%), and join virtual lessons synchronously (62%). Other activities performed by student teachers are taking part in virtual lessons asynchronously (42%) and completing and submitting assignments (42%). There was no significant difference between male and female student teachers with regard to the activities for which they use their devices.

Table 13. *Activities performed by students using the devices.*

	Male student teachers (%)	Female student teachers (%)	All student teachers (%)
Reading course materials	85.4	77.3	82.0
Conducting independent research	76.2	70.0	73.6
Joining virtual lessons synchronously	62.1	62.0	62.1
Joining virtual lessons asynchronously	42.2	42.7	42.4
Completing and submitting assignments	39.3	44.7	41.6
Other	10.2	11.3	10.7
N	206	150	356

Out of the three specific attributes required for the objective, student teachers performed significantly better in 'reading course materials' and 'conducting independent research'. However, less than half indicated they were able to complete assignments. Qualitative findings from tutors revealed most student teachers read course materials and conduct independent research assigned to them, but they struggle to complete and submit their assignments. The tutors further explained that student teachers do not keep to deadlines for submitting assignments.

Additional insights from student teachers revealed that individual factors such as family and work obligations contributed to the late or non-submission of assignments by some student teachers during virtual lessons. Specifically, when student teachers are at home and attending lessons online, some of them find it difficult to juggle both family and work responsibilities. From qualitative data, it emerged that some student teachers are engaged in some form of work to meet other financial obligations during the six weeks they are home for virtual lessons. The demands of the work during the six weeks when they were home prevented them from completing and submitting assignments. For some student teachers, family responsibilities such as household chores were contributing factors to their inability to complete and submit assignments. During face-to-face lessons, student teachers are accommodated on campus, they receive regular meals and do not have to

worry about family responsibilities, chores etc. They are therefore able to complete and submit their assignments on time.

Again, qualitative insights also revealed that some student teachers felt their tutors were difficult and inconsiderate with regard to deadlines for submissions of assignments. Once a deadline is given for the submission of assignments and student teachers miss out, there is no possibility for them to resubmit. Some student teachers also explained that since they do not participate in online classes synchronously, they are sometimes unaware of assignments being given and so mostly submit after the deadline or are unable to submit at all.

> **"I am unable to submit my assignments on time because I am taking care of myself in school and need to work to make money. I don't get the time at times to complete my assignments and submit because of work."**
>
> **– Male student teacher, March 2021**

> **"For me, the deadline given for us to submit the assignment is too short. When you are unable to submit on time, some tutors do not give you additional time to submit it."**
>
> **— Female student teacher, March 2021**

4.2.3. Participation and experience with current virtual learning platforms

The study also sought to determine the variation between the expected and actual synchronous participation rate of student teachers.[20] As can be seen in Table 14 below, among the 11% of students who claimed they are required to participate in virtual lessons daily, only 5% of these student teachers are able to participate. Further, among the 58% of student teachers who indicated that they are expected to participate 5 to 6 days a week, only 23% confirmed that they can participate within the specified period. Still further, from the 30% expected to participate 3 to 4 days a week, only 20% did. Student teachers

[20] For example, if 20% of students were expected to participate in the virtual class daily, were all 20% able to participate daily?

attributed the low synchronous participation rate to poor internet connectivity, and inadequate funds to purchase data. Some student teachers also stated that they have to engage in income generating activities while at home, hence their low synchronous participation rate.

Table 14. *Frequency of synchronous eLearning participation rate.*

	Proportion of students expected to participate (%)	Actual proportion of students who participate (%)
Every day	11.2	4.5
5 to 6 days a week	57.9	23.3
3 to 4 days a week	30.1	20.2
Less than 3 days a week	0.8	0.5

The study also sought to determine the places where student teachers access virtual lessons. The majority of student teachers access virtual lessons from their homes (83.7%), with more female student teachers (88.0%) doing this compared to their male counterparts (80.6%). Student teachers also indicated that they travel to different areas to obtain a stable internet connection (15.7%), they go to their friends' houses (4.8%) and also visit communal areas such as libraries or ICT centres (4%), see Table 25 in the Annex.

4.2.4. Student teachers' understanding of eLearning and confidence in online teaching

Another key objective of this study is to determine whether student teachers have a strong understanding of eLearning and are confident of undertaking online learning in the event of future institutional closures.[21]

The results show that overall, over half of the student teachers (66%) demonstrated understanding of eLearning and confidence in future online teaching. The difference between male and female student teachers was not significant.

Table 15. *Proportion of student teachers who have a strong understanding of eLearning and are confident of undertaking online learning in the event of future institutional closures.*

	Male student teachers (%)	Female student teachers (%)	All student teachers (%)
Year 2	71.6	66.7	69.2
Year 3	66.7	59.3	63.9
Overall	68.5	62.7	66.0
N	206	150	356

This was supported by the qualitative analysis where most student teachers revealed that before eLearning was introduced, they did not know much about it. However, having received resources and training, they were now able to take ownership of their studies and participate in eLearning lessons (synchronously or asynchronously).

[21] In measuring this objective, student teachers were asked to state whether they understood eLearning. Student teachers were also asked to indicate their level of confidence in undertaking online learning in the event of future institutional closures. A rating score of (. 1 = Very confident, 2 = Somewhat confident, 3 =Neither/Nor, 4 =Not confident and 5 = Not confident at all) was used. Student teachers who responded in the affirmative to depict their level of understanding of eLearning and also selected either 'very confident' or 'somewhat confident' to undertake online learning in the future were deemed to have satisfied the requirements of the objective.

> **"I understand eLearning as a system where tutors and students meet via electronic means, for teaching and learning to take place."**
>
> **— Visually impaired student teacher, March 2021**

> **"eLearning for me, means when teachers and learners learn through the internet"**
>
> **– Female student teacher, March 2021**

However, most student teachers did not consider eLearning as a total replacement for face-to-face learning in Colleges of Education, but it is rather seen as a temporary substitution for teaching and learning due to the Covid-19 restrictions. While they have confidence in eLearning, they believe that the physical classroom is a more conducive environment for conducting effective teaching and learning.

> **"As a visually impaired student teacher, I prefer to sit down with my friends in the classroom and not online because that is what I know and besides, I have told you that I do not have money to be spending on data all the time, online does not help me but when I sit with my friends in the classroom it helps."**
>
> **– Visually impaired student teacher, March 2021**

Why some student teachers do not understand eLearning and are not confident about continuing with online learning

Qualitative insights reveal that limited feedback and engagement has contributed to some student teachers not understanding eLearning and not having confidence about continuing with blended learning. The student teachers were of the view that while they are able to access recorded virtual lessons (asynchronous), they are not always able to ask their tutors questions

related to the content of the lessons and receive instant answers to help them better understand lessons.

Qualitative insights also reveal that some student teachers are increasingly becoming isolated from their peers. Student teachers need social interaction with peers and according to some of the student teachers, virtual learning makes them feel isolated and cut off from their friends. Some student teachers cited a sense of isolation and anxiety when participating in virtual learning. According to them, there is no active and engaging place to meet with their peers when it comes to virtual learning. They, therefore, feel isolated in their virtual learning environment. An attempt to get in touch with another student teacher for academic discussion would mean additional expenditure on data. We provide some quotes below.

> **"I feel very bored when we have to do virtual learning because I don't get to see my other colleagues face to face to talk to them when I need help. I always want to be around my friends."**
>
> **– Female student teacher, March 2021**

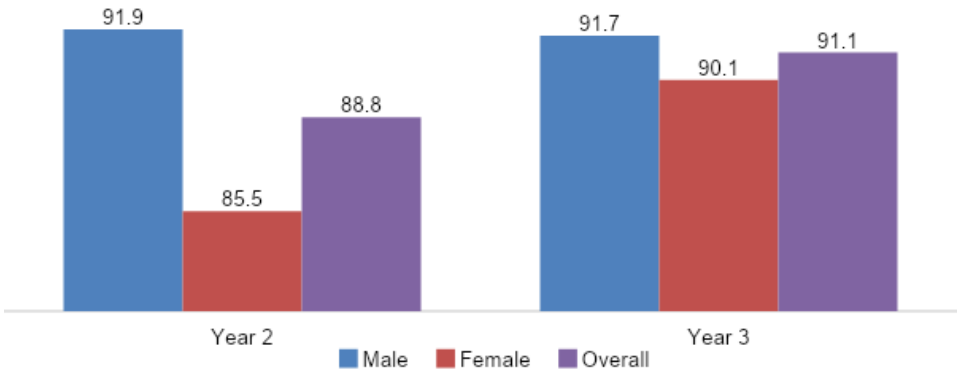
> **"I think the online is helping but I still think the face-to-face more effective … with face-to-face, the teacher is there to have immediate interaction … but for online, it is very difficult, if you don't understand anything, you have to wait until it's time for the teacher to come."**
>
> **– hearing-impaired student teacher, March 2021**

4.2.5. Challenges student teachers experience with virtual learning

The study also explored the various challenges student teachers face during virtual lessons. Of the student teachers, 90% indicated that they face challenges during virtual lessons. As shown in Figure 7 below, the majority of Year 3 (91%) and Year 2 (89%) student teachers stated that they experience challenges during virtual lessons with slight differences by sex. For Year 2

student teachers, a higher proportion of males reported facing challenges during virtual lessons (92%) than their female peers (86%), the difference was not significant, however.

Figure 7. *Proportion of students who face challenges during virtual learning (%).*



On the type of challenges faced by student teachers during virtual lessons, Table 16 below, shows that the vast majority (91%) of student teachers indicated poor network / internet access with no significant variation across sex. This was supported by the qualitative analysis, student teachers, especially those in remote areas, noted that "they are forced to move to other communities where the internet services are better in order to access the virtual platforms."

Other challenges faced during virtual lessons include tutors not attending lectures (7%), not understanding what is taught on the platform (5.6%), malfunctioning of study devices (4%) and inadequate teaching materials (2.8%) (see Table 26 in the Annex).

Further, qualitative findings indicated that some student teachers engage in economic activities to be able to take care of their needs especially when they are home. For these student teachers, there is mostly a conflict between their economic activity and scheduled online lessons. The issue of the high cost of data continues to be a key barrier to many student teachers participating in virtual learning. With limited or no personal incomes, some students find virtual learning to be very expensive. We provide some quotes below.

"Some of us are also working to pay our fees. Me, for example, I am taking care of myself in school. I pay my own school fees so I have to work to get money to pay my school fees and when I am working and it's time to do an online class, I can't do it. I hope you understand."

– Male student teacher, March 2021

"You know as SEN students, we do not work, so I for one depend on my parents and older siblings for small monies for data."

– Visually impaired student teacher, March 2021

"Sometimes, the time for online lessons will coincide with household chores and my parents will not understand for me to participate in the virtual lessons while I have been asked to perform a chore."

– Female student teacher, March 2021

Experience with blended learning

Table 16 below, shows the proportion of students who enjoyed the first 6 weeks of virtual learning for the 2020/2021 academic year. Out of 356 student teachers surveyed, 34% absolutely enjoyed the first six weeks of virtual learning, 36% enjoyed the first six weeks but would like a few adjustments, whereas 30% did not enjoy it at all. The difference between male and female student teachers was not significant.

Table 16. *Proportion of students who enjoyed the first six weeks of virtual learning for the 2020/2021 academic year (%).*

	Male student teachers (%)	Female student teachers (%)	All student teachers (%)
Yes, absolutely	34.0	34.7	34.3
Yes, but I would like a few things changed	34.0	38.7	36.0
No, not at all	31.6	26.7	29.5
N	206	150	356

In terms of the proportion of student teachers who are confident of continuing the blended approach of teaching and learning, the majority (68%) are confident, whereas 28% are not confident (see Table 27 in the Annex).

Suggested changes to blended learning

Qualitative insights from most student teachers point to the need to bridge the device gap for accessing virtual learning platforms. Student teachers who participated in the blended learning without a good device did not find the blended learning enjoyable. Without a good smartphone, it was difficult for such student teachers to adequately participate in virtual learning. They had to rely on devices belonging to family members in order to participate in virtual learning for the six-week period they were scheduled to do virtual learning. They would therefore also like to have good smartphones like those provided by T-TEL to some of their peer student teachers.

The majority of the student teachers also suggested a restructure in the curricula being used for blended learning. They believe teaching courses that involve a lot of practical demonstrations during face-to-face teaching will offer them the opportunity to understand what is taught better. They would therefore prefer courses with fewer demonstrations to be taught during the six-week virtual learning period.

Qualitative insights also reveal that most student teachers would like to see the mode of examination changed for them to enjoy the blended learning. For the six weeks that they were scheduled to do virtual learning, they had to write examinations online. However, the erratic nature of internet connectivity in most communities made it difficult for them to complete their examinations effectively. They would prefer examinations to be written in person and suggested that their Colleges of Education provide examination centres where they could do their examinations in person. This would make blended learning more enjoyable.

Additionally, almost all the student teachers also suggested some form of financial support be provided to help them purchase data for the period when they were scheduled to do virtual learning. They suggested an increment in their teacher trainee allowance to enable them to purchase data as virtual learning is a financial burden.

Qualitative insights from student teachers further revealed that student teachers prefer to be encouraged and counselled as opposed to being threatened for not participating or doing the online examinations. Their fear is that some tutors place so much emphasis on examinations and therefore failure to complete their online examinations will have implications for their progress in the College of Education. They would rather be encouraged and supported because online learning has placed some sort of additional burden on them.

" Once I do not have a good smartphone and using a yam phone, it will be difficult for me to participate and enjoy the six weeks of virtual learning. I always have to rely on the phone of my sister when I have a virtual lesson."

— Female student teacher, March 2021

"I will be happy if our teacher trainee allowance is increased by an amount that can allow us to buy data always. I spend close to 10 cedis a week on data so if we are given 50 cedis a month for data, it will go a long way to help."

— Visually impaired student teacher, March 2021

"Some courses, especially the science practical ones, should be moved to when we are having face-to-face lessons so we can understand it better. Teaching such courses online is difficult to understand."

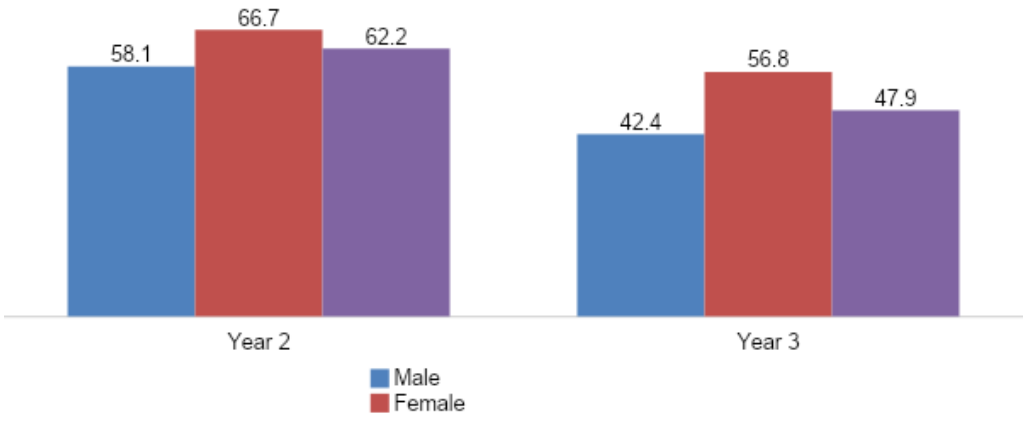
— Male student teacher, March 2021

Opinions on tutors' online lesson delivery

The study also sought the opinions of student teachers on whether tutors had delivered online courses effectively. The results indicate that 62% of Year 2 student teachers believe online courses were delivered effectively, with a higher proportion of female student teachers (67%) believing it than their male counterparts (58%). For Year 3 student teachers, about 48% believed that online courses were delivered effectively. Similar to Year 2 students, a higher proportion of female Year 3 student teachers (57%) than males (42%) rated that online courses were delivered effectively.

During the qualitative interviews, student teachers were asked to mention the courses they perceive to be inappropriate for online teaching. According to student teachers, some of these courses include General Curriculum, Ghanaian Language and Culture (Creative Writing), Statistics, Research Methods, Introduction to Social Studies, Oral Literature, Population and Development in Ghana, Methods of Teaching English, Phonetics and Phonology, Theories in Mathematics, Multimedia Authoring, Education and Instructional Technology, Methods of Teaching Mathematics, ICT Integration, Laboratory Management and Safety, Methods of Teaching Computer Studies, Physical Education, Clothing, Religious and Moral Education, and Music.

Figure 8. *Proportion of students who think their courses have been delivered effectively online (%).*



4.3. Findings from Colleges of Education, GTEC, and mentoring universities

In this section, we seek to ascertain whether Colleges of Education can cope with any future institutional closures by making the transition to online education.

4.3.1. Policies and Infrastructure available to Colleges of Education to facilitate virtual learning

Qualitative data collected from principals indicated that they have enthusiastically embraced online teaching and learning and have put measures in place to make it sustainable. The principals stated that they have made financial commitments to enhance infrastructure and human resources through their institutions' internally generated funds. These qualitative insights also revealed how committed principals are in ensuring that tutors and student teachers are comfortable and confident about eLearning.

None of the Colleges of Education had policies and relevant infrastructure to support eLearning as of March 2021. The Colleges of Education are however taking advantage of the pandemic to make investments in internet connectivity to facilitate eLearning. The College of Education principals indicated that they have now provided internet connectivity on their campuses with the support of GTEC and T-TEL. Most Colleges of Education are now developing their eLearning policy with the support of their mentoring universities and GTEC.

"No, we didn't have a policy on eLearning and didn't have any architecture whatsoever that supported eLearning. We all didn't know we will be affected by Covid-19, so I guess we were taken by surprise and did not prepare for it."

– Male principal, March 2021

"We didn't have a policy on eLearning per se. For the ICT architecture, we currently have good internet on campus, but not before Covid-19."

– Female principal, March 2021

"On the policy on eLearning, we have a team working on it currently and they have not finished with it. I believe when they are done with their work, the policy will be approved. As for the architecture that supports eLearning, we currently have. Specifically, we have Wi-Fi connectivity on campus."

– Female principal, March 2021

"My College of Education didn't have any policy before I came but fortunately when Covid-19 came, we have installed internet on campus and now the tutors and students have the internet to do virtual learning."

– Male principal, March 2021

4.3.2. Support for tutors and students in facilitating virtual learning

Qualitative findings reveal that Colleges of Education continue to organise workshops and refresher training for tutors on how to teach online using the eLearning platforms available to them i.e., Zoom, Google Classroom, WhatsApp, and Telegram. This training also focuses on areas such as student teacher assessment, group work, and so on. The Colleges of Education believe that these capacity building workshops are helping tutors to deliver lessons online effectively.

Colleges of Education also organised eLearning orientation workshops for all student teachers at the beginning of the semester. The orientation workshop covered areas such as how to access the learning platforms, when to attend lessons synchronously and asynchronously, how to submit assignments and access learning materials.

The principals also revealed that they and other senior management staff have joined all their College of Education virtual learning platforms to monitor teaching and learning. The principals indicated that they have observed some differences in the virtual lessons compared to face-to-face lessons. They were concerned that the student teacher participation rate was low during virtual lessons compared to face-to-face sessions. The principals stated that they held

management meetings to understand why the student teacher participation rate was low and implemented mitigation measures. This included follow-up calls to student teachers, loading materials on SD cards and delivering them to some student teachers in remote areas, continuously encouraging student teachers to participate in lessons.

Here are some quotes from principals.

> *"In fact, last semester, before the students went home we asked the IT Tutors to take them through how to navigate the online platforms like the UCC LMS, the Foso College of Education LMS. Some of them didn't even have any idea on how to participate in online lessons, the zoom and others. So, we made sure that the IT Tutors took them through that. So that has at least enhanced their capacity to participate in the online learning. And we have also encouraged them to participate; we are hoping that this will bring about improved participation of students, going forward."* (Female principal, March 2021)

> *"As I have already said, we saw the need to get them the tablets because many of them or, let me say some of them, were saying they didn't have laptops and using their phones to teach online was not convenient because the screen is so small and all that. So initially we had wanted to get them laptops but we didn't have enough money for that so we settled on the tablets, which at least has a pouch you can mount and connect an external keyboard so they can work with it almost as if it is a laptop. In addition to that, we also give data (to tutors) every month. In addition to this, we have already done one or two workshops to build up their capacity and we are looking forward to having more."* (Female principal, March 2021)

> *"Training and provision of data are what my College of Education did to support tutors and students. The college itself provided data, monthly data for staff, no matter how big or small, we were supporting them with data, and every tutor was supported with monthly data. Then finally what the college was doing was that we also have a technical team. The role of the technical team, which I am heading, was that of training. The technical team was responsible for training and orientation of tutors and student teachers."* (Male principal, March 2021)

4.3.3. Qualitative insights on overseeing the effective transition to online education

In this section, we explore whether Ghana's teacher education regulatory agency is overseeing the effective transition of Colleges of Education to online

education. Qualitative data from the GTEC staff interviewed reveals how they worked with T-TEL to organise the online Certificate in Design, Teaching and Learning delivered by the Amsterdam University of Applied Sciences. Some quotes follow.

> *"So basically, I will say from the beginning that we actually did not transfer fully to online learning. What we did was to transfer to an emergency remote learning. The difference is, there was a pandemic and then we had to put in a stopgap measure and emergency system that will be able to sustain the institutions and be able to facilitate the education so that there will not be any break in the semester. So with this, we first of all had to do training for all tutors in the institution. I think there were about 1,900 tutors that we had to train with Amsterdam University, teaching on how to teach using a virtual system. It didn't end there, but we went ahead and identified institutions with need when it comes to technology implementation. When I say technology implementation, with this regard I'm talking about systems that could facilitate remote learning on campuses and then outside campuses. On campuses, we realise that technology is a structure, which actually forms the base of education in the institution. We were a bit not up to the kind of standard that they should have us there as a tertiary institution. So, we put in an Intervention with T-TEL. We did all these activities with financial support from T-TEL and then Mastercard to implement this."* (GTEC staff, March 2021)

> *"So on the regulatory front of course we ensured that the colleges complied to certain basic requirements so that at least, both students and tutors for that matter, the best that we could do for them or as many people that we could get to get online to participate in this was done. In addition to that of course T-TEL, we tried to get this thing going where we had this research done initially to actually find out how many people were actually getting on the platform to study and things like that in collaboration with the university. So the university will give us feedback as to what is going on, how many people are able to join the classes, and things like that. And then we will get similar data from the colleges as well to assure us that this thing is actually going on or not working for whatever reason, and if it wasn't working we needed to know what was going on, so that was our part that we played very well in actually ensuring that the teaching and learning went on well."* (GTEC staff, March 2021).

Monitoring and supervision of Colleges of Education

GTEC revealed that their key role is to monitor and supervise teaching and learning on the virtual learning platforms and to provide support where needed. Although GTEC has various departments (i.e., research, finance, planning, etc.) that conduct some monitoring and supervision of teaching and learning at the Colleges of Education, GTEC mostly rely on their partners such as T-TEL and the mentoring universities to undertake these activities and report their findings for decision-making. GTEC constituted a virtual learning task force made up of skilled IT tutors from the Colleges of Education and mentoring universities who are responsible for monitoring the blended learning approach being implemented across the Colleges of Education. According to GTEC, their inability as an institution to conduct regular monitoring visits to the Colleges of Education is due to the volume of work they are saddled with, as their regulatory mandate covers all tertiary institutions including Colleges of Education. We provide some quotes below.

> *"GTEC, as a body, has several departments, units and divisions. Of course, the entire college works under my office so you will have a coordinating department working under my office but depending on what we are going to supervise, a specific or specialist unit or department can obviously take the lead in doing that and of course, the reports are expected to reach the coordinating unit or department. If it is something about finance, you will probably ask the finance department or budget department to go and make sure everything is done right and come back with a report for us to know what is going on. If it is on research, if it is on a project, you have the appropriate department to do that, so there is nothing like a fixed team that says 'this is what we are going to do'. The teams are composed as and when the need arises and to which specific purposes they are going to look at. We are there to oversee, the coordinating department is just there to oversee that some of these things are done and done properly."* (GTEC staff, March 2021)

> *"Again, we have partners like T-TEL and the mentoring universities, obviously, which actually have people on the ground. Before they were situated in the zones and all that so they will also give us some kind of information. So there was also a team constituted called virtual learning taskforce who are responsible for monitoring virtual learning in the colleges. And like I said, where we are not really certain or not really clear about some of these things, then physically we also have to be there to actually ensure that some of these things are done. Of course, we will have our own mistakes here and there, I mean, it is quite, I wouldn't say expensive, but quite involving, to actually send people out*

there every minute to actually check on some of these things, where sometimes you can actually get the information in other ways." (GTEC staff, March 2021)

Support

GTEC also provided insights on how they assisted the Colleges of Education to negotiate with internet service providers to make the virtual learning platforms zero-rated.[22] This enabled student teachers and tutors to access teaching and learning materials easily. However, GTEC indicated that they lack the resources needed to carry out most planned support activities. To resolve this, GTEC is working with its partners such as T-TEL to support the implementation of some key activities (e.g., professional development for tutors, supported teaching in basic schools for student teachers, among others), particularly those related to teaching and learning at the Colleges of Education.

"When it comes to off-campus we had to negotiate with various telecommunication companies as part of government strategy to make their education side zero-rated. This zero-rated means like when students went to these various websites of the university that they are

[22] During the closure of schools last year, the Government of Ghana worked with the telecom providers (MTN and Vodafone) to zero-rate educational websites and learning platforms owned by tertiary education institutions in the country. This includes the learning management systems of the mentoring Universities.

Only one College of Education (NJA Ahmadiyya) developed a learning management system at that time. All other Colleges of Education tried using the LMS of their mentoring university, which led to a lot of traffic on these websites. Student teachers were, therefore, unable to attend lessons on the mentoring Universities' LMSs due to bandwidth congestion and ICT technical and resource limitations.

The Colleges of Education and the regulatory agency, therefore, decided that Colleges of Education should use other platforms including social media already available to student teachers and because they are familiar with these technologies. These are WhatsApp, Telegram, Zoom and Google Classroom. The telecom companies, however, indicated that these platforms are not fundamentally education platforms and do not belong to a university or College of Education. This made it impossible to identify its users as students and the specific use "for purposes of education and training" and therefore could not pass for consideration and zero-rating. Student teachers are therefore using their internet data to access the learning activities on these platforms at their own cost, just like other citizens patronising them for their traditional purposes i.e., social media.

affiliated to, I mean the mentoring universities, they are charged zero for any data usage. So, students were able to access it. Beyond the virtual learning / teaching that we did with Amsterdam we had. We call it the virtual learning task board, which supported individual institutions to implement the various teaching and learning. In fact, you transferred the learning that we learnt. We realise that not everyone was able to adapt to the situation so, in areas that they needed, we supported them to implement and teach them how they can fuse the technology into their teaching and learning so that they can carry their students along. Beyond that, we had to get some smart devices and then SD cards for students who had the critical need for them. Critical need, I must say, who could not afford or did not have this smartphone." (GTEC staff, March 2021)

"We have the ability to do some of these things but you will agree with me that some of these come with funding or cost and it is sometimes difficult. So you have your own programme line-up, you have a road map, you have to move from point A to point B, the ministry has also given you what they want to see and look like — all that. Sometimes the resources to execute those things are not really there. So yes, you will have a plan and fortunately you have people like T-TEL to offer that support and the facilitation to help you go through these things. So, yes, we should be able to do some of these things, we were doing some of these things before and to be frank with you T-TEL thing has really been beneficial because it is like they provide the funding on demand. It is like we are going to do this or another and the funding is there, not just the financial support but also human resources and I think that is good as well and it is helping." (GTEC staff, March 2021).

Challenges

Notable challenges include infrastructure and human resources.

Insights from GTEC revealed that the free Senior High School (SHS) policy being implemented by the Government of Ghana led to a high number of SHS graduates applying for admission into Colleges of Education, putting extra pressure on the limited infrastructure at the Colleges of Education. While the government has attempted to build additional infrastructure, this is, however, not enough. It is therefore likely that the blended learning approach will continue to be implemented in the Colleges of Education until this issue is resolved.

"Infrastructure challenges have been there since, and if you follow the trend very carefully you will realise that there is a free SHS policy, which

> *is producing a lot of graduates who have to further their study. This means that the infrastructure challenges are going to be worse, though the government has actually stepped in to try and put in some infrastructure to help curb the situation."*(GTEC staff, March 2021)

Another key challenge noted by GTEC is the poaching of College of Education tutors by some of the universities. According to GTEC, although it is one area that is difficult to control since one cannot prevent a dissatisfied person from leaving their post, it is so important that there must be better conditions of service to curtail this challenge. GTEC is therefore working to improve the conditions of service of tutors through a review of the tutors' scheme of work, provision of teaching and learning materials, discussion with the MoE on salary adjustment for tutors, and providing accommodation for tutors, among others.

> *"But beyond that, if you ask what else you can identify, there are a lot of strapping challenges currently. People are getting poached by other universities; some are leaving for other places and all that. Unfortunately, these are problems that technically, you cannot stop because everybody has the right to move on so long as they meet some requirements that brought them here in the first place, so it is difficult and we have to find ways of addressing those challenges. One way is probably to look at their scheme of service again and try to adjust it, or however, and the other way obviously is to make (I think it is still related) their condition of service more comparable to other education institutions, perhaps that will help to curb some of these things."* (GTEC staff, March 2021)

4.3.4. Principals' confidence in the regulatory agency

Principals were also asked to assess the support provided by GTEC and indicate their confidence in GTEC's ability to oversee the transition to online learning. The findings reveal that 93% of principals (with no significant gender difference) stated that they have confidence in the regulatory agency to oversee the transition to online learning.

The principals cited the range of support that GTEC has provided their Colleges of Education during the transition, leading to the high level of confidence they have in the GTEC. For instance, some principals indicated that GTEC, in collaboration with T-TEL, provided their Colleges of Education with learning materials and technological devices such as laptops and pen drives to aid their virtual learning. The majority of the Colleges of Education also confirmed that GTEC provided an e-library to their student teachers to access

course materials. The principals also confirmed that GTEC provided training and capacity building through workshops and professional development sessions. We provide some quotes below.

> *"GTEC tried to set up an e-library for many colleges. And that is how come we got to be the host of eLearning in the region. They called down our librarians and trained them on how to download new books for our students."* (Male principal, March 2021)."

> *"... Well, they supported us because those who created the platform in which they loaded a lot of materials for both tutors and students to have access and in collaboration, I think they supported almost everybody but the main challenges are the initial stages I mentioned earlier on, was the connectivity."* (Female principal, March 2021).

Despite the support provided by GTEC, a few of the principals suggested that they do not have confidence in GTEC's ability to oversee the effective transition to online learning. Their main reason was that GTEC refused to provide them with assistance after writing to them to support them with laptops for their tutors. Another principal also indicated that GTEC has not been effective in communicating with Colleges of Education about important issues concerning eLearning. They recommended GTEC adopt an electronic mode of communication instead of a paper approach. Another principal also indicated that the content of the e-library provided by GTEC is not useful because it focuses mainly on science and engineering, which is not applicable to non-science student teachers.

> *"GTEC has not been forthcoming with assistance. My College of Education wrote to them to assist us with laptops for our tutors but we did not receive any feedback from them on our request."* (Male principal, March 2021).

> *"For me, the major issue with GTEC has to do with means of communication. We are in modern and electronic times; I will prefer an electronic means of communication with them. Rather, with every single thing, they will want you to write a letter to them."* (Female principal, March 2021)

> *"GTEC assisted us with the e-library but unfortunately the content of the e-library in terms of the materials is not very much relevant to our College of Education. Most of the materials are science- and*

> *engineering-related. They don't benefit the students much."* (Male principal, March 2021)."

> *"Information from GTEC to my College of Education always delays. We receive communications from them always late."* (Female principal, March 2021).

4.3.5. Qualitative insights on mentoring universities and the effective transition of Colleges of Education to online education

As mentioned earlier in this report, mentoring universities supervise teaching, learning and assessment in the Colleges of Education. They do not directly engage with the student teachers in terms of teaching. The study collected qualitative data from the mentoring university leads to ascertain how they are working with the Colleges of Education to oversee the effective transition to online education. Insights from the university leads reveal that the mentoring universities have developed an ICT guideline for eLearning. The university leads indicated that the ICT guideline on eLearning will provide support on teaching and learning on the virtual platforms.

Some of the mentoring universities indicated that they have appointed an assistant registrar responsible for eLearning to assist tutors and student teachers on the eLearning platform.

> *"Basically, the policy is meant to ensure how the, I mean the guidelines, how teaching and learning can be done virtually and guidelines to ensure teaching and learning and the responsibilities of virtual facilitators or lecturers if you like and responsibilities of … that is students on the other hand and what measures and strategies can be put in place to support learners who are at the receiving end. And this particular team, of course I mean, they are organised and you know because in fact, virtual learning is very stressful so structures or measures that can be put in place to ensure that they are over fatigued etcetera are all taken care of."* (University leads, March 2021)

The qualitative data further sought to understand the architecture the mentoring universities have in place to support virtual learning in the Colleges of Education. Some of the mentoring universities indicated that they have an ICT directorate in charge of eLearning. The ICT directorates were therefore tasked with extending access of the mentoring universities' eLearning

platforms to the affiliate Colleges of Education. The university leads indicated that their eLearning platforms, which were extended to the affiliate Colleges of Education, were used to register student teachers and conduct end of semester examinations. The university leads further stated that they assisted their affiliate Colleges of Education to use platforms such as Zoom, Telegram, and WhatsApp and provided training to tutors to be able to teach online.

> *"So, we have the infrastructure but of course. I mean, it can't be enough for everybody. We are still trying to expand it, since year in, year out, the population will be increasing. And for financial support, the university is trying to put measures in, or the university has put measures in place in that regard, I know. And I have personally even worked with, I have worked with the Mastercard Foundation team here and we are working on a proposal to solicit support so that we can expand our infrastructure and in fact, the colleges were actually part of the proposal. We even wrote to Pin crops and even GTEC to solicit letters for support to enable us to do that. We are yet to hear from the funders."* (University leads, March 2021)."

> *"We helped them create committees on the various campuses and I think, these committees are largely funded by the Quality Assurance Unit and so we engage them a lot … we engage them a lot. And in fact, any time we also actually recommended other applications like the Google Meet, Google Classroom and our own Zoom and so on and so forth. You know, when Covid struck, I mean we have all of these, various kinds of applications coming up that could be used and of course, I mean some also used WhatsApp, Telegram"* (University lead, March 2021)."

> *"So what we did was that we organised training for all the assessment officers, their registry and then teachers or tutors who were teaching also for that semester. So a workshop was organised for them both face to face and online"* (*University lead, March 2021*).

5. Discussion

In this section, we focus on discussion of key findings of the study. The discussion is organised around the five research questions and uses the five phases of ↑Rogers' (2003) diffusion of innovation theory and the literature as a discussion framework.

5.1. Research Question 1

Are student teachers becoming independent and responsible in their learning?

Yes, student teachers are becoming independent and responsible in their learning. A number of student teachers (60%) participated in the virtual lessons synchronously, and most (82%) are reading their course materials and conducting independent research to inform their learning. eLearning has improved the participation of student teachers with SEN, making lessons more inclusive, and is creating autonomy for SEN student teachers who previously depended on their colleagues to read lesson materials for them. In addition to this, most student teachers think their tutors are becoming more accessible and are willing to provide one-on-one support to help improve their learning. A similar conclusion was reached by ↑Wahyuni, 2018, ↑Al Maani, 2019, and,↑Dalas et al. (2020).

However, less than half (42%) of the student teachers are completing and submitting assignments on time. Reasons for this included home, family, and work responsibilities such as engaging in household chores and working to support their family. Internet connectivity (availability, speed, and expense) is another key challenge to student teachers' transition to becoming independent and responsible. This corroborates (↑Dalas et al., 2020) findings that many students may have a challenge making the transition from face-to-face instruction to becoming independent learners. The major challenge of internet connectivity (availability, speed, and expense) makes the adoption of eLearning not simple to use. In line with ↑Rogers' (2003) innovation of diffusion theory, where an innovation is regarded as not simple to use, its adoption will not be fast. To ensure that the majority of student teachers adopt eLearning faster in the future, some provision in terms of improved internet connectivity will be helpful. Those learners who do not adopt the innovation seem to fall within the last two continuums of ''the diffusion of innovation theory curve" described by ↑Rogers (2003) as the 'late majority and 'laggards'. Making the innovation easy to use through improving

internet connectivity will encourage those student teachers who fall behind to join the 'innovators and early majority'.

5.2. Research Question 2

Do College of Education tutors have a strong understanding of eLearning and are they confident teaching online due to the persistence of the blended learning approach, which is being used in the 2020/21 academic year?

The majority of tutors (62%) have a stronger understanding of eLearning and are confident teaching online. This is in line with the literature that tutors' acceptance and willingness to adopt eLearning is important for its success (**<URL_CHANGED_LINK>**Almaiah & Alismaiel, 2019**<URL_CHANGED_LINK>**;↑Almaiah & Jalil, 2014). This highlights the promise of flexibility eLearning holds for its adoption in teacher education (↑Chakraborty, 2017). However, there are some challenges in practice. For instance, the factors hindering a certain category of tutors are as follows.

1. The difficulty in transitioning from the physical classroom to teaching on virtual platforms.
2. The inability to pick up nonverbal cues from student teachers and implement classroom management strategies.
3. The inability to demonstrate and make lessons online practical.
4. The limited opportunity for student teachers to follow up on lessons due to internet connectivity (availability, speed, and expense).

In situations where structures for supporting the adaptation and implementation of eLearning are limited (↑Almaiah et al., 2020) there will be difficulty in transitioning to eLearning. This will, in turn, undermine tutors' efforts at anticipating the needs of student teachers to provide timely feedback as required (↑Carter et al., 2020). It is important to note that the resource challenges in eLearning are barriers to teaching practical lessons and for learners to follow up on lessons (↑Appiah-Boateng, 2019).

The study also explored the instructional strategies tutors employed during virtual lessons to develop critical thinking among student teachers. The majority of the tutors used question and answer techniques and encouraged dialogue, debate, brainstorming, and to a limited extent, games, storytelling, and role-play during virtual lessons.

It is interesting to note that some gendered differences were observed regarding tutors' implementation of virtual teaching. While female tutors

self-report on their understanding of eLearning more critically, lesson observations show that they do better at encouraging student participation and critical thinking during virtual lessons than their male counterparts. The adoption of agreed guidelines as a framework for the uniform delivery of eLearning in teacher education institutions is important (↑Anamuah-Mensah et al., 2020) for addressing the gendered differences in the implementation of eLearning.

In terms of Rogers' innovation of diffusion theory (↑Rogers, 2003), the challenges tutors are confronted with regarding the adoption of eLearning relate to the five qualities that shape the success of adopting an innovation.

5.3. Research Question 3

Can Colleges of Education cope with any future institutional closures by making the transition to online education?

The leadership of Colleges of Education indicated their willingness to implement eLearning. The closure of Colleges of Education due to Covid-19 created an opportunity for Colleges of Education to explore ways to support eLearning and invest in their ICT infrastructure, with some Colleges of Education committing internally generated funds to meet some of the requirements for eLearning. This includes internet connectivity on campus and capacity-building workshops for tutors and student teachers on facilitation of, and participation in, eLearning.

Three major areas for institutional sustainability of eLearning were identified, namely:

1. institutional policies on eLearning;
2. infrastructure to support eLearning
3. capacity of staff and student teachers to engage in eLearning.

While challenges remain, clear progress has been made by Colleges of Education and their mentoring universities in all three areas. The support provided by the regulatory agency to Colleges of Education to ensure institutional sustainability of and transitioning to virtual learning reflects ↑Rogers' (2003) framework to a large extent. For instance, the emergency brought by Covid-19 has compelled all Colleges of Education in Ghana to adopt eLearning. In terms of the innovation of diffusion theory, all Colleges of Education have become "innovators and early adopters" (↑Rogers, 2003) in principle. However, in practice, the level of individual action in adopting

eLearning in some Colleges of Education place those individual tutors and student teachers in the five categories of Rogers' continuum.

5.4. Research Question 4

Can Ghana's teacher education regulatory agency support the transition to online education?

One of the mandates of GTEC is to monitor and supervise teaching at the Colleges of Education. The agency has already shown commitment to supporting and overseeing teacher education institutions to transition to eLearning by facilitating capacity-building training for staff to implement eLearning. Through T-TEL, GTEC has also supported Colleges of Education to improve internet connectivity on campus. The provision of ICT infrastructure, development of digital resources, establishing clear goals and means of implementation, building capacity and leadership are regarded as critical in supporting the adoption of eLearning (↑Hong Kong Education Bureau, 2015). These are in line with the view of the leadership of Colleges of Education that the ability to transition to online learning in the future hinges on the joint support from regulatory institutions, in this case, GTEC and the mentoring universities. Additional structure to support the effective transition to eLearning includes working with the Colleges of Education to continue implementing professional development sessions with a focus on building capacity for online teaching and learning techniques. Overall, those engaged in the study agreed that the regulatory body has the capacity to oversee and support Colleges of Education to transition to online learning.

5.5. Research Question 5

Do student teachers have a stronger understanding of eLearning and are they confident about undertaking online learning due to the persistence of the blended learning approach, which is being used in the 2020/2021 academic year?

Yes, the majority (66%) have a stronger understanding of eLearning and are confident about continuing to participate in the current blended learning approach being implemented by Colleges of Education. The factors hindering the remaining student teachers are as follows.

1. Limited engagement and feedback from tutors.
2. Difficulty in asking questions during eLearning sessions and not receiving feedback immediately.

3. Internet connectivity (availability, speed and expense).

As eLearning encourages student teachers to learn at their own pace and level (↑Wahyuni, 2018), take control of their learning, reflect on their own thinking, and grapple with essential questions with some guidance from instructors to enhance their SDL skills (↑Zimmerman, 2015) they will be confident about continuing to participate in the eLearning being implemented by their Colleges of Education. However, the factors hindering full adoption especially internet connectivity (availability, speed, and expense) resulting in limited engagement between student teachers and tutors, is likely to widen the participation gap between learners from disadvantaged backgrounds, in their efforts to become independent learners (↑OECD, 2020).

Student teachers appear to regard eLearning as a temporary substitute for face-to-face learning, which they think has become the only option because of restrictions on face-to-face learning due to Covid-19. Face-to-face learning still remains the preferred choice. This preference is mostly due to the challenges with internet connectivity, with the additional feeling of isolation and anxiety experienced by some student teachers as eLearning means they are increasingly becoming separated from their peers and tutors, this is consistent with research by ↑Daniel (2020) and ↑Gillett-Swan (2017) on the challenges of online learning.

In conclusion, the discussion highlights how the adoption of eLearning among tutors and student teachers of Ghana's Colleges of Education fits into Rogers' innovation of diffusion theory, and how the five qualities of the theory shape the adoption of eLearning in the Colleges of Education. Additional literature drawn on by us to show how the issues found in the study regarding the adoption of eLearning in Colleges of Education corroborates similar findings from other contexts. The next section highlights the policy implications arising from these findings to improve eLearning in teacher education.

6. Implications of findings for policy and practice on eLearning

The research findings have implications for policy and practice on eLearning as presented below.

6.1. Independence and responsibility

Are student teachers becoming independent and responsible in their learning?

Policies on orientation for new student teachers should include capacity building of student teachers on eLearning. They should also ensure that provision is made for student teachers to have access to and own their own portable ICT devices to support their participation in blended learning.

The issues of internet connectivity are broader contextual issues that will require a national policy with the appropriate ministry in Ghana on how best to improve internet connectivity nationwide (e.g., with the Ministry of Communication).

Mentoring universities, GTEC and Colleges of Education need to explore ways to provide data to student teachers and tutors to enable them to participate in virtual lessons. Perhaps an agreed amount for data could be added to the monthly allowances of student teachers while campus Wi-Fi connectivity could be extended to tutors' residences.

6.2. Tutor's understanding of eLearning

Do College of Education tutors have a strong understanding of eLearning and are they confident teaching online due to the persistence of the blended learning approach, which is being used in the 2020/21 academic year?

Capacity building for tutors to understand how to manage eLearning and which platforms are helpful to support synchronous and asynchronous sessions is important. Colleges of Education need to build the capacity of tutors and student teachers to make the transition to eLearning easier in the following areas:

- Making tutors more accessible and available to support student teachers.
- Making access to eLearning platforms easier for student teachers.

- Building the capacity of tutors to have a deeper understanding of eLearning and how to navigate eLearning and virtual platforms.

Colleges of Education need to be supported to build systems and structures to facilitate eLearning in the areas of eLearning policy, infrastructure, and Wi-Fi connectivity.

It is critical for mentoring universities and Colleges of Education to continue to make online training for tutors an integral part of their continuous professional development (CPD) programme. This will require updating the institutions' staff CPD policy. Policy on peer support during CPD as well as other capacity issues should be pursued by the institutions. Colleges of Education should be supported to build a robust virtual professional development session in a sustainable way with cycles such that tutors can practice what they are being taught in their online classes continuously.

Policy on a community of practice for tutors needs to be developed and enforced as the discussion around a community of practice has not yet been implemented.

Policy on the psycho-social and emotional well-being of both tutors and student teachers is critical as the shift from face-to-face to online teaching and learning is too drastic for some tutors and student teachers. It is critical for institutions to consider this aspect of well-being as very important when pursuing virtual teaching and learning.

6.3. Coping with future institutional closures

Can Colleges of Education cope with any future institutional closures by making the transition to online education?

Colleges of Education need to work with their mentoring universities to update their operational policies to include an emergency response to circumstances that will affect teaching and learning. Current approaches to teaching and learning that include online education must be scaled up to prepare for any future adjustments to instructional delivery.

It is important that the instructional policies of Colleges of Education focus on building the capacity of tutors to go beyond questions and answers, to include the adoption of application scenarios during their instruction. This will enable student teachers to relate what they are learning to real-life issues, to move beyond recall. Institutions need to take interest in the adaptation and use of improved instructional strategies during online lessons.

6.4. Regulatory support for the transition to online learning

Can Ghana's teacher education regulatory agency support the transition to online education?

GTEC will have to develop its unique implementation guide of MoE's ICT in education policy and the provision for Open and Distance Learning in Higher Education in Ghana's Education Strategic Plan 2018–2030. This policy should also include strategies that would ensure that every aspect of the implementation guide of the ICT in education policy is adhered to in practice.

6.5. Student teachers' understanding of eLearning

Do student teachers have a stronger understanding of eLearning and are they confident about undertaking online learning due to the persistence of the blended learning approach, which is being used in the 2020/2021 academic year?

Student teachers must be trained to understand and use a range of online learning tools and how these tools affect learning outcomes individually and in combination. This should also include critical digital literacy to identify fake news /spam / online predators.

7. Conclusion

This report presents findings to generate evidence on whether the approaches adopted during the closure of Colleges of Education due to Covid-19 have led to an improvement in teaching by tutors and learning among student teachers.

Based on interviews with principals, tutors, student teachers, GTEC staff, and university leads, it is evident that the efforts made during the closure of Colleges of Education have significantly improved eLearning in the Colleges of Education. This is especially so with the uptake of blended learning for the 2020/2021 academic year. While uptake is high, most stakeholders do not think eLearning has taken the place of face-to-face learning in the long term.

One of the strongest arguments in support of eLearning is its potential to radically revolutionise teaching and learning. The majority of the stakeholders surveyed in this study attested to the positive impact of eLearning in spite of some challenges.

Through eLearning, the capacity of tutors has been enhanced in instructional design and the use of multimedia techniques in delivering online lessons. While these tutors are now demonstrating a stronger understanding of eLearning and confidently teaching online, there is a need for the Colleges of Education, mentoring universities, and GTEC to prioritise providing support (orientation, devices, and internet solutions) to tutors to enable them to deliver on the virtual learning platforms.

We further conclude that eLearning has had a positive impact on the lives of student teachers, especially those with SEN as well as those from low-income backgrounds. It has enhanced their research skills, improved interaction with course materials and with their tutors, it has also improved their knowledge of IT and their ability to conduct independent studies. Interviews with student teachers made it clear that the devices they were provided with have enabled them to become more independent and responsible. While some orientations have been organised for student teachers on eLearning, the fact that almost all the student teachers indicated that they faced challenges during their virtual lessons means a lot remains to be done by the Colleges of Education, mentoring universities, and GTEC to successfully transition to eLearning.

While Colleges of Education reported some investments in internet connectivity on their campuses to support eLearning, there is, however, a significant need to upgrade and expand ICT networks across Colleges of Education to enable a successful uptake of eLearning. Funding for this

expansion remains a challenge. Given that Colleges of Education are now implementing the blended learning approach for the 2020/2021 academic year, there is a need for ongoing funding to sustain and build the capacities of Colleges of Education to effectively implement the blended learning approach for the 2020/2021 academic year and perhaps for subsequent academic years.

GTEC continues to live up to its mandate in ensuring that Colleges of Education transition seamlessly to online learning by providing the necessary support as well as by monitoring the implementation of eLearning.

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9. Annex

About T-TEL

Transforming Teaching, Education & Learning (T-TEL) was officially registered as a Ghanaian not-for-profit company limited by guarantee on 7 July 2020 and as a national non-governmental organisation (NGO) with the Department of Social Welfare on 28 September 2020. T-TEL's mission is to become a leading supplier of educational technical assistance for improving learning outcomes and productivity. We are a proudly Ghanaian organisation aiming to harness our local talent and expertise to enable our education system to reach greater heights.

T-TEL's board Chair is Professor Jophus Anamuah-Mensah with Sister Elizabeth Amoako-Arhen as Vice-Chair. Other board members include Professor Rita Akosua Dickson, Professor Mohammed Salifu, and Professor Kwame Akyeampong. Robin Todd is T-TEL's first Executive Director.

T-TEL's establishment came about following the completion of Transforming Teacher Education and Learning (T-TEL), which was a six-year (2014–2020) GBP 25 million Government of Ghana programme funded by the UK Foreign, Commonwealth and Development Office (FCDO, formerly DFID) and implemented by Cambridge Education. Initially designed to strengthen pre-service teacher training, T-TEL grew into a large-scale, comprehensive policy reform agenda owned and led by the National Council for Tertiary Education (NCTE), which worked with all 46 public Colleges of Education and five universities to support the implementation of the Bachelor in Education (B.Ed) degree in Initial Teacher Education. The programme was implemented by Mott MacDonald Ltd and ended in December 2020.

T-TEL was viewed by key stakeholders, including the Ministry of Education and the FCDO, as a very successful programme that has brought about significant changes in Ghana's teacher education system. It was this success that led to the decision to establish T-TEL as a Ghanaian not-for-profit organisation, which can continue to provide advice and support to Ghana's education system in the years to come.

Table 17. *How tutors are able to identify students online learning.*

	Male Tutors (%)	Female Tutors (%)	All tutors (%)
Student refuses / is unable to respond to questions when asked	55.7	57.9	56.3
Student does not contribute during the session	54.8	58.7	55.8
Student regularly misses online sessions	43.1	37.2	41.6
Student does not take part in group sessions	33.4	38.8	34.9
Student does not complete or submit assignments	31.7	35.5	32.7

MR

Table 18. *Competency attributes on instructional strategies that encourage student participation and critical thinking (virtual lessons only 2021).*

	Male Tutors (%)	Female tutors (%)	All tutors (%)
Tutor uses question and answer (where students also ask questions) to gauge understanding	98.8	100.0	99.1
Tutor uses strategies to challenge students to think hard.	97.0	95.7	96.7
Tutor uses dialogue (e.g., discussion, debate, brainstorming)	91.5	95.7	92.4
Tutor uses strategies, such as share, talk, and feel for students to ask questions of the tutor and one another	89.0	97.9	91.0
Tutor uses demonstrations, explanations, or experimentation during lesson	87.8	93.6	89.1
Tutor uses project / enquiry-based learning (i.e., student presentation of their work, answers, or discussions)	66.5	76.6	68.7
Tutor uses group / peer work (collaborative learning) (e.g., discussion, debate, brainstorming)	67.1	66.0	66.8
Tutor uses manipulatives / modelling during lesson	53.7	59.6	55.0
Tutor uses storytelling during lesson	18.9	21.3	19.4
Tutor uses role-play during lesson	17.7	19.2	18.0
Tutor uses games during lesson	15.9	17.0	16.1
N	164	47	211

MR

Table 19. *Competency attributes on instructional strategies that encourage student participation and critical thinking (virtual lessons only 2021).*

	Male Tutors (%)	Female tutors (%)	All tutors (%)
Tutor uses question and answer (where students also ask questions) to gauge understanding	98.8	100.0	99.1
Tutor uses strategies to challenge students to think hard.	97.0	95.7	96.7
Tutor uses dialogue (e.g., discussion, debate, brainstorming)	91.5	95.7	92.4
Tutor uses strategies, such as share, talk, and feel for students to ask questions of the tutor and one another	89.0	97.9	91.0
Tutor uses demonstrations, explanations, or experimentation during lesson	87.8	93.6	89.1
Tutor uses project / enquiry-based learning (i.e., student presentation of their work, answers, or discussions)	66.5	76.6	68.7
Tutor uses group / peer work (collaborative learning) (e.g., discussion, debate, brainstorming)	67.1	66.0	66.8
Tutor uses manipulatives / modelling during lesson	53.7	59.6	55.0
Tutor uses storytelling during lesson	18.9	21.3	19.4
Tutor uses role-play during lesson	17.7	19.2	18.0
Tutor uses games during lesson	15.9	17.0	16.1
N	164	47	211

MR

Table 20. *Competency attributes on instructional strategies that encourage student participation and critical thinking (face-to-face lessons, 2019 and virtual lessons, 2021).*

	June 2019 (face-to-face) (%)	March 2021 (virtual platform) (%)	Δ from 2019 to 2021 (%)
Tutor uses question and answer (where students also ask questions) to gauge understanding	94.8	99.1	+4.3
Tutor uses strategies to challenge students to think hard	76.1	96.7	+20.6
Tutor uses dialogue (e.g., discussion, debate, brainstorming)	90.2	92.4	+2.2
Tutor uses strategies, such as share, talk, and feel for students to ask questions of the tutor and one another	67.1	91.0	+23.9
Tutor uses demonstrations, explanations, or experimentation during lesson	85.6	89.1	+3.5
Tutor uses project / enquiry-based learning (i.e., student presentation of their work, answers, or discussions)	55.4	68.7	+13.3
Tutor uses group / peer work (collaborative learning) (e.g., discussion, debate, brainstorming)	68.2	66.8	-1.4
Tutor uses manipulatives / modelling during lesson	41.6	55.0	+13.4
Tutor uses storytelling during lesson	16.6	19.4	+2.8
Tutor uses role-play during lesson	23.1	18.0	-5.1
Tutor uses games during lesson	12.8	16.1	+3.3
N	368	211	

Table 21. *Assessment of tutor competency strategies evaluated during lesson observation (virtual lessons, 2021).*

	Male Tutors (%)	Female tutors (%)	All tutors (%)
Tutor listens to students and gives constructive feedback.	98.2	97.9	98.1
Tutor uses a variety of assessment modes during teaching to support learning	79.3	83.0	80.1
Tutor explains concepts clearly using examples familiar to students.	68.3	72.3	69.2
Tutor pays attention to all students, especially girls and students with Special educational needs (SEN), ensuring their progress	56.7	46.8	54.5
Tutor produces and uses a variety of teaching and learning resources that enhance learning	39.0	31.9	37.4
N	164	47	211

MR

Table 22. *Assessment of tutor competency strategies evaluated during lesson observation (face-to-face lessons, 2019 and virtual lessons, 2021).*

	June 2019 (face-to-face)(%)	March 2021 (virtual platform)(%)	Δ from 2019 to 2021 (%)
Tutor listens to students and gives constructive feedback.	87.0	98.1	+11.1
Tutor uses a variety of assessment modes during teaching to support learning	57.3	80.1	+22.8
Tutor explains concepts clearly using examples familiar to students.	50.5	69.2	+18.7
Tutor pays attention to all students, especially girls and students with Special educational needs (SEN), ensuring their progress	20.7	54.5	+33.8
Tutor produces and uses a variety of teaching and learning resources that enhance learning	24.7	37.4	+12.7
N	368	211	

MR

Table 23. *Types of virtual platforms accessed by students.*

	Male student teachers (%)	Female student teachers (%)	All student teachers (%)
My College of Education platform (Telegram, WhatsApp, Zoom, etc.)	51.0	52.7	51.7
Affiliate university's learning management systems	35.4	26.0	31.5
Other college platforms	11.2	10.7	11.0
NCTE Curriculum Resources Hub or B.Ed. Resources Hub	7.3	4.7	6.2

Table 24. *Rate at which students study independently.*

	Male student teachers (%)	Female student teachers (%)	All student teachers (%)
Always	32.2	30.1	31.3
Often	31.7	26.6	29.6
Sometimes	34.2	42.0	37.4
Rarely	2.0	1.4	1.7

Table 25. *Places where students access virtual lessons.*

	Male student teachers (%)	Female student teachers (%)	All student teachers (%)
Home	80.6	88.0	83.7
I normally travel to a different town or area e.g., on a hill to gain internet access	18.0	12.7	15.7
A friend's house	3.9	6.0	4.8
Communal area (Library, ICT centre, etc.	4.9	2.7	3.9
N	206	150	356

MR

Table 26. *Type of challenges faced by students during virtual learning.*

	Male student teachers (%)	Female student teachers (%)	All student teachers (%)
Network / internet access challenges	91.0	90.9	91.0
Tutors do not attend lectures	7.4	6.8	7.2
I do not understand what is taught on the platform	5.3	6.1	5.6
The device I use does not function properly	6.9	0.8	4.4
Lack of adequate teaching materials	2.7	3.0	2.8
I find it challenging to use the platform	1.1	1.5	1.3

MR

Table 27. *Proportion of students who are confident of continuing the blended approach of teaching and learning.*

	Male student teachers (%)	Female student teachers (%)	All student teachers (%)
Very confident	26.2	14.0	21.1
Somewhat Confident	43.2	52.0	46.9
Neutral	2.9	6.0	4.2
Not Confident	20.9	23.3	21.9
Not confident at all	6.8	4.7	5.9
N	206	150	356