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How Knowledgeable are Graphic Design Faculties about the Universal Design for Learning Framework? Evidence from selected Technical Universities in Ghana

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Abstract

Although there is a preponderance of evidence in support of the fact that Universal Design for Learning remains one of the most ideal educational frameworks for addressing leaner variability, research into the knowledge base of educators regarding the phenomenon in the Ghanaian context has rather been limited. This study was aimed at assessing the knowledge levels of Graphic Design Faculties (GDFs) about the Universal Design for Learning Framework (UDL) across selected Technical Universities in Ghana. Driven quantitatively and operationalised as a simple descriptive survey, an accessible population of 61 GDFs responded to a four-point rating scale, which measured their knowledge levels in terms of their beliefs and understandings of general and specific fundamental concepts about UDL. However, data from only 51 usable copies were analysed and concluded for the study. The indication from the findings were that the GDFs in general held average or medium knowledge levels about UDL (MM =2.521), with 43.7% of the sample recording average or medium knowledge, 25% with high knowledge, and the remaining 31.3% reported low or limited knowledge about UDL. The study yielded an urgent need to, among other interventions, develop UDL resource packs as well as provide UDL-focused continuous faculty development and training programmes by the universities to compensate for the knowledge gaps in the short to medium terms.

Keywords: knowledge levels, universal design for learning, graphic design faculties, technical universities

Introduction

There is consensus that educational systems across the globe are currently faced with much diversity among their learner populations in different forms and proportions (Evmenova, 2018; Tomlinson, 2005). Equally, Higher Education Institutions (HEIs) in general and universities in particular, continue to grapple with the issue of addressing the needs of student populations with an increasingly diverse learner characteristics (LaRocco et al., 2013; Sellar et al., 2011). One often-cited reason for this challenge is the lack of knowledge and skills by faculty to adequately address the students, who more often than not come with a myriad of variabilities in their knowledge, experiences, cultures, strengths, and academic needs, which invariably affects the quality of teaching and learning (Baucham, 2020; Morley et al., 2018).

In parallel, Shaw (2011) aptly notes that "meeting the educational needs of a diverse population requires a new way of thinking about instructional access for students" (p. 23). It stands to reason that scholars, instructional designers, and educators in the higher education space must direct efforts toward the continuous understanding, development, and implementation of more nuanced tools, strategies, and models in response to the current developments (Behling & Tobin, 2018; Davies et al., 2013). One such widely acknowledged evidence-based instructional frameworks is the Universal Design for Learning (UDL). UDL has been established in the scholarly literature as a framework that offers a paradigm shift for reconsidering and modelling educational programmes in terms of instructional goals, assessments, and instructional practices (Meyer et al., 2014; Nelson, 2014; Rose & Gravel, 2012; National Center on UDL, 2012). The Center for Applied Special Technologies (CAST, 2018) adds that, beyond understanding the diversity of students, educators need to be abreast of the principles and guidelines of UDL so that the learning environment and the learning process could be optimised.

Nonetheless, though a relatively new educational framework across countries in the developing economies, little attention has been given to conducting research into understanding the phenomenon in the Ghanaian context. Even with the limited research on the implementation of UDL in Ghana's education system (Ministry of Education, Ghana Education Service, UNICEF, and Inclusive Development Partners, 2021; Karr et al., 2020; Senadza et al., 2019; Deku, 2017), such studies did not consider the knowledge levels of educators about the framework, especially within the University-level higher education systems. This is buttressed by the fact that, other than the recent Transforming Teacher Education and Learning (T-TEL)

and Ghana Tertiary Education Commission (GTEC, previously, National Council for Tertiary Education, NCTE) research report (Senadza et al., 2019), which in part cursorily tested the awareness of UDL among some trainee teachers and tutors in the Colleges of Education (CoEs), there is currently non-existent scholarly literature that attempts to explore the extent to which Universities in general and Technical Universities' (TUs) faculties in particular, are knowledgeable about the UDL framework. It is therefore warranted, that research of this nature be undertaken. Thus, drawing from the case study of Graphic Design Faculties (GDFs) across selected Technical Universities (TUs) in Ghana, this research sought to assess the knowledge levels of educators regarding the UDL framework.

Review of Literature

As noted from the outset, Universal Design for Learning (UDL) is an educational framework that aims to provide all students with equitable access to learning opportunities and optimize their learning outcomes (Taylor et al., 2023). From the literature, UDL builds upon and integrates concepts from two earlier frameworks: Universal Design (UD) and Universal Design for Education (UDE) (Taylor et al., 2023; Almumen, 2020). To have a better appreciation of the historical antecedents of UDL, it is important to trace its evolution from UD to UDE and finally to UDL.

According to Almumen (2020), Universal Design originally emerged as a concept in architecture and product design in the 1960s and 1970s. Architect Ronald Mace is often credited with pioneering the concept. UD advocates for the design of environments, products, and services that are accessible and usable by people of diverse abilities, ages, and backgrounds (Areekkuzhiyil, 2022). The goal of UD is to eliminate barriers and create inclusive spaces that accommodate a wide range of users without the need for adaptations or specialized design (Areekkuzhiyil, 2022; Almumen, 2020). The principles of UD include flexibility, simplicity, perceptible information, tolerance for error, low physical effort, and equitable use (Griful-Freixenet, Struyven, & Vantieghem, 2021a; Lowenthal & Lomellini, 2022). Fundamentally, UD seeks to shift the responsibility for accessibility from the individual with disabilities to the designers and providers of environments and products (Griful-Freixenet et al., 2021a).

Further building on the principles of UD, Universal Design for Education (UDE) emerged as an extension of UD, which specifically focused on education (Courtad, 2019; Buckland Parker, 2013). The UDE framework was developed in the 1990s

with the aim to apply the principles of UD to teaching and learning practices (Burgstahler, 2020). UDE recognizes that learners have diverse needs, preferences, and abilities. It encourages educators to proactively design instructional methods, materials, and assessments that are accessible, inclusive, and effective for all learners (Burgstahler, 2020; Hollingshead, Lowrey, & Howery, 2022; Quirke, Guckin, & McCarthy, 2023).

Then came the Universal Design for Learning (UDL), which represents the latest stage in the evolution of inclusive education frameworks (Chen, Evans, & Luu, 2023; Matthews, Cavanaugh, & Wilson, 2023). Just like UDE, UDL emerged in the 1990s and gained prominence with the publication of the UDL Guidelines by the Center for Applied Special Technology (CAST) in 2008 (Israel et al., 2020). However, the extension of UDL to the educational sciences happened in the early 2000s (Meyer et al., 2014) at the Center for Applied Special Technology (CAST). UDL expands upon the principles of UD and UDE by integrating research on cognitive neuroscience, learning sciences, and educational technology (Israel et al., 2020).

UDL emphasizes providing learners with multiple means of engagement, representation, and action/expression. It recognizes that learner variability is a norm as such it aims to provide flexible and personalized learning experiences to meet the diverse needs of students (Hromalik, Myhill, & Carr, 2020; Leif et al., 2023). Further to that, UDL acknowledges the importance of removing barriers to learning through proactive design and offers guidelines, strategies, and tools to support educators in implementing inclusive instructional practices (Edwards-Hudson, 2022; Leif et al., 2023). Tobin (2019) notes that, UDL takes cognizance of variability in learners as one which extends beyond disability and encompasses factors such as background, language, culture, and prior knowledge.

The evolution from UD to UDE and eventually to UDL has had significant implications for education in many ways. Notable amongst them is that UDL has shifted the focus from adapting learners to fit existing educational practices to adapting educational practices to meet the diverse needs of learners (Dalton, 2017). It emphasises proactive design that promotes accessibility, inclusivity, and engagement for all students (Jiménez, Graf, & Rose, 2007).

Another contribution of UDL lies in its promotion of individualized flexible learning. By UDL promotes the use of technology and instructional strategies that allow for personalized and flexible learning experiences (Glass, Meyer, & Rose, 2013; Pisha & Coyne, 2001). Pisha & Coyne (2001) assert that, UDL recognizes the

importance of individual variability and provides multiple means of engagement, representation, and action/expression to optimize learning outcomes.

More so, the evolution of UDL has emphasized that accessibility is a shared responsibility among educators, curriculum designers, administrators, and policymakers (Rao, 2015; Glass et al., 2013). Rao (2015) continues that, UDL calls for systemic change and collaboration to create inclusive educational environments that benefit all learners.

Furthermore, UDL is regarded as a research-informed instructional approach as it integrates research from multiple fields, including neuroscience, learning sciences, and educational technology (Kieran & Anderson, 2019). It encourages educators to use evidence-based practices and leverage technology to enhance learning outcomes for diverse learners (Dalton, 2017).

In sum, the evolution of the Universal Design for Learning (UDL) from Universal Design (UD) to Universal Design for Education (UDE) represents a significant advancement in the development of inclusive educational frameworks (Dalton, 2017; Kieran & Anderson, 2019). As suggested, UDL builds upon the principles of UD and UDE, integrating research and technology to provide personalized, flexible, and inclusive learning experiences for all students (Banes et al., 2019). This evolution has led to a shift in focus from adapting learners to adapting educational practices. Thus, UDL emphasizes the importance of proactive design, collaboration, and shared responsibility to create inclusive educational environments (Taylor et al., 2023). By incorporating UDL principles and guidelines, Tobin (2019) submits that educators can effectively address learner variability and optimize learning outcomes for all students regardless of their abilities, backgrounds, or learning preferences.

The Concept of UDL

As indicated, the concept of Universal Design for Learning (UDL) has gained significant recognition and adoption in the field of education (Kieran & Anderson, 2019). Klug (2022) opines that, UDL is a framework that aims to provide all learners with equitable access to education by addressing learner variability and promoting inclusive instructional practices. Countless definitions and interpretations have been provided by authorities and organizations on what UDL is (Matthews et al., 2023), highlighting its core principles and implications for teaching and learning (Hartmann, 2015).

The Center for Applied Special Technology (CAST), which is the leading non-profit organization in UDL research and development (Glass et al., 2013; Leif et al., 2023) defines UDL as a framework "to improve and optimize teaching and learning for all people based on scientific insights into how humans learn" (Edwards-Hudson, 2022). According to CAST, UDL involves providing multiple means of representation, expression, and engagement to meet the diverse learning needs of individuals (Tobin, 2019; Rao, 2015). Clearly, UDL emphasizes a proactive design for the purpose of ensuring accessibility and inclusivity in educational settings.

In congruence with CAST's definition, the National Centre on Universal Design for Learning (UDL Centre) describes UDL as a set of principles for curriculum development that aims to provide all individuals with equal opportunities to learn (Berquist & Dalton, 2016; Pisha & Coyne, 2001). The UDL Centre stresses that, UDL is not a one-size-fits-all approach but rather a flexible framework that acknowledges learner variability (Griful-Freixenet et al., 2021a). This implies that, UDL prioritises the design of learning experiences to address the unique strengths, preferences, and challenges of learners (Berquist & Dalton, 2016).

Additionally, the Education Development Centre (EDC) interprets UDL as a research-based framework for designing curriculum, instruction, and assessment that enables all individuals to gain knowledge, skills, and enthusiasm for learning (Courtad, 2019; Proyer, Kremsner, & Biewer, 2021). EDC underscores the importance of providing multiple means of engagement, representation, and action/expression to accommodate diverse learners. UDL, according to EDC, promotes inclusive practices that support the learning and development of all individuals (Hollingshead et al., 2022).

David H. Rose and Anne Meyer; the co-founders of CAST, have made significant contributions to the development of UDL (Quirke et al., 2023; Lowenthal & Lomellini, 2022). They define UDL as a framework to guide educational practice that accommodates the broadest possible range of learners (Taylor et al., 2023; Areekkuzhiyil, 2022). Universal Design for Learning (UDL) is also described as a framework for guiding instructional leaders and instructional designers in developing diversity-embedded curricula and teaching practices to meet the needs of all students (Davies et al., 2013). Very central to the tenets of UDL is the recognition that every learner, when provided with multiple ways to: consume new information or material, demonstrate their understanding, and tend to be engaged in the learning process, (King-Sears, 2014), they all benefit. Similarly, the UDL Guidelines, developed by CAST, provide specific recommendations and strategies for implementation in

educational settings (Lowenthal & Lomellini, 2022; Quirke et al., 2023). The guidelines outline three principles: providing multiple means of representation, multiple means of action and expression, and multiple means of engagement. These principles, according to Edwards-Hudson (2022) and Courtad (2019) encourage educators to offer diverse ways for learners to access, process, and demonstrate their understanding of information.

Clearly, it can be deduced from the expositions thus far that Universal Design for Learning directly addresses diversity in the classroom through the use of diverse teaching methods. More so, research findings (Hromalik et al., 2020; Dalton, 2017) highlight the importance of proactive design, recognizing that learner variability is the norm rather than the exception. These authorities further emphasize the need to design learning experiences that are accessible and engaging for all learners, regardless of their abilities or backgrounds. In agreement, the definitions and interpretations of UDL accentuate the importance of proactive design, equitable access to education, and the recognition of diverse learner needs (Leif et al., 2023). However, while their specific wordings may vary, there exist common themes and principles that underlie these definitions and interpretations. In effect, UDL is viewed as a research-based framework that promotes inclusive instructional practices and addresses learner variability (Pisha & Coyne, 2001). In short, UDL is aimed at reducing barriers to instruction and engaging every learner in the learning process (King-Sears, 2014) by providing multiple means of representation, action/expression, and engagement to optimize learning outcomes for all learners.

Recent Studies on Educators' Knowledge about UDL

As have been argued in the preliminary section of this paper, educators' knowledge relative to UDL is critical to determining its effective implementation. When stakeholders lack understanding of UDL, its implementation becomes difficult (Izzo et al., 2008). Likewise, the implementation of UDL can be promoted when stakeholders understand its tenets and implementation guidelines. The more exposure educators get on UDL, the more their drive to utilise the model (Baucham, 2020). Whiles some of the extant literature established that educators possess appreciable levels, others show limited knowledge levels about the implementation of UDL. For instance, a study by Westline et al. (2019) in the United States of America, which quantified the familiarity, usage as well as interests and priorities in UDL among an online faculty of a Southeastern University found that, 71.6%

of the respondents were largely high in their understanding of at least one of the UDL guidelines. However, 28.4% of that sample indicated that they were familiar with none of the guidelines. Mavrovic-Glaser (2017) also assessed a small sample of both licensed General and Special Education teachers from various schools in the Chicago metropolitan area about their knowledge and use of UDL to provide effective instruction to diverse learners. From the findings of the research, 55% of the sample indicated they were familiar with UDL.

Furthermore, at a mid-sized Canadian university, Hills, Overend & Hildebrandt (2022) in a mixed-methods study, explored faculty's awareness and understanding of UDL with the aim to identify bridges and barriers to broader implementation of UDL practices. They found that, 29.3% of the sample had good to full understanding of UDL, 38.5% claimed they had some understanding of UDL, and 32.2% of the respondents had little to no understanding of UDL. It was further revealed that, no differences existed in the faculty's levels of understanding on the basis of their demographics such as appointment type, Faculty/School or years of service. In yet another study, Kilpatrick, Ehrlich and Bartlett (2021) surveyed 38 university faculty to understand whether their knowledge about the principles and strategies of UDL enables their preparedness for a sustained instructional delivery in case of future emergencies or pandemics like Covid-19. It came to light that, lack of awareness of the principles of UDL was noted as one of the barriers to the design and development of the course prior and post the Covid-19 pandemic era. They concluded that courses were often designed at variance with the principles of UDL due to faculty resistance to change or lack of awareness.

There are also some mixed results reported by Dempsey, Hunt, Lone and Nolan (2023), where a sample of anatomy educators from HEIs in the United Kingdom (UK) and Ireland were essentially not aware of UDL, with 31% stating they had heard about UDL. However, they were able to identify the related UDL checkpoints within their curriculum (Dempsey et al., 2023). In South Africa, teachers realised they were already using UDL-related practices to address leaner diversity, after they gained an understanding of the UDL principles (Song, 2016). Also in a Kazakhstani context, teachers often used UDL principles to differentiate instruction to the individual learners even though they had no understanding of its principles and guidelines (Rakhimbekova, 2019). These findings imply that, the participants have been incorporating some UDL elements into their curricula design and delivery unintentionally.

Of importance equally are findings with regards to educators' perceptions and related attitudes toward the implementation of UDL, which according to Anstead (2016, p.4) accentuate the "fundamental link between knowledge and application" of UDL. In a study to gauge the general perceptions of educators, Anstead (2016) found that the participants generally held negative perceptions about UDL. These negative perceptions was supported by an indication of their resistance rather than interest in the use of UDL. In a related research, Al-Azidiyenn, Mei and Fook (2010) described teachers' perceptions as resistant and possibly damaging for learners, albeit possessing no to little basic knowledge about UDL. It was also found that, educators felt UDL was irrelevant or not adaptable within their contexts, so they often doubted the feasibility of implementing it though they valued the concept and believed in its benefits (Braun & Okwako-Riekkola, 2018; Song, 2016). McKenzie, Karisa, Kahonde and Tesni (2021) bemoaned the perception held by certain people who limit UDL to only disability or special needs education instead of expanding the scope to include all learners with diverse learning styles. There is also the perception held among staff groups that there were incoherent communication and no joined-up thinking, which negatively affected the Implementation of UDL (Martin et al., 2019). In line, Zhang and Zhao (2019) opine that UDL can pose a challenge to the teaching philosophy being used in certain low and middle-income countries, where curriculum design is often content-focused rather centring on learners' abilities. Another challenge is the belief held by most instructors that they employ UDL already and thus perceive same as not a novel approach to they have always known or practiced (Quirke & McCarthy, 2020).

Meanwhile, Humber (2020) in a mixed methods, exploratory phenomenological case study which involved eight teachers from Title I high school in southeast Houston reported that, 75% of teachers held positive perceptions about UDL. Similarly, Griful-Freixenet et al. (2021b) conducted an empirical study to examine UDL among pre-service teachers and found that participants held positive attitudes. Yet, they added that there was room for improvement in teachers' understanding and implementation of UDL principles.

Given the seeming mix of perceptions and attitudes held by educators, there is preponderance of research reports on UDL-related capacity development programmes to remediate the situation but not without challenges as well. According to Craig, Smith and Frey (2022), professional development can support teachers in implementing UDL principles, but there are challenges to be addressed such as lack of

time and resources. Besides, most of the instructors had no UDL-specific training to enable them implement UDL and accessible curricula in their schools (Karr, Hayes & Hayford, 2020; Song, 2016; Dalton, et al., 2012). Rao, Currie-Rubin and Logli (2016) in their CAST research similarly noted that, most educators had no training in their teacher education programmes on UDL, neither did they have the chance to partake in any formal UDL-related professional development to learn about it. Further, even though not focused on instructors' training per se, Chiwandire (2019) found that the lack of instructor training, was the reason for lecturers' non-existent UDL knowledge in South Africa's higher education institutions. Consequently, there have been advocacies for instructor training with a focus on UDL (McKenzie & Dalton, 2020). In line with the advocacies, Canter et al. (2017) found in their research that, when educators were offered the time and resources for training and planning, there was a shift in their instructional practices which aligned with the universally designed instructional settings for accommodating the needs of all students. Kamga (2013) also suggested among others in a Cameroonian study that, there was the need for teacher training, and the provision of appropriate assistive technology.

On the flip side, there are studies of UDL-related instructor training occurring informally in other contexts. Braun and Okwako-Riekkola (2018) for instance, described a collaborative learning process between untrained Tanzanian teachers in UDL and their partners from the United States of America. In Jamaica, a UDL-related study by Best (2016) highlighted the need for collaboration in the areas of implementing teacher-education programmes, international resource sharing, as well as mutual leadership at the local and international levels. The conclusion drawn by Best (2016) was that the benefits of hybrid models of professional development go beyond the offerings of outside expertise, flexibility and resources, to include peer learning and feedback. In situations where no formal training exist, Trivedi and Mthombeni (2019) suggest that professional development activities in the form of workshops, seminars and short courses can be held. It is believed that, a UDL-focused professional development activities can lead to a shift in the teaching philosophies of instructors to effectively facilitate and create opportunities for all students to develop (Zhang & Zhao, 2019).

Research Methodology

This study was quantitatively-driven, with the descriptive survey adopted as its design. Osuala (2001) notes that descriptive surveys are ideal in terms of their practicality in identifying existing needs and circumstances. The descriptive survey, as further explained by Gay, Mills and Airasian (2006), has to do with unearthing the nature of prevailing conditions or relationships, opinions, attitudes and practices or processes among people. Considering that this research was purposed to gauge and document the current state of knowledge among educators about UDL, the descriptive survey design was better suited choice of research design.

Both the purposive and simple random techniques were used in this study. Whilst the purposive sampling technique informed the choice of only the Technical Universities in Ghana that offer Graphic Design or Communication Design related programmes at the time of the study, the simple random technique was used to recruit all GDFs who responded to the questionnaire. From a target population of 68 GDFs from four (4) Technical universities in Ghana, only 61 responded to the web-based questionnaire. Out this, data from only 51 usable copies were analysed and concluded on.

By instrumentation, the survey questionnaire was used in this study because of its advantage in taking less time to collect data than other qualitative instruments like interviews. In designing the instrument, a dichotomously structured precursor item on UDL awareness was initially posed to the participants to respond with a simple "Yes" or "No" to the question "Have you heard of Universal Design for Learning (UDL)?". This provided an opportunity for participants who responded in the affirmative to proceed to the UDL knowledge levels-related questions. However, participants who responded "No" were automatically directed to the "Thank You; End of Survey" section. This screening question embedded in the survey was meant to prevent those respondents who were unaware about UDL from potentially skewing the data by guessing their response(s). Structured in two parts, the researcher-designed questionnaire first asked of the participants' UDL training statuses and the sources of their UDL training. Then, participants were asked to self-rate their beliefs and levels of understanding about general and specific fundamental ideas about UDL on a four-point Likert scale ranging from 1 (strongly disagree) to 4 (strongly agree). To end the questionnaire, an open ended section was created so respondents could provide any other comment(s) in relation to their knowledge of UDL.

To ensure validity and reliability, the face and content validity approach was used; where consensus was reached amongst experts/researchers relative to items of an instrument, which were checked on their "face value" and subjective views, by assessing whether it would produce the desired outcome (Kumar, 2011; Delport, 2005). Further, the Cronbach's alpha was used to assess the internal consistency of the constructs that made up the survey instrument, which produced an Alpha value of 0.857. This suggests that, the instrument is highly reliable; since the acceptable threshold of 0.70 reliability coefficient (Vanderwegen, Van Nuffelen & De Bodt, 2013; Hair et al., 2010; Pallant, 2000) for conducting research of this nature was achieved.

The data from the participants' responses were analysed with descriptive statistics, using means, standard deviation and percentages. In so doing, a knowledge score for each of the 16 UDL knowledge-related questions were analysed with the measure of central tendency (mean scores) and measure of spread (standard deviation), which were then aggregated into an overall knowledge level score of the respondents, with the criteria set as "Low or Limited", "Medium or Average" and "High" levels to aid interpretation. The four point Likert response scale, ranging from: (1) Strongly Disagree; (2) Disagree; (3) Agree; to (4) Strongly Agree was used to make a determination of the participants' responses, where "1" denotes the least agreement and "4" for the strongest agreement to the statements. So, in determining their test values, all mean values below 2.00 were considered as 'low', whereas values that ranged from 2.00 to 2.99 were considered to be 'medium or average' and values above 2.99 were indicative of 'high' knowledge.

Results

Just like many other educational innovations, the successful implementation of UDL is largely driven by the faculties' appreciation of the principles that underlie such innovation in order that they be well informed in their application of same in their instructional practices. It is noted that, knowledge is a key contributor to the effective implementation of UDL (Baucham, 2020; Dallas et al., 2016; Williams, 2020).

As indicated earlier in the Research Methodology section of this study, the survey item "Have you heard of the Universal Design for Learning (UDL)?" was a precursor question, which was meant to screen participants' awareness before proceeding into the details of determining their understanding of UDL. Having confirmed

their awareness, the next two UDL-related background items sought to establish the frequency of staff development programme(s) or training they had in UDL and the sources of their prior knowledge about UDL. Tables 1 and 1.1 provide summaries of data in terms of UDL staff development programmes attended and the sources of their UDL knowledge.

Table 1

Staff Development Programmes Attended on UDL

Staff Development Programmes (SDP)	Frequencies	Percent
None	44	86.3
1 - 3	5	9.8
4 - 6	2	3.9
Total (N)	51	100

Staff development programmes in this context, are the continuous professional learning platforms provided by the institution to all educators in order they hone their knowledge and skill to sustain the demands of the profession. As shown in Table 1, majority of the sampled GDFs (86.3%, n=44) reported that, they had no staff development programme(s) in UDL throughout their professional practice. Of the remainder (n=7) who had attended *staff* development programmes (SDPs), they generally did so from one through six occasions. In specific terms, 9.8% (n=5) of the respondents had attended between 1 – 3 SDPs, whereas 3.9% (n=2) did so between 4 – 6 times. It is clear from the data that, most of the GDFs did not have the opportunity to participate in any staff development programmes, which focused on UDL. This finding aligns with the CAST (2016) report by Rao, Currie-Rubin and Logli, which pointed to the fact that, most of the sampled educators had not been given the opportunity to participate in any formal professional development on UDL nor received any training in their teacher education programmes to learn about UDL. Finally, the source(s) of the sampled GDFs' prior knowledge relative to UDL have been presented in Table 1.1.

Table 1.1

Sources of prior Knowledge about UDL

Sources of Prior UDL Knowledge	Frequencies	Percent
*I*ndependent reading from books and articles	47	92.2
University education (coursework/unit)	8	15.7
Professional Development (In-service training)	3	5.9
Webinars	1	2
YouTube videos	2	3.9
Quick introduction from colleague(s)	1	2
My research area	1	2
Informal discussions	1	2
Online platforms	1	2

Although the GDFs largely indicated they had limited to no staff development programme or training on UDL, there is the possibility that they had gained their knowledge via other sources. Therefore, the medium through which respondents' gained information about UDL was also considered and the data shown in Table 1.1. As the data suggest, majority (92.2.5%) of the sampled GDFs claimed they had learnt about UDL on their own through independent reading from books and articles. The GDFs also mentioned they had learnt about UDL through sources such as coursework/unit in their university education (15.7%) and professional development (5.9%). Additionally, GDFs who chose the option "other" in their answer indicated they acquired information on UDL via YouTube videos (3.9%), webinars (2%), colleagues (2%), own research area (2%), informal discussions (2%) and online platforms (2%). Given the assumption that respondents could gain information through one or more sources, they were given the option to select those that applied them. Consequentially, the data for this aspect (refer to Table 1.1) was not suitable for determining the overall percentage.

In the next section, a determination has been made on the details of respondents' knowledge levels about the Universal Design for Learning framework.

Graphic Design Faculties' Knowledge Levels about the Universal Design for Learning

In order to assess UDL knowledge levels among the GDFs across the selected universities, it was important that respondents were asked questions that measure their depth of understanding of concepts and other information related to UDL. These questions were purposed to gather baseline data on faculty knowledge levels about UDL in terms of the respondents' beliefs about the value of UDL and their general understanding and ability to undertake instructional design and delivery activities with UDL. The descriptive statistics (mean and standard deviation) were calculated for all the knowledge scales (survey items/statements K1 – K16). The participants' responses to each of the statements have been presented with their corresponding means and standard deviations in Table 2 and discussed in the next section.

Table 2

Means and Standard Deviations Analyses of Survey Responses (N = 51)

Statements/Items		M	StD
K1	I have adequate knowledge about UDL and do not need additional staff development programme(s)	3.627	0.631
K2	If presented with the opportunity to attend a staff development programme on UDL, I would attend	3.667	0.476
K3	I believe there should be multiple staff development opportunities for all educators' on UDL	3.549	0.541
K4	I believe Teacher Education Institutions should run a programme or unit on UDL in at least one course	3.529	0.542
K5	I understand the Government's policy direction on the implementation of UDL	1.843	0.703
K6	I understand the three principles of Universal Design for Learning (UDL)	2.647	0.658
K7	I understand UDL as a flexible framework that guides the creation of goal, methods, materials and assessments to address learner variability	2.412	0.638
K8	I know UDL is designed to meet the needs of all learners	2.706	0.701
K9	I know how to apply the UDL principles and guidelines to instruction	2.059	0.732

K10	I know the three learning networks of the brain (recognition ,strategic, affective networks) that are associated with UDL	2.039	0.824
K11	I know how UDL can be used to reduce barriers in the learning environment	1.922	0.913
K12	I know how to use UDL during the lesson planning process	1.843	0.784
K13	I know how UDL can be used to create inclusive learning environments	1.961	0.799
K14	I know how to design instruction to address learner variability during the lesson planning process	2.000	0.775
K15	I know how to include flexible options and instructional scaffolds for students with disabilities	1.961	0.662
K16	I know how to use digital media and technology tools to create accessible instructional environments	2.569	0.855
	MM; StD	2.521	0.422

Note: M: Mean; StD: Standard Deviation; MM: Mean of Means.

Discussion

The data from Table 2 shows that, some areas of variance exist among the responses of GDFs' knowledge level scores from the survey questionnaire, with responses recording mean values that ranged from 1.843 to 3.667. However, the global mean score from an accumulation of the 16 knowledge level items was MM = 2.521, (StD = .422, N = 51), which falls between 2.00 – 2.99. By implication, the sampled GDFs generally had medium or average knowledge levels about UDL across the selected universities. Rogers (2003) explains knowledge as a cognitive phase in the innovation-decision process by which an individual has an awareness about the innovation (in this case UDL). Rogers adds that, the individual's knowledge is influenced by their socio-demographic variables like educational level and personality variables including their beliefs, expectations and opinions. Likewise, the knowledge levels in the context of this study was considered under two subcategories namely: respondents' beliefs about the value and training in UDL and their understandings of some underpinning concepts of UDL with their ability to implement it in their learning environments. The survey items under each of the subcategories of UDL-Knowledge have been discussed in greater detail to clarify the sampled

GDFs' knowledge levels. Table 2.1 provides a summary of the data for each of the UDL-Knowledge subcategories, with their corresponding mean sub scores.

GDFs' beliefs about UDL was the first in the series of the knowledge subcategories to be analysed, which included four survey items. Beliefs, according to Brand and Glasson (2004) are pointers to our subjective reflections, moods, emotions, and feelings, which are gained from the long term memory storage of how we view the world. In educational research findings, beliefs (also referred to as values) have long been acknowledged as a key driver in the decision-making process of the educator's instructional practices (Dolan, 2016; Usher, 2015; Ifenthaler and Schweinbenz, 2014). Meaning that, educators' instructional behaviours and practices can be influenced by their beliefs. Consequently, the sampled GDFs were asked to rate their levels of agreement or disagreement regarding statements that touched on: the adequacy of their knowledge about UDL and the need for additional staff development programmes, willingness to attend staff development programme(s) on UDL if given the opportunity, the need for multiple staff development opportunities for all educators' on UDL and the need for Teacher Education Institutions to run a programme or unit on UDL. Generally, the findings from the responses in the 'beliefs subcategory' suggest that, the GDFs mostly leaned highly favourably towards this knowledge domain. Thus, the mean sub score of 3.593, ranging from 3.529 – 3.667 was recorded (see Table 2.1).

Table 2.1

Summary of the Subcategories of GDFs UDL-Knowledge Level

Subcategories	Corresponding Survey Items	Sub Means
Beliefs	K1, K2, K3, K4	3.593
Understandings	K5, K6, K7, K8, K9, K10, K11, K12, K13, K14, K15, K16	2.164

A closer examination of the data in Table 2 with the first statement (item K1), which was negatively phrased showed that, the majority of the sampled GDFs responded to it with the most agreements (M = 3.627, StD = .631). The relatively small standard deviation value with this item shows that there was less variability in the opinions of GDFs. But the suggestion after reversing the coding scales of this negatively-worded item is that, most of the respondents were certain they did not have adequate knowledge about UDL and so would need additional staff development programme(s). Also, the GDFs' initial responses in the previous Table 1 could be seen as a further confirmation to this finding, where 86.3% of the sample

claimed that they had not attended any staff development programme(s) on UDL. There is an obvious gap worthy of concern; as the lack of staff development programme/training in UDL will adversely affect the GDFs effective implementation of the framework. Craig et al. (2022) and Alquraini and Rao (2020) emphasise that, professional development programmes are essential to sustaining the implementation of UDL. This study aligns with the available literature (McKenzie, et al., 2021; Karr, Hayes & Hayford, 2020; Song, 2016; Dalton, et al., 2012), which indicates that most educators did not have UDL-specific training to facilitate its implementation.

The results from the survey item K2 further lend credence to respondents' willingness to participate in UDL-focused training/staff development programme because they have limited knowledge of the framework. When asked whether the GDFs would attend a staff development programme on UDL if offered the opportunity, their mean score shows a positive response (M = 3.667, StD = .476), with most of them strongly agreeing and agreeing with this statement a indicated by the very low disparity in the spread of their responses. In a similar vein, respondents' mean scores on the survey items K3 and K4 were within the "high" range, which could be seen as positive responses. GDFs believe that there should be multiple staff development opportunities for all educators' on UDL (M = 3.549, StD = .541). They also thought that, Teacher Education Institutions should run a programme or unit on UDL in at least one course (M = 3.529, StD = .542). These findings further buttress the GDFs beliefs in the need to compensate for their lack of prior training or additional staff development programmes to effectively practise UDL. The implication is that, there is the need for training on UDL for educators (McKenzie and Dalton, 2020).

In assessing their knowledge levels in relation to their understanding of some basic concepts of UDL, GDFs were asked to indicate their levels of agreement on 12 survey items, which focused on areas such as: understanding of the Government's policy on UDL, the underpinning principles of Universal Design for Learning (UDL), and the inherent flexibility associated with UDL to guide instructional planning and delivery efforts to address learner variability. It also included: the aim of UDL as being designed to meet the needs of all learners and the three learning networks of the brain that are associated with UDL among others. In this regard, the mean sub score of 2.164 was recorded, suggesting that GDFs generally responded somewhat favourably to this subdomain.

However, a further analysis of the individual items in the "Understanding" subcategory points to some degrees of favourable and unfavourable responses in the

GDFs' understanding of some basic concepts and information about UDL. With reference to the respondents' knowledge about government's policy direction (item K5), GDFs generally had unfavourable responses for this statement whereby they disagreed that they understood the Government's policy direction on the implementation of UDL (M = 1.843, StD = .703). This was particularly worrying to the extent that, educators' understanding of the nation's policy direction on a given educational innovation will help them stay in touch and significantly shape their instructional design and delivery practices. Hence, GDFs misunderstanding of the policy direction on UDL will not help to facilitate their buy-in and resultant implementation. Watkins (2022) adds that, when educators are brought into the policy conversation from the outset, chances are that the policy will be well-designed, there will be increased buy-in and implementation will be improved. They however claimed that they were somewhat familiar with the three principles of Universal Design for Learning (UDL), which was reflected in the values of mean and standard deviation observed for the item K6 (M = 2.647, StD = 0.658).

In further agreement, GDFs provided answers with fairly favourable leanings toward items such as understanding "UDL as a flexible framework that guides the creation of goal, methods, materials and assessments to address learner variability" (M = 2.412, StD = .638), knowledge that "UDL is designed to meet the needs of all learners" (M = 2.706, StD = .701), knowledge of "how to apply the UDL principles and guidelines to instruction " (M = 2.059, StD = .732) and the three learning networks of the brain (recognition ,strategic, affective networks) that are associated with UDL" M = 2.039, StD = .824. It can be inferred that though GDFs indicate a lack of appreciation of the Government policy direction, they fairly understand some of the basic principles and related information that underpin UDL. This fair level of understanding could be attributable to their own initiatives where over 90% of the GDFs indicated their sources of prior UDL knowledge as emanating from independent reading from books and articles. The finding thus far, is in alignment with that of Mavrovic-Glaser (2017), who found that majority of the sampled licensed general and special education teachers (55%) in the Chicago metropolitan area were familiar with UDL. Thus, it is agreed that just as any innovation, the implementation of UDL becomes challenging when implementers have limited understanding of it (Williams, 2020; Dallas et al., 2016; Dallas et al., 2014; Izzo et al., 2008). It has also been established that, there is heightened interest from educators to understand and implement UDL when they are exposed to it (Baucham, 2020).

Yet, examining the remaining survey items under this subcategory revealed a largely unfavourable set of responses. For instance, the majority of the GDFs disagreed that they "know how UDL can be used to reduce barriers in the learning environment". This item (K11) had a mean score of 1.922 and a standard deviation of .913. GDFs further responded negatively to the statement "I know how to use UDL during the lesson planning process" (item 12), with a mean score of 1.843 and standard deviation of .784. Again, with a mean score of 1.961 and a standard deviation of .799, GDFs disagreed that, they "know how UDL can be used to create inclusive learning environments". Furthermore, majority of the respondents disagreed that they "know how to include flexible options and instructional scaffolds for students with disabilities", with a mean score of 1.961 and a standard deviation of .662. Though these findings were considered as averagely unfavourable, the mean scores equally suggest some closeness to favourable responses too. This is significant for some reasons. The fact that the GDFs rated their understanding and confidence in their abilities to undertake UDL-related instructional practices very closely to the average levels could also stem from their initiative to gain information about UDL on their own. However, the consequence therein is that whether such information is accurate or not was subject to their own varying interpretations. The situation can be improved if they are given some professional development on UDL or had they been provided a related programme or unit on UDL in their professional training prior to teaching.

Contrarily, the majority of the GDFs expressed confidence in their abilities to "design instruction to address learner variability during the lesson planning process", recording a mean score of 2.000 and a standard deviation of .775 on this statement. Lastly, there were agreements in the GDFs' responses regarding the final statement: "I know to how to use digital media and technology tools to create accessible instructional environments" (item 16) with a medium mean score and standard deviation, which can be considered as favourable (M = 2.569, StD = 0.855). This finding, though commendable is an area equally worthy of consideration because with the competence to use digital multimedia and technological tools, it becomes practicable to recreate instructional environments that allow for flexibility and versatility unlike the traditional teaching resources (Edyburn, 2010). The suggestion from the findings is that, although GDFs had some understanding and confidence in their abilities to use UDL in their instructional practices they are not highly knowledgeable in how to facilitate UDL with the appropriate digital media and technologies. Minshew and Anderson (2015) found that, teachers' confidence level is explicably linked to the levels of their instructional practices as well

as their technological knowledge. Even though it is prudent to make digital technologies available, it is more important for the educator to know how it is used to make instructional content accessible to students in order that the curricular goals are attained. Bouck (2010) opined that, not only are students of all abilities helped with digital technologies but they make significant impact particularly on students with disabilities by addressing their challenges, when effectively used. Minshew and Anderson (2015) concluded that, the learning environments become more engaging and students' success are improved as educators' increased their competencies of using digital technologies as pedagogical tools. However, though not in a higher education context, other research findings such as Blackwell, Lauricella and Wartella, 2014; Ertmer et al., 2012 and Ertmer, 2005, also pointed to the linkages between confidence and anxiety as they assessed teachers' non adoption of digital technologies in their learning environments. In light of the ongoing debate around the impact of digital technologies on the implementation of UDL, there is the need to push the frontiers of research in this area in order to support or enhance inclusive instructional practices.

Following the completion of the Likert-type statements, respondents were asked to respond to an open-ended question. Of the 51 analysable surveys submitted, only four (4) respondents provided answers to the open-ended statement: "If you have any comment(s) in relation to your knowledge of UDL, please note them below". The participants' responses suggest some unanimity that GDFs would be more effective in their implementation of UDL if they were provided with some professional training in that regard. For instance, one respondent states that, "I have been using some of the practices I think can qualify as UDL but I will be happy to learn more about this to use it properly". Similarly, other respondents stated the following: "We should be trained on this UDL thing", "I hope your research will highlight the importance of using UDL framework to teach in our universities", "As lecturers, we need some intensive training on these UDL strategies".

On the basis of the findings, the overall knowledge levels about UDL among the GDFs in the selected technical universities was measured as medium/average. This is supported by the score of the mean of means of 2.521, which fell within the 2.00 – 2.99 range. Furthermore, the data in Table 2 shows that, except for five items (K5, K11, K12, K13 & K15) and four items (K1, K2, K3, K4) that were rated within the low or limited and high knowledge bands respectively, the remaining knowledge level statements used in this study recorded average/medium mean scores. In percentage terms, about 31.3% of the GDFs had low or limited knowledge, whereas

43.7% had average or medium knowledge and the remaining 25% had high knowledge level. This current study is similar to the study of Hills and colleagues (2022) but not without some variance, where in categorising their respondents' knowledge they found 29.3% of the sample had good to full understanding, 38.5% claimed they had some understanding, and 32.2% of the respondents had little to no understanding of UDL.

Conclusions and Recommendations

The analysis from the descriptive statistics revealed that, GDFs in the case study universities held a generally average knowledge level, which was rated with a weighted mean score of 2.521. This clearly fell within the 2.00 – 2.99 of the band set for the descriptor "average or medium" knowledge level of the respondents. Percentage-wise, close to 44% reported average or medium knowledge level whereas about 25% had high level knowledge, with the remaining approximately 31% indicating low or limited knowledge. A plausible reasoning for the average knowledge level among the GDFs could be that, UDL is a relatively new framework for most educators in Ghana, yet training and development in this respect have been patchy. Relatedly, findings from the academic literature which sought to quantify educators' knowledge level about the Universal Design for Learning have been mixed. For instance, Westline et al. (2019) found from their study in a Southeastern University that 71.6% of the online faculty had a high understanding of at least one of the UDL guidelines, but the remaining percentage of the sample did not. Mavrovic-Glaser (2017) also reported that only 55% of a small sample of both licensed General and Special Education teachers from various schools in the Chicago metropolitan area were familiar with UDL. Though with some variance, this current study is largely consistent with the findings of Hills et al. (2022) where 38.5% of the respondents indicated they had some understanding of UDL and 29.3% recorded good to full understanding, and the other 32.2% held between little to no understanding of the Universal Design for Learning.

A further disaggregation of the knowledge category data showed that, the GDFs rated high on the belief items but average on the understanding items. A case in point was where respondents indicated that they were not knowledgeable enough about UDL and so additional staff development programme(s) would help to intervene. Also, the GDFs thought that there should be multiple staff development opportunities for all educators' on UDL and that there should be a programme or unit

on UDL in at least one course in the Teacher Education Institutions. When asked to rate their understanding, an average or medium level mean score was recorded with a blend of favourable and unfavourable responses. For example, respondents generally expressed some familiarity with the three principles of Universal Design for Learning (UDL) but noted that, they did not understand the policy direction of the government on the implementation of UDL, neither were they knowledgeable in how the UDL framework could be used to reduce barriers in the learning environments. Respondents further indicated they did not know how to use UDL during the lesson planning process or how UDL can be used to create inclusive learning environments.

More so, the medium knowledge level recorded among the GDFs in the selected universities can be as a result of many factors including personal initiatives and training. However, it was noted from the study that though most of the respondents did not have any staff development programme or training on UDL, they learnt about UDL on their own via sources such as reading from books and articles. It was also found that few of the GDFs claimed to have gained their knowledge about the framework through other sources like their university education (i.e. coursework/unit), in-service training as well as through YouTube videos. These sources may however be inadequate in equipping GDFs with the requisite knowledge to meaningfully address the diverse needs of all learners. It was also clear from the findings that, aside the majority who have been teaching with UDL for at least two years, almost of the same proportion did not attend any staff development programme or training. Meanwhile, Clyne (2021) noted that, the application of UDL to professional development for faculty is a valid but underutilized approach. In sum, there is a need for continuous faculty development and training in UDL for the GDFs so as to increase their understanding of the framework to an optimum level.

With the generally average knowledge level among the GDFs about UDL, there is the possibility that the GDFs do not fully understand the concept and related principles that underlie the framework, which could mean that it is unlikely they would implement it to the optimum. Therefore, in the short to medium term, there is an urgent need for some interventions such as the development of UDL resource packs (a catalogue of accessible resources for the GDFs who would require more information about UDL) and the provision of UDL-focused continuous faculty development and training programmes by the universities to make up for the knowledge gaps. In the long term, the Ministry of Education should support teacher education institutions to mount a specific course or unit in their programmes to expose

prospective educators to UDL and other innovative approaches that are relevant to addressing the needs of the current diverse learning environments.

It is further suggested that, similar study should be conducted beyond the contexts of graphic design faculties or technical universities in Ghana. Thus, broadening the pool of participants or geographical scope like conducting a longitudinal or comparative study including students, lecturers and administrators from both the technical and traditional universities will make an interesting study with a more a generalizable result.

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