

THE INFLUENCE OF TECHNOLOGY EDUCATION ON THE GRAPHIC DESIGN PROGRAMME AT TAKORADI TECHNICAL UNIVERSITY

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ABSTRACT: *It has been observed that the Department of the Graphic Design Technology lacks a wide range of immerging Technologies linked to the Graphic Design Programme. Consequently, students lack of knowledge about most of these new technologies with the current trends is making them fall behind. The study sought to find out the influence of today's technology on the Graphic Design programme being pursued by Higher National Diploma (HND) students at the Department of Graphic Design Technology. This is against the background that technology forms an integral part of the Graphic Design programme in the 21st century. An in-depth review of related literature from various authors have been discussed concerning the study. Through non-probability purpose sampling, an aggregate of 128 students and 6 teaching staff were selected for the study. In terms of the research design the qualitative approach was adopted for the study. The methodology employed for the study included participant observation and a questionnaire to reveal key findings for the study. That was complemented with proper structured and semi-structured interview techniques to beseech views from respective respondents for practical analysis. Consequently, the findings from the data revealed that technology had had some level of influence on the Graphic Design programme. Based on the findings, the researchers have made appropriate recommendations to help include the contemporary trends in the technology for the Graphic Design programme to prepare students adequately with the requisite hands-on training as the Graphic Design industry in Ghana and beyond demands. However, the importance and the practices cannot be overemphasized.*

KEYWORDS: graphic design, technology, influence, programme, trends, computer graphics

INTRODUCTION

The study's primary purpose is to highlight technology education of the Graphic Design Programme in the department presently and bridge the gap between modern technology and the existing ones and the influence the latter has on the Graphic Design Programme. In the Graphic Design profession today, technology is needed to drive the study of the programme to a higher level. This is upheld by Carrie (2017), "As an industry that relies on technology to realise its ideas

and drive creativity forward, Graphic Design is heavily influenced by technological innovation and invention. From programmes such as Adobe Illustrator, InDesign to the internet itself, the graphics world has been transformed again and again by groundbreaking technologies." Modern-day technology education applied in the Graphic Design Programme should be the critical factor for imparting knowledge and requisite hands-on training for Graphics students in this era. Technology is also used predominately in designing and creating work in the Graphic Design field (IPL, 2017).

A cursory research revealed by the researchers suggests a gap regarding technology being used in the department and that of contemporary ones the Graphic Design industry players expect from students. Hence, the need to bridge the gap concerning the inculcation of contemporary technology education in the Graphic Design programme to meet industry expectations. In the view of Bengaluru (2021), "As advances in technology drive globalisation and digital transformation, teachers can help students acquire the necessary skills to succeed in the careers of the future". Therefore, it is admissible and behoves lecturers who teach the Graphic Design Programme to research modern technology and apply it in their teaching methodologies. "Through the use of technology inside and outside the classroom, students can gain 21st-century technical skills necessary for future occupations," (Washington, 2020).

Accordingly, lecturers are to review the technical aspects of the Graphic Design Programme and fortify the technology to meet the up-to-date trends. Hence, to make it more vibrant to help students acquire adequate knowledge in new technology to fit well in the fast-evolving world of the 21st century and beyond. This contention is backed by Carrie (2017b), "As this becomes more common and teaching technologies evolve to become more efficient, Graphic Designers will need to offer clients something a bit different if they are going to stay ahead of the game. That will inevitably push Graphic Design forward, helping to create a more vibrant and dynamic industry".

To ensure that quality Graphic Design Programme is being run at the department to align with Technical University education mandate and satisfy Graphic Design industry prospects, with applied technology that will enable students to be more efficient and effective in the Graphic Design industry. That is buttressed by Creswell (2021), "Technology has positively affected the design industry by helping designers improve on their skills and work". The findings of this study will enable policymakers including the Ghana Tertiary Education Commission (GTEC) of the Ministry of Education, the University Council, and lecturers in the department, to make the needed alignments as regards the curriculum to reflect the 21st-century skills on demand by the Graphic Design industry players.

Gyau & Obiri – Yeboah (2011) stated that "the concept of Graphic Design simply means the birth of a skill-oriented career where all forms of visuals are used to communicate effectively. It is the rationale behind one's ability to create something out of nothing with the ultimate goal of informing, projecting or announcing a message in an organised format". Meggs (2002), also defines Graphic Design as the art and profession of selecting and arranging visual elements such as typography, images, symbols and colours to convey a message to an audience. More so, Hollis

(1994), defines Graphic Design as a form of visual communication. More precisely, it is the business of making or choosing marks and arranging them on a surface to convey an idea. Given the outlined definitions from different authors, the researchers believed Graphic Design could be defined as an essential tool for communicating to both the illiterates and literates, mainly because it has to do with visual communication. Nonetheless, "Technology is the application of science, engineering and industrial organisation to create a human-built world", (Alfred and Richard, 1999). Moky (1990), stated that "By technology progress and advancement the researchers meant, any change in the application of information to the production process in such a way as to increase efficiency, resulting in either in the production of a given output with fewer resources (i.e. lower cost), or the production of better or new products". Graphic Design has been all about technology since computers were invented years ago. Technology is the heartbeat of a Graphic Designer. Before computers were invented, Graphic Design was done manually to make postcards, call cards, posters, banners, signposts, signboards, greeting cards, and many more. According to Meggs (2002), Graphic Design has been practiced in various forms throughout history. Indeed, strong examples of Graphic Design date back to manuscripts in ancient China, Egypt and Greece. As printing and book production developed in the 15th century, advances in Graphic Design developed alongside it over subsequent centuries, with compositors or typesetters often designing pages as they set the type. Graphic Designers were by then used to stenciling, block printing and illustrating manually with their hands. Meggs (2002) stated that "in the late 19th century, Graphic Design emerged as a distinct profession in the West, because of the job specialisation process that occurred there and partly because of the new technologies and commercial possibilities brought about by the Industrial Revolution".

In the late 19th and early 20th centuries, advertising agencies, book publishers, and magazines hired art directors who organised all visual elements of communication and brought them into a whole. In 1922, a typographer William A. Dwiggins coined the term Graphic Design to identify the emerging field. Thus, the transition of Graphic Design with the introduction of Computer Technology into the system. Throughout the 20th century, the technology available to designers continued to advance rapidly, as did the artistic and commercial possibilities for design. Indeed, the technology of using computers for designing was unavailable in the few tertiary known institutions and, in the country, as far back as the last quarter of the 20th century.

By the 21st century, Graphic Design had become a global profession as advanced technology and industry spread worldwide. The evolution of Graphic Design as a practice and profession has been closely bound to technical innovations, societal needs, and practitioners' visual imagination. In the words of Meggs (2002), "now in the 21st century, technology has really improved the outcome of works done by Graphic Designers, in terms of printing graph and more".

"Graphic Designers rely on powerful software to get their jobs done. Complex visual manipulations that used to be laboriously done by hand are now performed easily and quickly on a computer," (Schools, n.d.). With the introduction of technology, work has been made easy. Graphic Designers work faster and effectively and can produce many works at a goal. As we all know, technology has the upper hand in the Graphic Design sector, and if not upgraded personally,

it could make an individual left behind time and progression. Graphic Design with Computer Technology training for HND students at the Department of Graphic Design Technology of the Faculty of Applied Arts and Technology, Takoradi Technical University, which was practically oriented, is being boosted and enhanced with 21st-century software and a series of applications for effective teaching and learning. Consequently, there is a need to appraise how Graphics technologies have influenced the Graphic Design programme, which will help Graphic Design students know the impact technology has on the programme being it positive or negative.

Statement of the Problem

Considering the artistic developmental needs of the country, the three year Higher National Diploma in the Commercial Art Programme (Graphic Design) was set up to meet the growing demands of the Graphic Design industry. Based on this fact, it has been observed that the Department of Graphic Design Technology lacks a wide range of immerging technologies linked to the Graphic Design programme. As a result, students' deficiency of knowledge about most of these technologies with new trends is making them fall behind regarding the influence of technology on Graphic Design for the vibrant industry. Due to this, most students do not see or value the essence of using the latest technology, nor do they value the core and the need to upgrade them. Since the Higher National Diploma in Commercial Arts (Graphic Design) was introduced in the year 1995, only the computer and software applications such as Photoshop and Corel draw were introduced to students, making them limited in knowledge and hands-on skills and depriving them the knowledge of the impact of a wide range use of current trends with technology. Consequently, the researchers believe there is a need to study and research the role of current technology and its influence on the Graphic Design programme students are studying and the benefits the industry will derive from them.

Objectives of the Research

1. To identify and discuss the effect of technology and possible gaps in the Graphic Design Programme.
2. To assess the various Computer Graphics equipment in the department's laboratory.
3. To discuss the importance and the need to bridge the gap of modern technology in the Graphic Design Programme.

LITERATURE/THEORETICAL UNDERPINNING

Education is changing so much in the world in the 21st century. The Theoretical Framework for the study involved the Experiential Learning Theory or ELT. The concept of Experiential Learning is to provide students with both hands-on practical training and theory exposures (Kreber 2001; Larsen et al., 2017; Roberts 2018). That is the closest theory linked to the study. Experiential Learning Theory focuses on learning by doing (University, 2020a). This theory encourages students to learn through experiences that can help them retain information and recall facts (University, 2020b). That is rightly so because the researchers of this study involved Graphic Design students applying technology in their day-to-day theory and practice of the various courses under the Graphic Design Programme. The application of new technologies in the programme will

enable Graphic Design students to be effective and efficient in the Graphic Design industry or as Entrepreneurs.

There are five main Educational Learning Theories available to educators to impact knowledge to students at all levels of education ladder. According to Pulsipher (2020) the five learning theories include Cognitive Learning Theory, Behaviourism Learning Theory, Constructivism Learning Theory, Humanism Theory and Connectivism Theory. Nevertheless, there are other additional learning theories developed in the 20th century as well. They include Transformational Learning Theory, Social Learning Theory and Experiential Learning Theory.

For the purpose of this study the latter (Experiential Learning Theory or ELT) was employed in carry out the research. For this reason, new trends of technology in the Graphic Design profession could be introduced to students (knowledge) and as they practice (hands-on-training to acquire skills) will add more value to the existing ones. Although, Kolb's conceptualisation of ELT came from pioneered theorists including John Dewey, Kurt Lewin and Jean Piaget. He identified four stages of ELT. In the words of Pulsipher (2020), the first two (Concrete Learning and Reflective Observation) focus on grasping an experience. In this case the experiences the study respondents will derive from the lecture rooms, theatres, laboratory and studios from the tutorials and demonstrations will enhance and deepening their understanding of the new technologies in the programme hence to bridge the gap between theory and practice.

Mork (1994) states that the history of Graphic Design dates back to the days when drawings were made on the cave walls and decorations made on pottery. The term and profession Graphic Design and Graphic Designer respectively came up in the 20th century. Graphic Designers assemble images, typography, or motion graphics to create a piece of design. It involves producing ideas, creating layouts, digital editing, typography, producing graphics, typesetting, printing and presenting the final product or designs (Kazan, 2019). As a consequence of the changing educational climate which is being directly shaped by global, economic, social, political and technological issues, institutions of Art and Design are now seeing a dramatic change to the way in which design education is taught (Marshalsey & Sclater, 2018).

Technology-based knowledge in Graphic Design is a vital component of the Graphic Design programme of study, designed to equip students in the department with hands-on skills in theory alongside practice for the job market in the Graphic Design industry. Endowing students with adequate data on technology education and benchmark/modelling them to rehearsing as part of course activities would broaden their reasoning in graphics technology, equip them with practical skills, and bridge the gap between ancient technology and contemporary technology associated with Graphic Design. Hence, students will acquire imperative technical knowledge and practical skills in modern technology-related subjects in Graphic Design. Traditionally, design students are influenced by research channelled directly from their interactions with educators (Marshalsey & Sclater, 2018).

(Gyau & Obiri – Yeboah, 2011) stated that "the concept of Graphic Design means the birth of a skill-oriented career where all forms of visuals are used to communicate effectively. It is the rationale behind one's ability to create something out of nothing with the ultimate goal of informing, projecting or announcing a message in an organised format". Meggs (2002), also defines Graphic Design as the art and profession of selecting and arranging visual elements such as typography, images, symbols and colours to convey a message to an audience. Hollis (1994), also defined Graphic Design as a form of visual communication. More precisely, it is the business of making or choosing marks and arranging them on a surface to convey an idea.

The researchers believe that Graphic Design is all about art, skills, and visual communication based on the definitions above. Looking at the practical nature of Graphic Design and what it entails, Hollis (1994) made a point that it is more precisely the business of choosing and arranging marks, which conveys messages to a target group. Given all that has been outlined, Graphic Design is an essential tool for communicating to both illiterates and literates because it communicates visually. The profession gained popularity in book design and general print design. Typography technology developed in the early 20th century when designers claimed fonts, logos and stamps as their own. Graphic Design became famous as a result of advertising, packaging and printing. Graphic design firms sprung up, leading to the first Graphic Design School- Bauhaus, founded in 1919 in Germany. In the 1980s, computers began to be used, and they became the standard for Graphic Design. Bonsiepe (1994) writes that by tradition, it is known that the Graphic Designer is mainly a "visualiser", one who organises visual components that are then reproduced with the aid of printing technology. Subsequently, we find the list of objects of professional actions: logotypes, stationery, book and magazine layout, advertisement and campaigns, exhibitions, displays corporate identity systems and signage systems. Most of the project works of students fall under these categories of works. Thus, these students could also be referred to as "visualisers" because they organise and reproduce visual components with the aid of technology to bring out their works. Margolin (2000), in a journal concerning Graphic Design, says that Graphic Design does not have a fixed meaning; it was first used by the American book and advertising designer W. A. Dwiggins in 1922. During that period, Graphic Design was a profession about typography, book design or advertising design. By the mid-20th century, designers worked on a large scale; they got involved in exhibitions, urban signage projects and corporate identity programmes, which brought about the term communication design. There has been additional improvement, especially in the digital realm, where designers use text, images, sound, and others that work hand in hand with film making and sound design. These days many products (graduates) of the Department of Graphic Design Technology find themselves in firms and companies making use of digital visuals and sounds in their daily demands, hence the name Communication Design in the 21st century instead of Graphic Design in some state-owned and private institutions. As regards this, technology plays a significant role in Graphic Design.

According to Margolin (2000), some of the things that make current Graphic Design different from earlier times include the proliferation of new media and software. While it is true that Graphic Design software continually updates with AI-driven enhancements, these facilitate, rather than replace creativity. The Graphic Artist, the idea maker using the technology, will always be human

(College, 2021a). According to him, designing good websites, for example, requires a deeper understanding of cognitive psychology, learning theory, and other social science disciplines than most communication designers have. There are creative jobs, and there are technological jobs — and there are jobs that are both. Graphic Design is a perfect example of work that requires both creativity and mastery of technology. The career of a Graphic Artist is an adventure in continuous growth and learning. Exciting new challenges are always around the corner, and the technology never stands still (College, 2021b).

Some Technological Advancements in Graphic Design

Holly (2012), in an article, talks about the advancement of Graphic Design, said that, "Graphic Design has come a long way from its days on a letterpress and that technology has aided design at every turn and made it increasingly more straightforward, shareable, and powerful". He clarified that design benefits from programmes such as the Adobe creative suite and innovations with technology such as online file storage has only fueled the power of Graphic Design. According to Holly (2002), previously, Graphic Designers depended on web developers to help create websites. While designers could easily create effective layouts and beautiful content, they need more than design experience to make their sites interactive. Designers had to learn computer and coding languages or hand over their work to more technological savvy collaborators. However, today, Adobe systems have delivered an update to its Web creation tool for designers; one of them is the code-named *Muse Beta 3*. This helps Graphic Designers access the web. Adobe Muse can enable Graphic Designers, according to Holly (2002), to create and publish professional websites without writing code or working within restrictive templates. Already a success, more than 260,000 designers downloaded the technology in the first 40 days after it was developed. This shows the advancement and how ready Graphic Designers are to adapt to technological progress. Another technological advancement shared by Holly (2002) is 'Cloud Computing'. Designers put a ton of effort into creating engaging, quality work. However, large files can be complicated to handle. Designers with high-quality files and complex work quickly find that e-mails are not powerful enough to move those files around. Designers had to transport large files physically, mailing flash drives back and forth. Now, designers have the luxury of cloud computing. By storing their work online, they can deal with much larger files and share them with anyone who has an internet connection. Recently, FedEx and Google Docs (companies) teamed up to make cloud computing and printing even more collaborative computing has been a hugely helpful tool for boosting designers' work, their presence, and their reach.

Nonetheless, these developments have had little influence on the Graphic Design Programme being run, for example there is a set back to the Department's approach on blended learning for proper interactive session. Efforts have been made to address this and other challenges in respect to technological advancement in the programme. The "Adobe Creative Suite" is also a software application for continually evolving designers. It allows Graphic Designers, Animators, and Artists to create what they intended and create it faster. The progressive software keeps designers on their toes by rolling out an update every 18-24 months. These updates make the Creative Suite (Illustrator, Photoshop Extended, Flash Professional, InDesign, Fireworks, Dreamweaver, Flash Catalyst, Bridge, Drive Central and Acrobat) more intuitive and vaster. Updates to the new

software are impressive. The programme has new tools such as perspective drawing for Illustrator and a touch-sensitive brush for Photoshop. It is a great time to be a Graphic Designer, and the growing ability of design technology will free designers to become true designers instead of technicians.

Technology and its influence on Graphic Design in modern times

Technology has imparted and transform many aspects of our lives. Amber (2012) stated that "As technology continues to change at a mind-blowing pace, we should not be surprised that Graphic Design evolves right along with it." As a result, at this stage, the researchers look at what influence technology has had on Graphic Design and view a few examples of today's Graphic Design. Graphic Design has been evolving and changing throughout the years, often redefining the definition of form and functionality while it does so. However, why has Graphic Design changed so rapidly in the last decade? Thanks to the ever-rapidly developing technology used to create, display, and even print Graphics and art. People are seeing designers push themselves and the boundaries as to what we define as Graphic Design. Noble and Bestley (2004) stated that "It is clear that the designer's field of operation (a phrase the authors have borrowed from the Dutch Graphic Designer educator, Jan Van Toom) has changed considerably in recent years. A major influence on this has been technology and continue to be". These changes can be seen in the various courses being run at the Graphic Design Programme but at a slow pace; in a few cases the changes cannot be recognized.

Amber (2012) further stated that "thanks to the advent of faster, more powerful computers and faster internet, we expect our Graphics to be of higher quality. We as viewers expect more colours, higher resolutions, and more detailed designs because our computers can handle these Graphics; whereas even as little as five years ago, Designers had to be mindful of what they could unload onto us". Now we fully expect art and design that seem to jump right out of our computer monitors, signage, or product packaging. Thanks to Graphic tablets, new design software, and advances in printing, designers can get creative, and one can design almost everything without limitation. Imagine how much faster a Graphic Designer can create things with a tablet rather than using a mouse to do all of their work. Moreover, with design suites like Adobe Creative Suite, illustrators and much more updated software feature robust options for designers to utilise in new and often unexpected ways. Now that technology has branched out, and it has offered designers hundreds of programmes to choose from, there are almost as many Graphic Design methods as there are Graphic Designers out there.

Amber (2012) further noted that, "sure we want more colours and more details, but some of the best designs offer something more immersion. People expect to be pulled in by design, whether product packaging or a movie poster, web design or digital art. We expect our Graphic Designers to utilise the powerful technology around them to create a world at a glance. As designers, we also receive most of our work through electronic means, be that e-mail, portfolio websites or just through forums, dropbox and the likes. After all, is not it nicer to browse a website that feels like it tells a story about a company, product, or individual rather than browsing one that feels very sterilised and cold?"

"With a traditional paper portfolio, it is rarely possible to accommodate all our works. With a laptop, we can take everything" (Shaughnessy 2010). This piece of Shaughnessy brings us to the light of how technology has made it easy for works of Graphic Designers to either be kept or sent to clients, especially with the fact that one can now stay far and still have works done.

Dealing with press impacts, Ausrine (2008) stated that "new technology has had a significant influence on the field of Graphic Design because of printers and scanners, internet and designing programmes". With this, Shaughnessy (2010) has further enlightened us on the impact of technology on Graphic Design. Printers used in the printing industry as of now can print high-resolution images, blending inks to create true-to-life representations of what you see on a computer monitor, allowing for bolder designs on more materials than ever before. Today, designers and printers could run over a thousand copies without delay. Finishing, binding and cutting of printed works are done with complete ease, and less caution is taken. This has been possible and achievable due to the advanced technology of equipment, machinery, software applications and the likes via computer technology applications in Graphic Design.

So far, as regards the research topic, it has been proven that technology has a great influence on Graphic Design through:

1. Several software programmes were introduced for Graphic Designers to make their works look more realistic and appealing. It has also enabled colourful works to be seen all over social media platforms for countless forms of advertising, promotions, and many others.
2. The introduction of computers and their accessories, printers, cameras and many more to do work at the press and Graphic Design studios easier.
3. The institution of the internet has enabled Graphic Designers to do more research about their work, thus enabling them to enhance their creative concepts and output to be competitive in the global markets.

Thanks to advances in technology, printers, animators, artists, photographers, typographers, web designers and package designers, and others are developing varied methods and styles that continually impress and appeal to many people around the globe.

METHODOLOGY

With respect to the research design, the researchers employed a case study approach with a combination of the relevant aspects of qualitative research methods to gather comprehensive views and experiences of respondents to understand better the influence of technology on the Graphic Design programme in the department. Plowright (2010) participant-as-observer methodology and a face-to-face semi-structured interview with designated lecturers and students were the main instruments used to collect the study's primary data. In this method of research strategy, the researchers took a more active participatory role in the laboratory activities to observe occurrences therein. The observations, therefore, was carried out in a naturalistic setting, and the participants were aware they were being observed.

According to Payne and Payne (2004) interview is one of the research instruments which deal with data collection in face-to-face settings, using an oral question-and-answer format. It either employs the same questions in a systematically and structurally way for all respondents, or allows respondents to talk about “issues in a less controlled but discursive manner (Guest, 2013). Nonetheless, for the purpose of this study, a semi-structured interview was adopted to gather data from selected study respondents and head – Department of Graphic Design Technology. The semi-structured interview was used by the researchers to effectively collect qualitative open ended data from the respondents (lecturers and students) in the Department of Graphic Design Technology. It was more so, used to unearth thoughts, feelings and believes from the study respondents in respect to the influence of technology on the Graphic Design Programme.

The qualitative analysis took the form of interpreting specialised views and content analysis of interviews and documents, while quantitative analysis took the form of descriptive statistics such as correlations, frequencies and percentages supported with very few relevant tables. Specifically, the non-probability purposive sampling procedure was used. According to Onwuegbuzie and Leech (2007), with the non-probability purposive sampling technique, a researcher chooses respondents thought to be of most relevance to the survey and takes appropriate steps to reach the sample. Hence, they are at a better position to outline the influence of technology in their studies. In this regard, the purposive sampling was used to select one hundred and twenty-eight (128) students from levels 200 and 300, respectively, pursuing a Graphic Design programme with six (6) teaching staff in the department. All 128 (100%) copies of a set of questionnaires were retrieved and analysed.

RESULTS AND DISCUSSION

This section of the study analyses the data obtained from the survey and uses very few tables to depict the findings diagrammatically. The data analyses were undertaken with a focus on the set objectives. The analyses involved making comparisons of variables measured and finding connections between variables; the identification, description and discussion of various sample proportions (the proportions of respondents in the sample with specific characteristics). Nevertheless, the response rate for the study was 100%.

The Impression of Technology on the Graphic Design Programme

It emerged from the data on the part of the teaching staff that 4 (66%) respondents specified that they integrate technology in their courses as stipulated in the programme. One (17%) said they accommodated it for a few minutes. The remaining percentage 1(17%) responded that they do not include it in the courses they teach since it is not included in the curriculum. Furthermore, 6(100%) of the teaching staff strongly agreed that technology is incorporated into the curriculum in their courses. The courses included; Packaging Technology, Printmaking Technology, Advertising Technology, Computer Graphics, Typography, Photography, Printing Technology and Camera Operation. As the lecturers impart knowledge of technology education in graphic design at their various lecture halls, theatres, and computer laboratories, the students on the spot can grasp a skill.

"Through the use of technology inside and outside the classroom, students can gain 21st-century technical skills necessary for future occupations" (Washington, 2020).

Regarding whether technology is incorporated into the Graphic Design curriculum, it was evident from the data that students (both 2nd and 3rd years respectively) who strongly agreed were 102(80%). The remaining 26(20%) who responded otherwise disagreed that just diminutive of the technology is incorporated in the various courses being offered in the Department of Graphic Design Technology. To the researchers' knowledge, although some first years have been introduced to Technology Education earlier prior to their University admission, they have little exposure as compared to both the 2nd and 3rd years who have had it for 2-3years respectively.

In connection with data of the number of students exposed and had had an encounter with technology, interestingly, all 128 respondents have an idea of what technology is and its impact on the courses they are studying under the Graphic Design Programme. A few respondents in the 3rd year; according to them, they have had some level of exposure to technology before starting the course in the Department of Graphic Design. The data gathered from respondents indicated that 29(23%) of the 2nd years agreed that they had had experience with the usage of technology earlier; whereas 41(32%) by another section of the 2nd years were of the similar view while 58(45%) of the 3rd years shared similar opinion that they have had an opportunity with the practice of technology. This indicates that students pursuing the Graphic Design Programme in the department have some level of experience and knowledge in technology practices in the numerous courses. The researchers presumed this is a good fundamental representation knowledge-based of the programme and its average influence on the students in the department despite some major challenges that need to be addressed. Therefore, the direction the department has been preparing its students to fit into the 21st century on the job market in the Graphic Design industry is laudable and should be sustained. It also implies that the department is doing well to meet the industry demands in this rapidly changing world. For instance, in terms of software application to manipulate designs faster and easier to implement ideas for clients.

Regarding teaching staff years on the exposure to modern Technology related applications in the various courses, the lecture data revealed that 1(17%) had had the practice of technology for up to 10 years while 3(50%) had exposure to the course for between 11-16 years; whereas only 2(33%) had exposure over 20 years. This indicates that selected staff who handle the students pursuing HND in Graphic Design have exposure in terms of the requisite technology knowledge base. This is to impact appropriate hands-on training in terms of the Graphics Technology skills to their students vis-à-vis the current technology trends as the industry expects graphic design graduates to be well equipped with all the intrinsic worth associated therein. Furthermore, it suggests that the department has the right requisite lecturers to handle the technology-related knowledge and skills to affect the technical know-how to students to fit well in the job markets after graduation.

Computer Graphics equipment in the department's laboratory**Table 1: Adequate equipment in the department's laboratory**

Answer variation	Frequency	Percentage (%)
Strongly disagree	24	19
Strongly agree	104	81
Total	128	100

Source: Authors' Field Survey (2021)

The above data indicate the respondents' views as regards Table 1. It shows 24(19%) strongly disagree that equipment found in the department are obsolete and need replacement to reflect the current trends of modern Graphic Design laboratory to benefit the department. However, the remaining 104(81%) strongly agree that both lecturers and students currently displayed and used equipment are archaic and need immediate replacement. The equipment presented at the department's laboratory includes desktop computers (old-fashioned) and a projector. Through Plowright's observer-as-participant methodology (2010), the researchers observed that the existing computer laboratory room, which takes a maximum of 51 students, is too small to accommodate the current number of HND levels 200 and 300 Graphic Design students, respectively. Per the data available to the researchers, the existing number of HND level 200 is 307 students and that of those in HND level 300 is 234 students. However, it must be emphasized that these levels of students' class sizes have been divided into three equal parts 2A, 2B, 2C, 3A, 3B and 3C. Therefore, any time there is a Computer Graphics course, evidence revealed that the class size is further divided into shift systems by the lecturers involved to have proper teaching and learning sessions. This indicates that the Department of Graphic Design needs major changes in the Computer Graphics Laboratory to meet the growing learning trends and enable its students to acquire the needed skills to be effective and efficient in the ever-changing Graphic Design Industry in Ghana and beyond. The changes could include a bigger space to accommodate the growing number of Graphic Design students in the department; the expansion of various facilities in the department's laboratory. It behooves on the department to take the task to ensure that the department computer laboratory is transformed to meet the current trends of the course.

In the 21st century, every technical tertiary institution needs adequate and well-equipped studios, laboratories, workshops and others for proper demonstrations to impart the right knowledge to their students. Again, it is to enable the students to have hands-on training to acquire the technical know-how to fit into the sections of the Graphic Design industry. Moreover, using Plowright (2010) participant-as-observer methodology, the researchers noted that the Graphic Design Department of the University is not well equipped to translate adequate Graphics Technology knowledge-based to its students. Given this, the researchers wanted to know from respondents if the Department of Graphic Design is using the needed equipment to run the Computer Graphics course. Subsequently, feedbacks indicated that the department has some general equipment that keeps the Computer Graphics laboratory running. More so, internet connectivity in the department is sporadic, affecting quality teaching and learning processes regularly.

It is also an indication that the influence of technology on the Graphic Design Programme, TTU is flowing into students' performances in the industry. Evidence from the industrial supervision reports suggest that Graphic Design Students perform creditably well in their respective industry-based attachment.

However, the lecturers believe the University could procure modern equipment to augment the existing ones available at the department. The respondents (students) conceived that there are much more the department can do to enhance the teaching and learning of Computer Graphics Technology in the Department of Graphic Design.

A respondent asserted that the department lacks the necessary equipment to prepare students for the job market in the industry adequately. One scanner in the department is not in good shape, thereby affecting the quality delivery of some computer-related skills. More so, 51 desktop computers available to the department is outmoded, which hitherto are not in good shape. On the other hand, a respondent believed that the department lacks some modern technologically advanced equipment to better implement the Computer Graphics Technology in the Graphic Design Programme.

For better and effective teaching and learning of the computer technology education-related skills, there should be adequate computer logistics to assist the teaching of the course in the department. Other respondents believed that the equipment needed to make teaching and learning effective includes desktop computers, scanners, printing machines, cameras, studio projectors, high-speed internet connectivity, etc.

Perceptions of what Students and Lecturers think has changed about Graphic design over the years

The data gathered gives valid accounts of what respondents think has changed about the Graphic Design programme over the years in the department. Fifty-eight (45%) of the respondents assumed that Graphic Design has changed over the years concerning technology due to new software. Hence, 38 (30%) of the students believed that the inclusion of technology in the graphic design programme is encouraging and help students learn and work faster. This avowal by the students is more so, buttressed by Meggs (2002), "now in the 21st century, technology has improved the outcome of works done by Graphic Designers, in terms of printing, photography, and more". In addition, 32 (25%) students alleged that the invention of computers, equipment and various technologies brought about the change in Graphic Design in relation to technology.

Few decades ago, teaching and learning of Graphic Design in tertiary institutions in Ghana were done manually. They included Animation, Photography, Printmaking, Typography, Advertising, Packaging and many more, but now graphics technology software has augmented the Graphic Design sector and has put a halt to some manual works that took several hours to be executed. It shows how well students have become skilled at existing technology in Graphic Design education. Graphic Design is now much easier and faster with Graphics Technology associated software. The respondents have brought about speed, accuracy, and effectiveness in the graphic design industry.

As a result, the Graphic Design industry can execute more works within a short time and in good quality. Once more, this claim is also reinforced by Meggs (2002), "now in the 21st century, technology has improved outcome of works done by Graphic Designers, in terms of Printing, Photography and more".

On the contrary, the data reveal interesting statistics on this issue. Two-thirds (67%) of the respondents believed that nothing much has changed over the years as far as the teaching of Graphic Design is concerned and that they still use the old ways. Nonetheless, one-third of the lecturers thought that the change about the Graphic Design programme in the department over the years is that students being trained now cannot acquire much knowledge and the technical know-how so far as the industry's demands and trends are concerned. That might be because students do not have access to enough equipment, which would impact the students' studies. Accordingly, the use of participant-as-observer in the department's computer laboratory suggests that much has changed in delivery by the teaching staff but not limited to the various accessories that go a long way to improve the teaching of technology-related issues.

Importance and Uses of Computer Technology in the Graphic Design Programme

Study participants gave two different views regarding this particular item. The discoveries show that 25(20%) of the respondents shared views stating that they use technology by the use of installed software on their computers and by the use of the internet to research under the various courses. One hundred and three (80%) stated that they also use technology to design packages, in the photography discipline for editing, and in the printing for designing layouts, in the advertising course for designing posters, signage et cetera. Considering the diverse views, study respondents attested using technology in their various courses of study, including software such as Adobe Photoshop, Corel draw, and Adobe Illustrator to design. Evidence from the Industrial Attachment Supervision Programme organized annually by the Industrial Liaison outfit of the University suggest that managers of industry in the Graphic Design field expect students to be equipped with new technology in the field. The acquisition of these technologies is to enable students improve their capacities to be able to cope with industrial demands in terms of manpower requirements for Ghana. The above finding is supported by Margolin (2000), "some of the things that make current Graphic Design different from that of earlier times include the proliferation of new media". Nevertheless, it must be emphasised that the students' few software learnt is not enough to meet the ever-changing world in the Graphic Design discipline. Although the current Graphic Design curriculum, which was sketched years ago, provides the above to be used to teach the students, the trends have changed rapidly in the last decade.

However, the data from the lecturers show that 5(83%) talked about using the software applications such as Adobe Photoshop and Illustrator, Sketch, Motion Graphics, Affinity Designer, CorelDraw, et cetera in lecturing, demonstrating, online teaching and assessment and the use of the internet to carry out their research. This assertion is strengthened by Amber (2012), "thanks to the advent of faster, more powerful computers and faster internet, we expect our graphics to be of higher quality. We as viewers expect more colours, higher resolutions, and more detailed designs because our computers can handle these graphics; whereas even as little as five years ago, designers had to be

mindful of what they could unload onto us". More so, 1(17%) shared their view using gadgets such as the projector and laptops as a helping aid in their day-to-day lectures.

On the part of the students, respondents were asked to state the practical and theoretical knowledge and skills they have acquired from the use of computer technology in the course they studied. Few respondents stated that they have not acquired any skill since they came to 2nd year not long ago. In the words of Philip B. Meggs (2002), "now in the 21st century, technology has really improved the outcome of works done by Graphic Designers, in terms of printing, photography and more".

Evidence from the data shows that 3(2%) stated that practically they have learned how to manage time and meet deadlines of works and projects assigned to them by their lecturers. Nonetheless, Eighty-five (61%) of the students emphasised that they have acquired skills through different kinds of software. Eight (6%) stated that theoretically, they have learnt that it is not right to use a person's image without his or her knowledge even if it is of good use or even if it will benefit the individual; hence, permission must be sort before using someone's image. Five (4%) stated that they acquired theoretical and practical knowledge in Photography, Printing technology, Advertising Technology, Typography on how to use the camera and its equipment. Additional proof suggest seventeen students gained creativity and thinking ability, whereas (15%) of them stated categorically that they could generate concepts and design at a short-given time. Few (9%) respondents stated that they are now familiar with any equipment associated with their coursework. Hence, students' ability to fathom the evolved technology in the graphic design programme is encouraging. Nevertheless, a lot more need to be done to improve on the existing ones.

Challenges faced with technology in the Graphic Design Programme

Despite the main objectives having been dealt with extensively in the earlier discussions, some challenges regarding the technology in the Graphic Design programme cannot be unheeded. Indeed, every innovation comes with its challenges; nevertheless, the innovators resolve the identified challenges as time goes on. Findings from the data revealed that 39(30%) of the participants talked about the regular update needed in their day-to-day technology education activities. If their systems are not updated, they descent behind time. In addition, 61(48%) find it challenging to manipulate tools associated with technology. Software including Motion Graphics, Adobe After Effects, Adobe Illustrator, Premiere Pro and Adobe Photoshop, 28(22%) of the respondents itemised that it is quite expensive since most software applications are not for free and have to be purchased from a source online. This is bolstered by the "Adobe Creative Suite", a software application for continually evolving designers. It allows Graphic Designers, Animators, and Artists to create what they intended and create it faster.

Furthermore, the study identifies some challenges associated with the technology on the Graphic Design programme since its implementation two decades ago. It disclosed that all the desktop computers in the computer laboratory have major challenges regarding their core functions to assist students in learning and practicing. Consequently, students are requested to attend lectures with their laptops. It was expected that the current desktops in the said department's laboratory would have been replaced long ago. This would have enabled students who cannot afford laptops yet have desired to learn and practice the courses to rely on those at the laboratory until they can afford them.

Substantiated on the current industry supervision experiences, the researchers asserted that in the 21st century, industry players (managers and employers) hire or employ the services of Graphic Designers with proficiency in software (Adobe After Effect, Premier Pro, InDesign, Adobe illustrator, Adobe Photoshop and others) or to a large extent a combination of these. The expectations from designers including to manipulate and creatively design or arranging all kinds of visual elements for the general public consumption in wide areas such as Packaging, Advertising, Photography, Printing and others. This assertion is espoused by IPL (2017b), "Programmes such as 'Adobe After Effects' had increased productivity in the motion industry as it allows designers to create animations in a concise amount of time compared to when they were traditionally analogue created". Indeed, these are the skills and competencies managers of the various Graphic Design firms in the sector require or expect from students. This is vital for the industry's rapid growth. These are a few claims the industry players are purported to make when supervisors visit various firms for assessing students on internship by the department during the long vacation holidays and semester out programmes.

In addition to the above challenges, the respondents narrated other views concerning the above matters that affect the delivery of technology on the Graphic Design programme. Proof of data from the study exhibits 51(40%) expressed having less adequate facilities such as the computers for constant practice whereas 34(26%) complained about finding difficulties in understanding software concepts. They also find it difficult, mainly because the lecturers do not teach to their understanding. 19(15%) find challenges when they lose works and documents due to regular system breakdowns, computer virus attacks, and the likes.

Implication to Research and Practice

As a result of the findings of this study, the researchers suggest to the university through the department to make an effort and install modern facilities and equipment at the department's computer laboratory for students' study via online research and practice. In practice, the installation of contemporary equipment will assist students to be on top of modern trends regarding the theory in technology which are developed for use on a daily basis. For advanced research, the technology in the Graphic Design programme should be revised to reflect contemporary trends (Affinity Design, Adobe Illustrator CC, Inkscape, InDesign, Premiere Pro, and many others) in the 21st century. Furthermore, that it should be mandatory as a policy by the department for all first-years to possess laptops as soon as they are admitted into the department for intense practical and theoretical research in the field of study. This will enable the Ministry of Education's effort to make the technical/vocation education in the Technical Universities of acquiring hands-on training such as for Graphic Design students fulfilled.

CONCLUSION

The research revealed that Technology Education had had some influence on the Graphic Design Programme despite the numerous challenges. It includes the fact that the programme, according to the data gathered from the respondents, has helped in the acquisition of skills, made working easy,

made learning effective and yet with some technological deficiencies. Hence, the inculcation of technology on the programme needs to be sustained. Among the challenges involves the programme's contents need to be urgently reviewed to reflect the contemporary trends in the Graphic Design industry in the 21st century and beyond.

Recommendations

Based on the findings, the researchers recommend to the University through the department to make an effort and install modern facilities and equipment at the department's computer laboratory for students' study. The technology in the Graphic Design programme should be revised to reflect the contemporary trends (Affinity Design, Adobe Illustrator CC, Inkscape, InDesign, Premiere Pro and many others in the course in the 21st century).

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