AN INTERDISCIPLINARY APPROACH TO MEDICAL EDUCATION: THE ROLE OF VISUAL MEDIA IN TEACHING AND LEARNING OF "GROSS HUMAN ANATOMY" AT THE UNIVERSITY FOR DEVELOPMENT STUDIES, TAMALE, GHANA

By

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A thesis submitted to the Department of Educational Innovations in Science and Technology, Kwame Nkrumah University of Science and Technology, Kumasi in partial fulfilment of the requirements for the degree of

DOCTOR OF PHILOSOPHY IN ART EDUCATION

March, 2019

DECLARATION

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person anor material which to a substantial extent has been accepted for the award of any other degree or diploma at Kwame Nkrumah University of Science and Technology, Kumasi or any other educational institution, except where due acknowledgment is made in the thesis.

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ABSTRACT

Anatomy science and visual media are interconnected and serve as key components in the medical education curriculum. Similarly, visual media and visual art-based interventions have the potential of facilitating medical education for clinical practice. However, there is no visual art-based intervention framework for integrating visual media in the pedagogy of Anatomy at the School of Medicine and Health Sciences of the University for Development Studies, Tamale. The main objective of the study was to investigate how visual media and visual art-based intervention framework can be integrated in the pedagogy of the medical school. The study was important because the findings will be beneficial to lecturers and students since the developed framework will provide the basis for integrating visual media more effectively to improve teaching and learning of Anatomy. The study employed the explanatory sequential mixed methods, with experimental and descriptive research methods. The researcher employed observation, interview, questionnaire, focus group discussion and an experiment as tools to collect data for the study. A sample population of 234 was chosen using stratified random and purposive sampling techniques. The study revealed that although, the medical school had enough Anatomy models the students did not utilize them during tutorial sessions where they are expected to engage and explore visual media to enhance understanding of concepts taught; visual images of two and three-dimensionality were found to be effective in enabling the students to achieve their objectives of learning Anatomy; and testing of hypotheses established that the developed framework was effective in improving students' critical thinking and observational skills. Hence, the developed framework will augment other existing approaches to the teaching and learning of Anatomy. The study recommends that the developed framework should be incorporated into the medical school's curriculum to enrich the education of students in Anatomy. Further researches are needed to identify how other medical humanities and medicine can be explored to develop students' knowledge and skills to offer effective compassionate care to patients during physical examination.

DEDICATION

This thesis is dedicated to the staff and students of the School of Medicine and Health Sciences of University for Development Studies, Tamale.

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ACKNOWLEDGEMENTS

I thank my supervisors Dr. Mrs. Akosua Tachie-Menson and Dr. Harry Barton Essel for offering valuable suggestions and taking the pain to reshape the content and structure of this thesis to an appreciable standard. I sincerely thank the entire lecturers of the Department of Educational Innovations in Science and Technology for the immense suggestions they made to help reshape this thesis. I am heavily indebted to Mr. Evans Ameade John, a lecturer at the department of Pharmacology, UDS Medical School, Tamale, for his selfless and relentless assistance during data collection, analyzes and processing which made possible the successful completion of this thesis. I would also like to express profound thanks to Dr. Abass Alhassan - Head of Department of Anatomy; Mr. Saeed F.

Majeed - Head of Department of Physiology and Biophysics; Mr. Kwame Opare Asamoah, Lecturer at the Department of Anatomy; Dr. Femke MatorwmasenAkkermans - Skills Training Coordinator for sharing useful suggestions with me and permitting me to sit in their lectures to observe lessons taught during data collection. I thank Dr. Der Edmond – Head of Department of Pathology, for granting me audience for an interview. Further, I would like to thank the following staff of the UDS Medical School for assisting me during data collection:

The Dean of the Medical School, Professor Francis Abantaga; Senior Assistant Registrar of Medical School, Mr. Kwame-Ohene Amponsah; the Head of Registry of Main Administration, Mr. Alhassan Paul Nabila; Madam Patience Adiikanbasi; Dr. Baba Sulemana Mohammed Head of Department of Pharmacology; Mr. Lawrence Quaye, Head of Department of Biomedical Lab Sciences; Mr. Mohammed Habib, Principal Library Assistant; Abdulai Fuseini Braimah, Senior Library Assistant; Abass K. Ibrahim, Assistant Librarian and Mr. Victor Mogre, Examinations officer.

I would like to thank Madam Ladi Kanton, the Principal of Tumu Midwifery College; Mr. Mustapha Titi Yussif, Head of Academics; Mr. Paschal Bonoe, Nursing Tutor; Mr. Mohammed Abdulai, Clinical Coordinator, all of Tumu Midwifery College, for permitting me to use the skills laboratory of the college to observe and acquaint myself with anatomical structures at the initial stages of the research. I also thank Mr. Richard Totime Worlako, a Statistician at the Tumu

District Hospital, and Mr. Richard Dery Orizo of the National Service Secretariat for their assistance in processing the quantitative data.

I sincerely thank Mr. Morrow Issahaku, the former Principal of Tumu College of Education; Mr. Adams Kaleo Bertinus, the current Principal of Tumu College of Education, and Mr. Eric Nombare, the Finance Officer of Tumu College of Education, for their continued financial and moral support that enabled me to successfully complete this thesis. I would also like to acknowledge the support of my brother in-law Mr. Haruna M. Alhassan and his wife Rabi Issahaku for hosting me and providing free accommodation each time I was in Tamale to conduct the research.

Further, I am grateful to Rev. David Frampton and his wife Sue; June Whittaker and Comrad Dueck and his wife Belinda of WEC Mission, for the significant role they played in financing my tertiary education. I also thank Rev. Daud Dolinzomor and his wife Patience for their moral and prayer support during my studies.

Also, I am heavily indebted to the following members of my family for their moral and financial support: Inusah Mani, Mathew Mani and Simon Mani, Timothy Mani and Samuel Mani, Rhoda Mani, Lydia Mani as well as Joyce Mani for their moral and financial support during my training. Finally, I would like to thank my wife Comfort Mani and my children Sharon Mani, Faith Mani, Nathanael Mani and Sussana Mani for their patience and moral support while I was studying and conducting this research.

I sincerely thank Mr. Opoku Richard and Akwasi Gyamfi for their financial and moral support during my studies. Last but not least, I thank my colleague Dr. Mohammed Baidoo and Mr. Aantuore Eric of KNUST Unity Hall for their moral support and useful ideas.

CHAPTER ONE

INTRODUCTION

1.0 Overview

This chapter consists of the background to the study, statement of the problem, objectives of the study, research questions, delimitation, definition of terms, abbreviations/acronyms, importance of the study, justification for the study, rationale for the study and organisation of the rest of text.

1.1 Background to the Study

Medical education at the tertiary education level is an important component of the educational system of every nation. It is at this level that medical schools prepare medical students to acquire medical knowledge and skills necessary to function as physicians who will be able to provide high quality healthcare to the Ghanaian citizenry and humanity in general (Mileder, Wegscheider & Dimai 2014; Peluso & Hafler 2011).

Training medical students to acquire Anatomy science knowledge using visual media facilitates students' understanding of what occurs in the human body, and the physical diagnosis they can carry out in order to suggest remedies when the body is wounded, sick or placed under stress (Assefa & Tsige 2003). That is, the role of visual media in enriching students' understanding of Anatomical Science is crucial, because certain complex phenomena that occur in human health are difficult to understand and handle when approached from a single academic discipline or method or approach (Tanasia, Tanaseb & Harsovescua 2014; Klein 1990 cited in Borrego & Newswander 2010).

Several authors have defined visual media based on the qualities of audiovisuals to communicate ideas to promote understanding, retention and recall of information learned. Prem, Tushar, Prithwiraj, Shankar, Sanjay and Sanjit (2015) explain that visual media are teaching aids by which knowledge, information and ideas are communicated to an audience. These visual media are audiovisual instructional materials that can be perceived through the human sense organs of seeing, touching and hearing to make the message, knowledge or ideas better understood and remembered as well as sustain interest (Farooq 2014; Pushpa 2009). Visual media as instructional material can be employed in teaching and learning processes to make the teaching and learning experience more concrete, clearer, valid, effective and efficient (Lecture Notes 2019). Prem, Tushar, Prithwiraj, Shankar, Sanjay and Sanjit (2015) have identified three types of visual media that are used in teaching-learning processes. They are visual materials like slides, overhead projectors, epidiascope, chalk boards, maps, models, posters and photographs; audio-visuals such as television, video tape, computer and films as well as audio materials which comprises radio, tape, language laboratory and sound distribution system sets.

In commenting about the benefits of audiovisuals, Ghulam, Khuram, Naqvi and Nadeem (2015) stipulate that audiovisuals like pictures, models, charts, videos and maps arouse the interest of learners and help teachers explain concepts easily.

Other benefits of audiovisuals are that they draw attention of learners to concepts taught while securing their interests in the information being conveyed to them. They also enable teachers to transmit knowledge, ideas or concepts quickly and efficiently to a large number of learners and at the same time, explain those facts, ideas and processes more clearly, illustratively and elaborately. Furthermore, audiovisuals are beneficial in the sense that they help students to better retain and reproduce information learned systematically in an organized manner (Prem, Tushar, Prithwiraj, Shankar, Sanjay & Sanjit 2015). In medical education, visual media play a key role in facilitating teaching and learning of specific topics in disciplines involving more illustrations and demonstrations such as Anatomy Science in which audiovisuals become indispensable in transmitting medical knowledge and critical thinking as well as observational skills (Souza, Ankolekar, Kotian, Souza & Hosapatna 2014).

In commenting on circumstances that call for interdisciplinary studies approach, Newell (2001) explains that interdisciplinarity is necessitated by complexity, specifically by the structure and behaviour of complex systems. That is, the only justification for the use of an interdisciplinary approach in investigating a phenomenon is that the phenomenon to be studied must be complex with its multifaceted parts interconnected. That is why Newell concluded that the degree to which a phenomenon is complex, and the degree to which its elements are interrelated determine whether an interdisciplinary approach or multi-disciplinary approach be used in investigating the problem.

It is in light of the above observations that Golding (2009) mentions that in interdisciplinary subjects, students explore and integrate multiple viewpoints from diverse disciplines, sub-disciplines and areas of competencies. According to Golding, for effective interdisciplinary teaching and learning to occur, students must cultivate positive conceptions about sub-disciplines or second disciplines that drive interdisciplinarity. If not, students will misunderstand the entire idea, aims and expectations of interdisciplinary teaching and learning, and perhaps, end up with limited competencies. Thus, Golding re-echoed his support for interdisciplinary approaches to medical education by asserting that some complex issues, phenomena or concepts are difficult to comprehend or resolve using a single disciplinary approach. According to Golding, knowledge can only be explored by employing multiple perspectives and ways of thinking. Therefore, "we must educate for both disciplinary and interdisciplinary expertise". Although, disciplinary depth is essential for investigating these complex issues, they require what Howard Gardner called "a synthesizing mind" (Golding 2009, p.2).

The views expressed by Golding are relevant and pertinent to the objectives of this thesis, because in medical education where students are educated to tackle complex health issues about life and death, it is certainly important for students to acquire multiple interdisciplinary intelligences to enable them handle complex and challenging health problems that confront humanity. In this context of interdisciplinary approach, the need for the University for Development Studies (UDS) School of Medicine and Health Sciences to incorporate virtual and physical media in its pedagogy is very important. That is why a renowned educationist and philosopher John Dewey (1859-1952) advocated for interdisciplinary curriculum; a curriculum that focuses on connecting multiple subjects where students are allowed to freely pursue their interest and construct their own paths for acquiring and applying knowledge (Akinsanya 2014).

The School of Medicine and Health Sciences (SMHS) of the University for Development Studies (UDS) initially employed the traditional curriculum to train her medical students when it was established in 1996. Later, the university shifted to using the Problem Based Learning (PBL) methodology in 2007 with the aim of training medical students who will be able to adjust to and cooperate within interdisciplinary teams to provide healthcare to the Ghanaian populace within the Northern, Upper West and Upper East Regions of Ghana (Savanna News 2011).

According to Du, Massoud, Al-Banna, Al-Moslih, Abu-Hajleh, Hamdy and Cyprian (2016), the PBL pedagogy is employed as an education approach in a number of medical universities globally since the late 1960s. The idea behind implementing the PBL system in medical education includes the advancement of efficient knowledge acquisition, self-directed learning, participation, critical thinking, self-reflection as well as developing other competencies that are necessary for success in the health professions. Interdisciplinary study is an effective approach, because it brings together diverse disciplines, including the visual arts, in a comprehensive manner that enables students to develop a meaningful understanding of the complex associations within a topic.

The benefits of integrating visual arts and visual media with problem-based learning in medical education are that teaching and learning become more interesting and productive for both students and teachers (Edutopia 2008). The role of visual arts has also been highlighted in many research findings that provide evidence that education through the visual arts improve not only observational skills but also listening skills, reflective and analytical thinking (Yang & Yang 2013; Bramstedt 2016). Thus, the quest to investigate the role of visual media in teaching and learning of Anatomy calls for an interdisciplinary research approach in order to understand how Anatomy as a major discipline harnesses ideas from visual arts (as a sub-discipline) to promote effective teaching and learning of Anatomy in medical education at the School of Medicine and Health Sciences at Tamale.

According to University of Illinois-Chicago School of Medicine (2017), Anatomy is the identification and description of the structures of living things. It is divided into Human Anatomy, Zootomy or Animal Anatomy and Phytology, which is Plant Anatomy. Human Anatomy is the study of the structures of the human body. There are two ways of looking at Anatomy: Gross or Macroscopic Anatomy and Microscopic Anatomy. In medicine, Gross Anatomy, also known as Macro Anatomy, Surface Anatomy or Topographical Anatomy refers to the study of the biological structures that are visible to the naked eye. The aim is to collect data about the larger structures of organs and organ systems. There are two approaches to studying Gross Anatomy: Systemic Approach and Regional Approach. With systemic approach human body is studied in different systems whiles with regional approach human body is studied in different regions. The end results of both approaches are the same but generally for students of Surgery, regional approach is preferred (Nordqvist 2007).

There are eleven organ systems in the human body. These include Integumentary system such as the meaning of skin, hair, nails, and so on; Skeletal system; Muscular system; Lymphatic system; Respiratory system; Digestive system; Nervous system; Endocrine system which regulates hormone production; Cardiovascular system; Reproductive systems and Biology 230 (Cuyamaca 2019). According to Ameade and Amalba (2015), Anatomy is taught as a foundation course for Level 100 students of the School of Medicine and Health Sciences, University of Development Studies at Tamale, Ghana.

1.2 Statement of the Problem

While lecturers and students at UDS medical school put in their best in teaching and learning of medicine, certain medical concepts in the pre-clinical subjects especially Anatomy are difficult to learn and understand using a single disciplinary approach, or method without the aid of audiovisuals (Rashmi, Sameer, Vivekanand & Rashmi 2015).

Although, lecturers at UDS medical school make efforts in incorporating visual media in teaching of Anatomy, observation studies conducted revealed that visual media identified at the medical school were not fully incorporated in teaching and learning of some topics taught under Anatomy. It is possible that students may find it difficult to understand some topics taught if visual media is not properly incorporated in teaching Anatomy especially, on challenging topics (Kramer &

Soley 2002).

Secondly, observation studies conducted realised that students at UDS medical school did not utilize relevant visual media during tutorial meetings in order to explore them to facilitate understanding of challenging topics taught under Anatomy. The non-use of relevant virtual media and anatomical structures during tutorials impeded the students' efforts in knowledge and skills acquisition through 'self-directed learning, participation, critical thinking and self-reflection' to develop their competencies to the fullest (Jenny, Nikitha, Nimra, Aileen & Rea 2015).

Even though, critical observation is an important skill medical students need to acquire for learning of Anatomy in particular, and for clinical practice in general, preliminary studies also identified that the School of Medicine and Health Sciences did not provide training to medical students on visual thinking and critical observational skills development. The lack of training in the visual artsbased interventions for the medical students to develop their critical thinking and observational skills may result in deficiencies in the students' ability to physically diagnose disease conditions of the human body of patients accurately, and this might be detrimental to humanity (Sona & Norma 2013; Orr 1996). According to Bramstedt, observational skills are prerequisite for the practice of medicine, yet they are seldom formally taught in medical school curricular. Clinical observation entails more than a casual glance; it requires skillful integration of visual information. Bramstedt contends further that the use of Visual Arts in medical school curricular can shape one's visual literacy skills the capacity to identify and analyze facial features (Bramstedt 2016, pp.843-844). The limited attention paid to developing medical students' observational skills could be attributed partly to the fact that observational skills are "seldom taught directly within medical curricula" (Bell & Darrell 2014, p.370). For instance, the research findings of Academy Medical (2004) as cited in Holmboe (2014) on observational skills indicated that some medical educators themselves possess limited direct observational skills. According to Academy Medical, the main task confronting medical educators is how to ensure that the educators themselves possess the necessary clinical skills to effectively observe, evaluate and be able to transfer the skills to medical trainees.

The need to train medical students in art appreciation to improve their observational skills has also been recognized by Harvard University's Medical School (2008) when the school conducted a study on a group of medical students who took art appreciation course at the University. The research findings indicated that the medical students who took art appreciation course at the University's museum, and had opportunity of observing "various works of art to hone their observational, analytical and communication skills" could make more accurate medical diagnoses than their counterparts who did not take part in the art appreciation course (Harvard Medical School 2008 as cited in McMaster University 2017).

Furthermore, while there is documented literature available on how several medical schools around the world integrate visual art-based interventions to enhance medical students' training, no research has been conducted about the role of visual media in the pedagogy of the UDS medical school at Tamale. The lack of documented literature on the role of visual media at the UDS medical school may deny stakeholders in medical education, art educators and researchers the body of knowledge they need to know about the impact of Visual art-based interventions on teaching and learning of Anatomy at the medical school.

Azer and Azer (2016) point out that Anatomy is a discipline that requires spatial visualization in which medical students are expected to manipulate the various components of anatomical structures to appreciate and understand the spatial relationships to the surrounding structures. That is why Bramstedt (2016, pp.843-844) argued that "observation is a key step preceding diagnosis, prediction and treatment". Also, Bramstedt refers to observation as a cautious application of the human senses in looking; it is sometimes thought to have occurred when, perhaps, it has not.

Observation and understanding of the human body are vital elements of both art and medicine that enable both artists and scientists to see things that they otherwise would not notice without observational skills (Ge 2013). Therefore, the limited exposure given to the medical students to interact with a variety of visual media as well as anatomical structures may negatively affect their ability to critically observe, visualize and diagnose the facial features of sick patients in real-life situations. This may be risky to all of us because medical students are trained to become 'tomorrow's doctors' to deal with health issues which directly affect our lives. Their ability to save lives is partly dependent on the richness of training they receive while they are students.

Azer and Azer (2016) argue that though Anatomy textbooks are useful in presenting two-dimensional static anatomical images, they are of limited value in learning physical three-dimensional anatomical structures. The implication is that, over dependence on illustrated images found in Anatomy textbooks may limit students' ability to observe and manipulate medical objects of threedimensionality to identify the interplay between the parts and the whole. Also, they may not be able to relate the 'parts' to the unified 'whole' as advocated by Gestalt's theory of learning (Man-Wai 2012). That is why Orr (1996) said most students who graduate without broad integrated sense of how the body of knowledge is unified may graduate with limited knowledge. Thus, the consequences of the limited knowledge students acquire can have telling effects on themselves and the society in general. The concerns expressed by Orr reechoes the need for medical educators to provide learners with sufficient learning opportunities to explore their competencies fully from 'disciplinary' and 'interdisciplinary' perspectives with the visual arts (Golding 2009 as cited in Kerry 2015). If this risk is to be minimised or avoided, then medical students must be given sufficient opportunity to explore various visual media to improve their knowledge in Anatomy for practice. It is when the medical students have a "substantial role to play in integrating relevant visual art concepts with their existing knowledge in anatomical science" (Man-Wai 2012, p.2), then they can be said to have benefited holistically from medical education.

Hence, this study sought to investigate the visual media that are integrated into the teaching and learning of medical sciences particularly, Anatomy; to establish and discuss their effectiveness on teaching and learning so as to propound an appropriate measure to incorporate the visual media and medical education to improve teaching and students' critical thinking and observational skills.

1.3 Objectives of the Study

1. To find out and describe the kinds of Visual Media and Audio-visuals (Audio-visuals, models and medical atlases) used for teaching and learning of selected topics in Gross Human Anatomy at the School of Medicine and Health Sciences of UDS in Tamale.
2. To analyze the effectiveness of Visual Media, (Audio-visuals, models and medical atlases) on teaching and learning of selected topics in Gross Human Anatomy at the School of Medicine and Health Sciences of UDS in Tamale.
3. To conduct an experiment to inform decisions to develop a suitable Visual Art-based framework to integrate Visual Media and Medicine to improve students' critical thinking, observational skills and understanding of topics in Gross Human Anatomy at the School of Medicine and Health Sciences of UDS in Tamale.

1.4 Research Questions

1. What are the kinds of Visual Media (Audio-visuals, models and medical atlases) used for teaching and learning of selected topics in Gross Human Anatomy at the School of Medicine and Health Sciences of UDS in Tamale?
2. What are the effectiveness of the Visual Media (Audio-visuals, models and medical atlases) used for teaching and learning of selected topics in Gross Human Anatomy at the School of Medicine and Health Sciences of UDS in Tamale?

3. How will a suitable framework be developed to integrate Visual Media and Medicine to improve students' critical thinking, observational skills and understanding of selected topics in Gross Human Anatomy at the School of Medicine and Health Sciences of UDS in Tamale?

1.5 Hypotheses

Four research hypotheses were formulated for this study concerning the experiment and they are as follows:

H_o1: There is no difference between medical students who are guided with visual thinking strategies and medical students who are not guided in their ability to observe and analyse visual images.

H_o2: Medical students' background knowledge in visual art does not influence their ability to observe and analyse visual images.

H_o3: Medical students will not find it easy to observe and analyse visual images.

H_o4: Visual art-based critical thinking and observational skills training will not improve medical students' ability to observe and analyse visual images more critically.

1.6 Delimitation

This study was limited to identifying the kinds of two-dimensional, threedimensional physical as well as virtual media that are employed for teaching of nervous system, digestive system, anatomy of musculoskeletal system and

Gastrointestinal, the brain areas and embryology. Tract under Human Gross Anatomy in Anatomy, and the effects that these visual media have on Level 300 and Level 400 students' critical thinking, observational skills and understanding of the course at the School of Medicine and Health Sciences of the University for Development Studies at Tamale in the Northern Region of Ghana.

1.7 Definition of Terms

Operational definition of terminologies used in the context of this study have been explained as follows:

- **Visual media:** This refers to both physical and virtual media that are visual and can be used as teaching-learning materials for disseminating or communicating medical information for the purpose of teaching and learning.
- **Medical education**: This is an education meant to impart onto medical students seeking to become physicians the knowledge and skills required for the prevention and treatment of disease.
- **Interdisciplinary approach:** This connotes to studies that go on between separate but inter-connected and inter-related academic disciplines that foster integrative learning to provide students with broad and holistic education to enable them tackle complex issues in their field of work.
- **Approach to interdisciplinary studies**: This refers to teaching and learning strategies that are implemented to foster integrative practice in integrative learning situations such as happen in interdisciplinary studies.

- **Anatomy**: This is the art of separating the parts of an organism in order to ascertain their position, relations and structure.

 Gross Human Anatomy/Macro-Anatomy/Topographical Anatomy: It is the study of the larger structures of human body that are visible and can be seen with the naked eye without the aid of magnification equipment or microscope.

- **Classroom environment**: It is the general situation in the classroom including seating arrangements that promote effective teaching and learning.
- **Models**: These refer to three-dimensional physical and virtual 3D anatomical models used as instructional materials in medical education.
- **Virtual imaging**: This refers to computer animations, simulations and digital images that are three-dimensional and are useful for teaching and learning in medical education.

1.8 Abbreviations/Acronyms

Abbreviation/acronyms used in this study and what they stand for are as follows:

- SHS - Senior High School
- SMHS - School of Medicine and Health Sciences
- UDS: University for Development Studies
- PBL: Problem-Based Learning
- TLM: Teaching and Learning Material
- VM: Visual Media/Virtual Media

- VMC: Visual Media Communication
- 3D:	Three-Dimensional

1.9 Importance of the Study

a) The findings from this study will be beneficial to lecturers and students of the SMHS since the developed framework will provide the basis for integrating visual media more effectively to improve teaching and learning of Anatomy at the medical school.

b) This report will trigger a dialogue between medical educators and art educators to consider the possibility of fostering inter-professional collaboration or partnership in order to implement visual art-based interventions that will benefit the medical school as far as the application of visual media is concerned.

c) Findings of this study will be important to stakeholders such as the National Council for Tertiary Education, Ministry of Education, University Council, Donor partners as well as Non-Governmental Organisations since it will inform policy decisions on review of medical school curriculum to integrate the proposed framework to enrich and improve the teaching and learning of Anatomy in medical education.

d) This research will not only add to the body of literature on the application of visual media in medical education, but it will also serve as a reference material for art educators, medical educators, researchers and students who wish to conduct similar studies to improve teaching and learning in other art and medical institutions.

1.10 Justification for the Study

For medical students to find fulfillment in providing health services to humanity in future the practice of medicine should be blended with art, and medical students have to be reminded of the artistic side of their profession. For the students to excel in physical examination of patients and their emotional care, they need time to develop imaginative skills through interaction with artworks, since it takes imagination to care for humans when solving a diagnosis and trying a treatment procedure (Tapia 2017).

The developed framework proposed by this study will guide the medical school on how to incorporate critical thinking and observational skills training in its pedagogy to properly integrate visual media as well as visual art-based interventions to improve students' critical thinking and observational skills for clinical practice. It will also provide opportunities for the students to gain broadbase integrated sknowledge to achieve excellence in learning medical concepts, and secure transferable skills holistically to become effective Physicians in conducting physical examination of disease conditions of patients.

1.11. Rationale for the Study

The low performance of the control group (Table 4.20) during the experiment also confirms that there is a shortfall in the students' critical thinking and observational skills development for physical examination. Thus, the students at the focus group discussion strongly appealed that visual art-based interventions critical thinking and observational skills sessions should be introduced at the medical school to help correct this deficiency. It is the above-mentioned shortfalls that initiated the quest to integrate visual art with medicine to help improve students' critical thinking and observational skills. These shortfalls necessitated the developed framework to address the issues.

1.12 Organisation of the rest of Text

Chapter Two highlights the theoretical and philosophical basis for the research including empirical review of previous studies pertinent to the study. The research methodologies, population for the study, sampling procedures**,** data collection instruments have been expounded in Chapter Three. Chapter Four presents the results and in-depth discussion of the analysis and interpretation of the data collected, while summary, conclusions and recommendations have been presented in Chapter Five.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.0 Overview

This chapter reviewed literature related to the topic. Specifically, it discusses the literature reviewed under three frameworks: philosophical, theoretical and empirical frameworks. This review enabled the researcher to discuss the findings in the context of the literature reviewed so that generalization of the findings could be made with reference to the effectiveness of visual media on teaching and learning of Anatomy.

The review comprises the History of Medical Education, History of Medical Education in Ghana, Rationale for Visual Arts Education in Ghana, Importance of

Visual Arts in Science, Importance of Visual Media in Medical Education, Anatomy as a Course of Study in Medical School and Anatomy Museum as Resource for Teaching and Learning in Medical Education.

The rest are Problem-Based Learning Concept, Teaching Anatomy in ProblemBased Learning in Medical School, Learning Styles of Medical Students, Influence of Critical Observation on Cognition, Visual Thinking Strategies and its Impact on Medical Students' Learning of Anatomy, Clinical Observational skills plus Impact Evaluation Analysis, Critical Thinking and Observation Experiment as well as Basis for Determining Effectiveness of Visual Media.

Also, the philosophies reviewed consist of the Interpretivist and Positivist Philosophies of Studying Phenomenon, Implications of Positivist and Interpretivist Philosophies for Research in Interdisciplinary Studies as well as Pragmatist Philosophy of Education.

Last but not the least, the theories reviewed included the theories of Interdisciplinary Studies, Art Functionalist and Art Formalist Theories, Theory of Teaching and Learning. Theory of Visual Communication, Theory of Observation and Perception and Impact Evaluation Theory and Theory of Change including the Conceptual Framework for the Study.

Empirical Review

2.1 History of Medical Education

Although, it is difficult to trace the origin of medical education, authorities usually say medical education began with the ancient Greeks' method of rational inquiry. This method introduced the practice of observation and reasoning regarding disease. It has been theorized that the rational interpretation and discussion led to the formation of schools at Cos, where the Greek physicians Hippocrates (460 AC to 377 AC) and Alcmaeon (510 AC) are said to have taught in the 5th Century BC. Medical education then expanded to Italy through Italian scholar Andreas Vesalius (1514-1564). Thus, 'medical knowledge continued to spread throughout the period in the United States of America at the Johns Hopkins University School of Medicine which was established at Baltimore in 1883 as a model scientific training medical school; at Leiden University, established in 1575 in the Netherlands; and at Medical College of the University of Pennsylvania in 1766 (Custers & Olle 2018). These developments in Europe, Latin America and Asia influenced curriculum change in most disciplines in medical schools. This change in the medical school's curriculum lead to competence-based curriculum requiring medical students to do residency in order to broaden their skills and knowledge in specific areas of their disciplines. The first successful initiative in this direction of competence-based curriculum was the

Yale Plan in 1917 from the Yale University (Silva & Baracat 2016; Fulton 1953).

2.1.1 Medical Education in Ghana

According to Lawson (2015), the vision for medical education in Ghana was born in 1919 when the Korle-Bu Hospital was built by the then Governor of the Gold Coast, Sir Frederick Gordon Guggisberg. Government's efforts to implement this vision practically was constrained by financial, logistic and human resource until in 1964 when the then Government of the Gold Coast took a bold decision and started the medical school with 41 students. Thus, medical education started almost entirely with Ghanaian lecturers. By the end of the first year, permission had been given to recruit expatriate staff to augment the efforts of the local staff. By December 1968, the Ghana Medical School had become a semi-autonomous institution within the University of Ghana with academic functions similar to those of any faculty in the University. The Curriculum of the medical school was revised a number of times to reflect national health needs and prevailing trends in medical education. In 1992, during one such revision, a BSc (Medical Science) degree was introduced and awarded at the end of the Para-clinical science courses

(University of Ghana Medical School 2018).

2.2 Problem-Based Learning

According to Asima, Khadeer and Janani (2014), Problem-Based Learning (PBL) is an innovative instructional method in which clinical scenarios form the basis of learning. This approach to learning was introduced in the 1960s by McMaster University, Canada. Since then, PBL has been implemented as a teaching method in some medical institutions around the globe. It encourages self-directed learning, and allows students to tackle topics as puzzles, or clinical situations. Asima et al. believe that PBL is a system of education which uses carefully constructed clinical problems as a context for students to learn problem-solving skills and acquire knowledge about the basic and clinical sciences. As pioneers of the PBL system, McMaster University described PBL as a pedagogical approach, which uses cases, and problems as the starting point for acquiring the desired competencies. It involves the use of clinical problems to inspire students to identify and apply research concepts and information to realistic situations, and to work collaboratively and communicate effectively. This approach to learning in medical education promotes self-directed life-long habits of active learning, and has become the most effective technique for learning, applying, integrating, and retaining information. It is now a well-established method of facilitating basic science education intended for clinical application (Asima, Khadeer & Janani 2014).

2.2.1 Problem-Based Learning in Medical Education in Ghana

Unlike University of Ghana Medical School that runs the traditional medical education, the University of Cape Coast and the University for Development Studies have also mounted programmemes to promote medical education in Ghana through Problem-Based Learning (PBL) curriculum. Again, AmoakoSakyi and Amonoo-Kuofi (2015) pointed out that the PBL pedagogy which was spear-headed by McMaster University in Rochester in Canada in the 1960s, has been embraced by early ‘adopters like University of Maastricht in the Netherlands; Newcastle University in Australia and University of New Mexico, in the USA and, in recent years, PBL has been adopted by University for Development Studies

(UDS) School of Medicine and Health Sciences (SMHS) as well as the University of Cape Coast (UCC) School of Medical Sciences (SMS) in Ghana.

In Tamale, the School of Medicine and Health Sciences (SMHS) of the University for Development Studies (UDS) was established in 1996. The graduates from SMHS/UDS are trained using the Problem-Based Learning (PBL) methodology and the Community-Based Education and Service (COBES), which allow students to stay in a community not only to provide some health services but also to learn from the community. With the PBL methodology students are introduced to normal Anatomy, physiology and gradually get to understand pathological Anatomy, pathophysiology and allied disciplines by the time they are in the third year (University for Development Studies 2019).

According to Ameade and Amalba (2015), the School of Medicine and Health Sciences (SMHS) of the University for Development Studies (UDS) runs a problem-based learning and Community-Based Education and Service (PBL/COBES) curriculum. The UDS SMHS runs a six-year medical programme starting with Level 100 students in the pre-clinical years to Level 600 in the postclinical years. Students in Level 100 are taught 'essential intellectual and social skills' necessary for the study of medicine. Hence students are taught courses in basic sciences including Physics, Chemistry, Mathematics, Behavioural Sciences, Statistics, African Studies, and Genetics as well as Communication Skills. The UDS SMHS employs the pragmatist and constructivist educational philosophy that allow for integration of course-content across disciplines through structured student-centred, problem-based teaching and learning approaches with little emphasis on basic clinical sciences. Relevance drives the curriculum in learning about the body systems through didactic sessions, scenarios and hands-on practical learning activities. The mode of delivery at this level is not based on the PBL pedagogy. The PBL curriculum begins with Level 200 students and the students are taught to be able to integrate basic human structure and function in relation to health and disease (Ameade & Amalba 2015).

2.2.2 Problem-Based Learning as a Pedagogical Approach in Higher Learning

Problem-Based Learning focuses on competence-based knowledge and skills acquisition. This approach to learning has now become the preferred pedagogical approach in tertiary education globally, because it makes possible implementation of student-centred interdisciplinary and professionally relevant education. PBL pedagogy also enhances critical thinking, promotes collaboration among students and teachers and allows for easy integration and organisation of information learned for easy recall (Haobin, Wipada, Areewan & Beverly 2008). Thus, Problem-based learning in higher education practices is often characterised as a pedagogical approach offering possibilities for students to engage in interdisciplinary learning in which students learn how to learn, integrate theory with practice to develop the capability to respond to changing contexts (Majeski & Stover 2005; Savery 2006; Savin-Baden & Major 2004; Ramsden 2003 as cited in Stentoft 2017).

According to Asima et al. (2014), problem-based learning places emphasis not only on the content of what is to be learnt, but also the learning process. Asima et al.

assert that there are some essential components of Problem-based learning which include the following:

1. There is a problem that acts as a trigger for the session.
2. Participants (students) have discussions in small groups for a period of time.
3. A tutor guides the learning process, which occurs through problem-based learning sessions**.**
4. Lectures are reduced and only form a part of the curriculum**.**
5. Self-initiated learning is encouraged**.**

In PBL, complex ill-structured problems are presented about observable phenomena or events (Schmidt 1983 as cited in Loyens et al. 2011) in which students put themselves into groups to construct understanding of the problem and brainstorm possible explanations or solutions to the problem. Thus, the PBL approach offers students the opportunity through peer collaboration to generate issues that form the basis of their self-directed learning through selection of relevant literature on the topic, plan their study activities and assess whether their self-study activities were effective and sufficient in enabling them fully understand the subject matter introduced in the problem. In brief, PBL in medical education enables students to construct broad-base knowledge through collaboration with peers in order to develop competencies for effective problemsolving, to resolve inconsistencies or differences in their findings and agree on possible solutions to the problem.

A problem commonly encountered by medical students with the conventional curriculum was that the students had challenges coping with first year courses such as Anatomy, biochemistry, and physiology. They were less motivated to pursue them because they did not understand the relevance of the issues taught and discussed for their future profession (Barrows & Tamblyn 1980; Schmidt 1983 as cited in Loyens, Kirschner & Paas 2011). In PBL complex, ill-structured problems are presented about observable phenomena or events (Schmidt as cited in Loyens et al. 1983) in which students put themselves into groups to construct understanding of the problem and brainstorm possible explanations or solutions to the problem. Since the students enroll on medical courses with limited prior knowledge, the PBL approach offers them opportunity to generate issues that form the basis of their self-directed learning through selection of relevant literature on the topic, plan their study activities and assess whether their selfstudy activities were effective and sufficient in enabling them fully understand the subject matter introduced in the problem. Thus, PBL in medical education enables students to construct broad-base knowledge through collaboration with peers in order to develop competencies for effective problem solving. In the process, they are able to resolve inconsistencies or differences in their findings and agree on possible solutions to the problem.

Loyens et al. (2011, p.8) point out that the amount and quality of new knowledge learned is dependent on one's previous knowledge. As a result, learners with limited or no prior knowledge become frustrated and demotivated when confronted with problems that are too challenging to solve. Therefore, learners need to possess prior knowledge before they can tackle complex issues successfully (Kirschner, Paas & Kirschner 2009a, 2009b; Otting & Zwaal 2006; Anderson 1990 as cited in Loyens et al. 2011, p.8).

The discussions above imply that Anatomy is partly art and requires medical students to possess visual thinking abilities in order to appreciate fully concepts taught under Anatomy. But how can they appreciate the concepts fully if they do not have prior knowledge in relevant aspects of the visual arts? Therefore, it is imperative to expose medical students to visual art-based interventions early enough to enable them learn Anatomy whiles building on prior knowledge acquired through the arts. This will help the students build on prior knowledge as far as application of visual thinking skills and visual literacy is concerned.

2.2.3 Teaching Anatomy in Problem-Based Learning

Mulu and Tegabu (2012) observe that teaching of Anatomy in medical schools is traditionally based on the use of human cadaveric specimens. Through dissection, students are able to visualize firsthand actual structures of the human body. According to Mulu and Tegabu, problems related to the use of human cadaver, teaching methods and resources have compelled many medical schools to review curricula in Anatomy to adopt alternative modalities of teaching using cadaveric plastination, non-cadaveric models and computer-based imaging.

Azer and Azer (2016) also mention that Anatomy is a discipline where spatial visualization is important. According to these researchers, students need to learn not just anatomical structures and functions but also spatial relationships to surrounding structures. While Anatomy textbooks and Anatomy atlases provide two-dimensional (2D) static anatomical illustrations, they are of limited value in exposing three-dimensional (3D) dynamics of anatomical structures. Learners may find it difficult to visualize 3D images that are captured in print and be able to understand certain dynamic aspects of functional Anatomy. For example, students will be unable to identify the structures related to the caudate lobe because the liver cannot be moved to different planes/positions. Therefore, it is important that students are guided to develop spatial ability to rotate 3D anatomical structures from various views to appreciate its spatial relationships.

Research in this area may not only assess visual-spatial abilities of students during learning but it will also lead to exploration of new pedagogical strategies to enhance students' learning skills and the advancement of medical training.

2.2.4 Resource Constraints as Challenges to Problem-Based Learning Implementation

In spite of the many benefits that PBL curriculum offers to medical educators, Amoako-Sakyi and Amonoo-Kuofi (2015) observe that resource constraints are some of the major challenges medical schools face in implementing the PBL curriculum. The quest to provide well equipped tutorial rooms, the need for experienced lecturers in handling PBL activities, together with the provision of other logistics such as overhead projectors, loud speakers and audiovisual learning materials relevant to medical education remains a challenge especially to most medical schools in developing countries where budget allocation for education is insufficient.

Amoako-Sakyi and Amonoo-Kuofi (2015) also assert that lack of adequate learning resources including well-resourced libraries, reliable internet connectivity, functional clinical skills laboratories, and basic science laboratories to facilitate self-directed learning (SDL) in a PBL curriculum are some of the resource challenges facing medical schools that implement PBL curriculum. Similarly, the provision of logistics such as flip charts, markers, LCD projectors, loud speakers, among others are additional strain on the inadequate education budget in such PBL learning settings. Amoako-Sakyi and Amonoo-Kuofi (2015) further observe that in a PBL curriculum, students study in small groups of about six to ten members and each of these groups is assigned a faculty member (facilitator) whose role is to facilitate the learning process at the tutorial group meetings. This puts stress on the human resource or lecturers available to facilitate these tutorial sessions. For instance, UDS SMHS runs tutorial meetings beginning from Levels 200 to 400 on campus with each level having a minimum of 10 tutorial groups. This translates into 30 groups requiring 30 facilitators (lecturers) during tutorial group meetings. This can be challenging to the lecturers, and also raise the cost of running a PBL curriculum as compared to Lecture-Based Learning (LBL).

Amoako-Sakyi and Amonoo-Kuofi further stated that, other resource implication of a PBL curriculum is infrastructure. Directly related to having tutorial groups is the need for suitable tutorial rooms. Ideally, PBL tutorial rooms should be purpose-built and well designed with adequate illumination and ventilation to provide a pleasurable learning environment for students and faculty. Poorly lit and ventilated tutorial rooms could make students uncomfortable and eager to end tutorial sessions before time.

2.3 History of Anatomy

The human body is complex and its intricacies can best be studied and understood through dissection. According to Boundless (2016), Anatomy evolved as humans continually developed interest in understanding organs and structures of living things. Beginning in Ancient Greece and developing through the Middle Ages and the Renaissance, methods employed in exploring the body have advanced dramatically from examination of animals and cadavers through dissection using complex techniques such as non-invasive imaging and radiology. According to Boundless, anatomical models, skeletons, textbooks, diagrams, photographs, lectures, and tutorials are other means by which medical professionals and students of biological sciences learn about the human body organs.

As a course of study, Assefa and Tsige (2003) say human anatomy describes the organisation and location of the different parts of the human body to provide a basis for understanding how the structure of the body forms a functional whole. According to Assefa and Tsige, branches of Anatomy include Gross Anatomy, Microscopic Anatomy, Regional Anatomy and Embryology. The objective for learning Anatomy is to integrate an understanding of normal structure with normal function of body organs. Thus, teaching medical students about Anatomy with audiovisuals is important because it offers information about the structure, location, and organisation of different parts of the body that are needed to understand physiology. That is, knowledge students gain about Anatomy and physiology enable them understand what occurs in the human body, and what to do when the body is 'injured, sick or placed under stress' (Assefa & Tsige 2003).

2.4 Visual Media in Medical Education

Tapia (2017) observes that medicine is an art and applied science that combines scientific knowledge, discovery and application with its practices. According to Tapia, medicine must combine with art to be effective, and those who take to practicing medicine are artists as well as scientists. Therefore, to clinch onto medicine alone as a physician is "folly"; it might result in 'poor physical care or emotional care' because humans are a mix of physical and emotional care. In connection with this, Tapia reminded practitioners of medicine to rediscover the 'artistic side' of their profession and asked, "And without the art, what is the difference between a physician and a machine?"

In thinking about the usefulness of visual media to medical students, Glatter (2013) also mentions medical students who explore more of their "right brain" to enrich their background knowledge in imagery, poetry and drawing may be recognized by experts in the medical practice. According to Glatter, Salvatore Mangione, Associate Professor of Medicine and a master of artistic expression and physical diagnosis at Thomas Jefferson University, artistic and visual skills may enhance the ability of a student to excel in medical school and become a successful physician in practice. In the view of Mangione, medical students with varied background in medical science as well as artistic and visual skills may potentially hold an edge over good future physicians in today's selection process. This implies that medical students without artistic and visual skills may not have adequate skills to sketch or critically observation and analyse visual details of the human body as well as represent anatomical organs graphically during physical examination to communicate medical information graphically to patients and colleague medical experts for further diagnosis and treatment. This might result in 'poor physical care or emotional care' on patients (Tapia, 2017). That is why Glatter noted that students with artistic qualities such as visual and drawing skills are more successful in contemporary digital, image-based world of medicine. Findings from observation-type programme created at Harvard Medical School designed to improve students' visual-spatial skills in visual literacy also confirmed that visual art-based programmes are essential to the training of medical students. In view of the current demands from society for the highest quality of healthcare and the stress these demands place on medical students and physicians, Mangione called for efforts to be directed to emphasizing on art and sketching as a relevant skill to develop a well-rounded physician. Mangione suggested further that aspect of visual art should be re-introduced during the early undergraduate medical school years prior to studying medicine, because the line between art and science is thin (Glatter 2013).

Hajar (2017) also states that an effective strategy that has been helpful in enabling medical students retain empathy and deepen understanding of the human condition is an arts-based medical curriculum. Visual arts, storytelling, writing, dance, theater, music and literature provide opportunities for medical students to have meaningful reflection and understanding of the human aspect of medical practice. Hajar also believes that incorporating arts and humanities in the undergraduate years of medical education will produce empathic physicians to meet the physical health and emotional needs of humanity in future.

2.4.1 Importance of Visual Media in Teaching and Learning of Science Subjects

Visual media and science are fundamentally linked as they both promote discovery learning. The integration of both disciplines allows students to attempt projects or learning tasks that enhance their imagination, higher-order thinking skills, creativity and knowledge in both visual media and science. Gullat (2008), Gelineau (2011), Alberts (2010) and Inan (2009) as cited in Dhanapal, Mastan and Ehsan (2014) postulate that the use of visual media in teaching non-art subjects started early in the 1800s when man called for visual arts and music to be taught in the common schools in Massachusetts as an aid to the curriculum, and an enhancement to learning'. Since then a number of studies have proven the success of integrating visual arts in the teaching and learning of other subjects, especially Mathematics and Science. That is, the use of visual arts in Science subjects also encourages students to pursue their scientific inquiries with relative ease (Gullat 2008; Gelineau 2011; Alberts 2010 & Inan 2009 as cited in Dhanapal, Mastan & Ehsan 2014).

The need for visual media to be incorporated in Anatomy Science education to improve students' observational skills has been recognized by Harvard Medical

School when the University took a group of medical students through art appreciation course. The findings indicated that, medical students who took art appreciation course at the University's museum and had opportunity of observing 'various works of art improved their observational, analytical and communication skills', and could make accurate medical diagnoses than their counterparts who did not take part in the art appreciation course (Harvard Medical School 2008 as cited in McMaster University 2017; Brooks 2016).

In connection with the important role that visual media plays in facilitating teaching and learning in Science education, Gazzaniga (1998) as cited in Barry (n.d, pp.7-8) also comments that although reading is important in understanding scientific literature, the easiest means of comprehending scientific literature is through visual media, because most scientific information has been learnt through watching. According to Gazzaniga (1998), the use of lecture alone as a pedagogical approach to teaching and learning is ineffective in imparting knowledge to learners. Therefore, teaching and learning should be structured in a manner that will provide students with opportunities to visually explore and engage in learning activities that will help them understand scientific concepts.

- **Theories Reviewed**

There are two Visual Art theories that underpin this study. These have been explained as follows:

2.5 Formalist and Functionalist Theories of Visual Arts

Functionalist and Formalist hold differing views about the usefulness of artifacts for teaching and learning. Kant (2008) and Tekiner (2006) mention that the Formalist's movement considers artifacts as anything that has 'form' or 'formal qualities' that are visible such that its external features are observable by the naked eye. These qualities, among others include line, shape, colour, size, mass, weight, texture and form as well as how these elements interrelate to create value that is meaningful to the perceiver. In contrast to the Formalist's view of artifacts, Davies (2001) says Art Functionalists define artifacts by the purpose(s) they serve that make them useful to the person using it. Davies explained that a function commonly assigned to a visual artifact is to provide a satisfying experience. For instance, a definition of "chair" will mention that the purpose of a chair is for sitting. That is, apart from the physical characteristics seen of a chair by the formalist, the functionalist asserted that a chair that cannot be sat upon has no value as a chair to the user.

Therefore, art formalist and functionalist differ in opinion in two ways. Whereas the formalist opine that in interacting with artifacts the perceiver should make conscious efforts to observe and analyse the physical features of the object being observed. These features may include lines, colour, texture, shape, tonal variations among others. On the contrary, Art Functionalist opine that any visual art form must serve a specific purpose for the user irrespective of its form. These differing views have some implications for teaching and learning of Gross Human Anatomy. That is effective use of visual media and other art forms in the pedagogy of the medical school will make teaching and learning of Gross Human Anatomy interesting, meaning and less stress. Hence students at SMHS, UDS would better understand concepts taught under Gross Human Anatomy as well as improve on their skills for critical observation and analysis of visual details of the human body using visual media.

The Formalist's view of artifacts implies that in employing visual media in teaching and learning of Anatomy, attention should be paid to the physical qualities of anatomical objects. Knowledge about physical qualities can be applied in guiding medical students in conducting physical examination of disease conditions on the body. On the other hand, the Functionalists theory implies that visual media utilized in medical education serves as a purpose only if it provides satisfying teaching and learning experiences that meet the learning needs of learners on one hand, and meet the teaching needs of teachers on the other hand. Thus, the functionalist theory has been used in the context of this thesis to guide the researcher find out the effectiveness of visual media employed in medical education and the specific purposes those visual media served in teaching and learning of Anatomy.

2.6 Teaching-Learning Theories

There are four teaching learning theories that underlie this study and they have been explained as follows:

2.6.1 Behaviourist, Cognitivist, Constructivist and Gestalt Learning Theories

Learning in every educational institution is largely influenced by availability and richness of teaching-leaning materials in the learning environment for students to explore practically. For that reason, the behaviourist urge teachers to state learning objectives on the basis of what learners will do rather than what the teacher will teach. Additionally, objectives should be based on results that are observable and indicate that the students have learned what has been taught. In view of that, the behaviourists remind teachers to be mindful of individual differences among students, since a kind of positive reinforcement appropriate for one student or a group of students may not encourage positive learning behaviour for other students (Sivalingam, Nalliah & Nazimah 2014). However, advocates of cognitivism focus attention on how information perceived from the environment is processed, retained and recalled from memory by learners (Yanchar & Osguthorpe 2005 as cited in Faryadi 2007). Both learning theories share common views that the learner should be placed central in the learning process, and communication of information and transfer of knowledge to learners should be in the most efficient and effective manner. Also, effective instructional strategies are utilized by both theorists (cognitivists and behaviourists), but from different perspectives.

According to Giesen (2004) and Beattie and Dabbagh (2003), the constructivists contend that learners create meaning as opposed to acquiring it; learners do not transfer knowledge from the external environment into their memories but rather they construct knowledge through hands-on activities. This movement believes that when students are allowed to construct their own knowledge, they tend to develop interest for what they learn, discover more knowledge, analyze and solve problems using their unique learning styles and experiences unique to each individual (Sivalingam, Nalliah & Nazimah 2014; Kauchak & Eggen 2012; Tam 1999). Gestalt theory describes how humans learn by organising small pieces of visual information into a larger meaningful structure (Palmer 1999). The Gestalt theory also has implication for teaching and learning in medical education as far as the application of visual media is concern. According to Davey (2015), the Gestalt theorists believe that learners are able to comprehend information when the intended information is presented to them in whole rather than in parts. Therefore, effective instructional strategies should be used together with appropriate visual aids to present lessons holistically to enable learners appreciate the full benefit of lessons taught on the body structure and its functions.

This study is therefore based on the Behaviourist, Cognitivist and Constructivist learning theories. The behaviourist theory guided the researcher to observe the physical medical school learning environment to appreciate whether or not the learning environment at the medical school is enriched with visual media for teaching and learning. The cognitivist theory was used to guide the researcher understand how the medical students processed on their minds information learned through interaction with variety of visual media to enhance understanding, retention and recall of information learned under Gross Human Anatomy. The constructivist theory also guided me to appreciate how lecturers and students at the medical school explored various visual media to make their own meaning of concepts taught and learned under Gross Anatomy.

2.7 Theory of Visual Communication

Theory of visual communication relates to how humans observe, perceive and process information and they have been explained as follows:

2.7.1 Influence of Observation, Perception and Cognition

Démuth, Slowkow and Trnavskej (2013) opine that cognition (learning) is influenced by two perceptual movements and they are called Internalism and Externalism. The internalists believe that pieces of knowledge or their sources can be found within the human mind (the brain), therefore**,** cognition is all about helping learners to build upon information that already exist in the mind by discovering more pieces of knowledge in the physical environment through observation and perception. In contrast, the externalists believe that there is no knowledge or information already existing in the mind or the brain as claimed by the internalist, but rather, knowledge learners possess is gained from an external source through experience as they interact with things in the physical environment. These viewpoints are also pertinent to this thesis.

Like the behaviourists theory of learning, the externalists believe that learners have minds which are more or less blank (tabula rasa) and so all knowledge is engraved onto the brain based on the things they perceive from the external world. Perception therefore, is the means by which we utilize our human senses such as sight, smell, hearing, taste and kinesthetic to collect external sensory information in combination with other internal conscious and unconscious mechanisms of the brain to understand the things we perceive in the physical environment (Barry

2002). Barry explained that conscious perception involves both top-down and bottom-up processing of information. With regards to top-down approach to learning, information contained in memory about visual media influence the way students perceive those visual media found in the physical environment. On the other hand, bottom-up processing of information is based on the things learners perceive from the external environment to input into the "blank" brain as claimed by the externalist. In relating the externalist's ideology to this thesis, it is possible to assume that the School of Medicine and Health Sciences of UDS may have no visual art-based interventions to compliment the scientific approach the medical school uses to develop perceptual abilities of students to improve upon their critical thinking and observational skills for learning of Gross Human Anatomy. This means that the absence of appropriate visual art-based interventions for teaching and learning of Anatomy can affect their learning of Gross Human Anatomy. Again, learners who believe in the internalists' ideas may also wish to interact with the available visual media to build upon the knowledge they already have about the link that exists between Anatomy and visual media.

2.8 Impact Evaluation and Theory of Change

According to Hearn, Taylor and Howard (2014), impact evaluation provides information about the impact produced by an intervention undertaken for formative purposes to improve or re-orient a programme or policy, or for summative purposes to inform decisions about whether to continue, discontinue, replicate or scale up a programme or policy. Billorou and Vargas (2011) explain that quantitative and qualitative methods are used for assessing the impact of a programme as separate tools or combined, depending on the characteristics of the programme to be evaluated, the type of participants and the evaluation approach adopted. The measurement of impact should verify that it is as a result of the training activities carried out that participants actually experienced the changes in the conditions set as targets. This approach uses statistical comparison techniques to establish the cause-and-effect (causal) relationship. That is, the purpose of evaluation is to ensure that the impact under study arises from the training activities themselves and not from any unrelated circumstances (Hearn, Taylor & Howard 2014). This theory is relevant to this study in the sense that it enabled the researcher to determine the impact of the visual art-based intervention on students' observational skills and ability to identify and analyse visual images.

2.9 Simple Difference Method (Treated versus Untreated)

For the purpose of this study, the simple difference method of impact evaluation was employed in determining the impact of the intervention, and the difference that occurred between the control and the treatment groups. According to Hearn et al. (2014), the simple difference method is one of the most common methods with straightforward methodologies that compare the group that received the treatment of an intervention with another group that did not receive treatment. In order to have a good representation of the counterfactual, the control group must represent what would have happened to the treatment group without the intervention. This measure of difference is determined after the intervention or activity has been implemented. However, if the treatment group and the control group are different prior to the intervention, the method may under 'value or over value' the real impact. That will mean that a selection bias has been introduced in the estimations. To avoid this bias, the researcher ensured that both groups had similar characteristics.

2.10 Audio-Visual Materials, their Usefulness and Demerits in Medical Education

Concerning effectiveness of audiovisuals in medical education, Souza, Ankolekar, Kotian, Souza and Hosapatna (2014) assert that the development of visual media has improved teaching and learning in education in general. In medical education, visual media play a key role in learning specific topics because in disciplines involving more illustrations and demonstrations such as anatomical science, audiovisuals become indispensable in transmitting medical information. Farooq (2014) defines audiovisuals as instructional materials that can be perceived through the human organs of 'seeing' and 'hearing', to make the message better understood, remembered as well as sustain learners' interest (Pushpa 2009). That is, any device that can be employed to make the learning experience more concrete and effective can be considered audiovisual materials (Lecture Notes 2019). Even though, a well-structured lecture is said to be an effective means by which information on complex topics is communicated to students, such lectures become more effective when combined with audiovisuals, as the inherent deficiency of one visual is compensated by the other (Roy & Saha 2015, p.69). Haque and Talukder (2016) also point out that the number of students taking courses in medical schools is usually more than the lecturers available. Since lecturers cannot avoid utilizing lecture method of teaching where large amount of medical information is to be covered in a short period of time, Haque and

Talukder opine that audiovisuals can be incorporated in lectures for 'better illustrations, clarity and learning', because during lectures both visual and auditory sense organs of students are tuned to absorb information.

2.11 Visual, Kinesthetic and Auditory Learning Styles of Medical Students

According to Busan (2014), the term 'learning styles' refer to situations where individuals differ with regard to the mode of instruction or study most effective for them. One of the most used classifications of learning styles is the one proposed by Fleming and Mills in 1992 as VAK model coined from the first letters of the three learning styles described as Visual, Auditory and Kinesthetic. Whiles visual learners learn by vision and prefer to see how things are done visually, auditory learners learn through listening and pick up new ideas and concepts through verbal lectures and discussion. Kinesthetic learners, on the other hand, are 'hands-on' learners who prefer doing rather than talking or listening. Since the quantum of medical information to be delivered to students is substantial, it is important for medical educators to know how their students are most receptive to medical information. Entwistle (1986) and Lubawy (2003) as cited in Salwani, Nor, Nasir, Norhasiza, Aminatul, Liyana, Wan, Zetty, Zakiru, Wan and Mainul (2014, p.48) have asserted that:

> "Familiarity with 'learning styles' have definite benefit for both teachers and students. Teachers can adapt new methods if they know the learning styles of the [learners], because teaching without learning taking place is sheer talking".

The study therefore proposes that the SMHS, UDS should emphasis on the use of Visual and Kinesthetic learning styles for teaching and learning of Gross Human Anatomy. These learning styles are necessary because all branches of Anatomy; whether Gross Anatomy, Histology, Embryology or Neuroanatomy involve significant amount of visual identification of physical features of the human body as well as spatial visualization of the relationships between various organs of the human body (Bargar, 2016). This implies that the use of visual learning style in learning of Gross Human Anatomy will provide opportunities for both lecturers and students to use their human senses of sight and smell in perceiving and critically observing and analysing anatomical images of two and three dimensionalities to enhance
comprehension of concepts taught. Similarly, the use of kinesthetic learning style will allow the medical students to touch, lift and remove anatomical organs in models to manipulate with to appreciate their spatial relationships to the whole body.

2.12 Anatomy Museum

Anatomy museum is defined as an institution that houses and cares for a collection of artefacts and other objects of scientific, artistic or historical importance, and makes them available for students and public viewing through exhibits that may be permanent or temporary (Venkatesh, Shivarama, Muhammed & Ramakrishna 2016). Findlen (1989) as cited in Venkatesh, Shivarama, Muhammed and Ramakrishna (2016) says the desire of human nature to preserve and keep artifacts has brought about the museum concept, and its subsequent application in medical education. According to Venkatesh et. al., the origin of the concept of Anatomy museums can be traced back to the year 1699 to 1763 when Surgeons of Edinburgh created a collection of anatomical specimens, pictures and books. It was called the 'collection of curiosities'. The Museum of Human Anatomy of the University of Bologna is believed to be one of the most ancient museums. The early museums predominantly comprised paintings and models.

The Turin's Anatomy Museum of University of Turin, Italy; Anatomy Museum of Queen's University of Belfast; Oxford University Museum and the Pedro Ara Anatomy Museum are some of the renowned Anatomy museums of the 19th and 20th centuries. The Anatomy Museum of Leiden Medical University in Netherlands and the Museum of Kawasaki Medical School in Japan are some examples of modern 21st century museums that use electronic screens and audiovisuals to teach Anatomy to medical students.

2.12.1 The Role of Anatomy Museum in Promoting Critical Observation and Interaction among Medical Students

According to Yehia and Luuk (2014), medical school museums are permanent educational resource that provide access to various visual media at students' convenience for observation and interaction. Historically, medical school museums were a principal resource for teaching Anatomy and surgery. They allow both self-directed learning and group study, providing a means to develop better professional communication skills. Graduate and postgraduate medical students develop these skills while interacting with artworks for the study of

Anatomy and other basic and clinical sciences like embryology and surgery (Yehia & Luuk 2014; Ray 2014). Concerning the significance of anatomy museums, Marreez, Willems and Wells (2010) stipulate that although biological and biomedical research activities have compelled some medical schools to convert museum space into research facilities, a few medical schools still maintain the contents of their museums as irreplaceable resources and upgrade them for modern medicine and medical education. According to Marreez et al.

(2010)**,** the Anatomical Museum of Leiden University Medical Center in the Netherlands and the Anatomy Museum of Kawasaki Medical School in Kurashiki, Okayama and Japan are two examples of such upgraded museums. These writers pointed out that student surveys at Leiden University have indicated that students find audio-guided museum tours to be useful for learning and clinically relevant. The research findings of Shibata, Manabe, Yamashita and Kajita (2019) indicate that audiovisuals at anatomy museum at Kawasaki Medical School in Japan attracted students to a greater extent and facilitated their independent learning in a more fruitful way.

It is in light of the above assertions, Ray (2014) believes that this approach to learning where medical students interact with various visual media found in museums have positive implications for preventing physician burnout and promoting better patient care. In view of this, Yehia and Luuk (2014) opine that existing medical school museums should never lose their value as scientific and pedagogic tools so long as teaching and learning of Anatomy is concern. If possible, medical schools should consider equipping existing museums with stateof-the-art Information Technology (Yehia & Luuk 2014). In view of the literature reviewed, this study is of the view that opportunities should be created for medical students at the School of Medicine and Health Sciences to visit relevant museums in Accra and Kumasi to interact with various visual media to develop their clinical competences holistically.

Plate 2.1 to plate 2.7 are specimen of visual media that can be found in Anatomy museums which medical students can interact with to improve their critical thinking and observational skills for learning of Gross Human Anatomy. Plate 1 shows specimen of the human brain and the brain stem in three-dimensionality; Plate 2 shows anatomical images displayed for observational skills training for learning of Gross Human Anatomy; plate 3 displays a section with plastinated fetus for medical students to observe and critically analyse their physical features; Plate 4 displays section with embryology models for learning of Gross Anatomy; Plater 5 shows Translite board showing brain surface in images of two dimensionality; Plate 6 shows a section of Anatomy museum with an array of anatomical images of two and three dimensionality displayed for learning of Gross Human Anatomy; Plate 7 shows a labelled specimen of the human skin depicting texture.

Plate 2. 1:Specimen of human brain areas.

Source: St. John's Medical College, Bangalore

Plate 2. 2: A section of skills medical museum for learning.

Source: Yenepoya Medical College, Mangalore

Plate 2. 3: Plastination section.

Source: Kasturba Medical College, Mangalore

Plate 2. 4: A section with embryology models *Source*:

Yenepoya Medical College, Mangalore

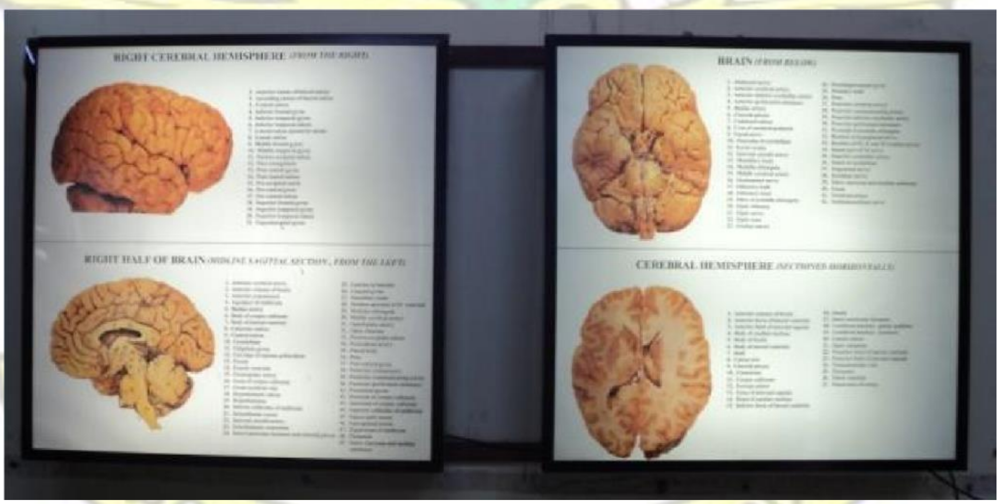


Plate 2. 5: Translite board showing brain surface.

Source: St. John's Medical College, Banghalore

Plate 2. 6: A section of a Medical museum.

Source: KSHEMA Anatomy museum, Mangalore

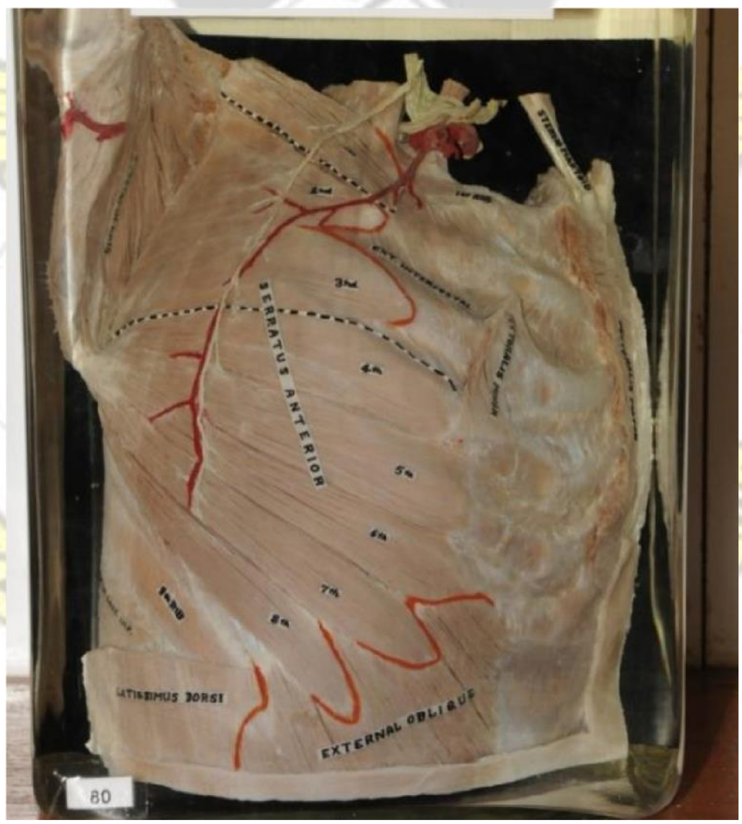


Plate 2. 7: A labelled specimen of the human skin.

Source: Kasturba Medical College, Manipal.

2.13 Critical Thinking and Observation Experiment

Visual Understanding in Education (2009) explains that visual thinking strategy is a student-centred curriculum in which students examine and discuss works of art prompted by questions to guide the perceiver to carefully look and provide evidence for what he or she has seen. These strategies produce growth in aesthetic thinking and promote cognitive growth in terms of observing, speculating and reasoning on the basis of evidence (Housen & Yenawine 2002). Experts believe that visual thinking strategies can be applied in viewing other phenomena in science to help medical students develop broad-based skills and teach observational and diagnostic skills (Jasani & Saks 2013; Klugman et al. 2011; Naghshineh et al. 2008 as cited in Moorman & Desiree 2019). Visual thinking strategies develop in learners transferable knowledge and skills for life-long learning in the 21st century (Research Council 2012). Housen and Yenawine (2002) developed the following visual thinking strategies questions:

- What is going on in this picture? (close looking/viewing)
- What do you see that makes you say that? (Evidence)
- What more can you find? (looking for details)

This study therefore adopted these strategies coined by Housen and Yenawine (2002) in conducting the critical thinking observation experiment. So, the following visual thinking strategies questions were asked on image one (Appendix C: Image 1) for example:

- Look at Image One carefully and write down the kind of image(s) you see.
- What activity is going on there?
- What is the posture of the images you see?
- What else have you seen?

Hence, be curious to look carefully to identify the hidden details that cannot be easily seen by the untrained eye.

2.14 Basis for Determining Effectiveness of Visual Media

Souza, Ankolekar, Kotian, Souza and Hosapatna (2014) and Rasul, Batool and Bukhsh (2011) assert that audiovisuals play an important role in medical education by helping students to learn and understand a particular topic in Anatomy that involves more illustrations and demonstrations in conveying medical information. That is to state that, the effective use of visuals can improve comprehension and increase retention of knowledge and information learned as well as enhance the retrieval of information that medical students have been taught (Kouyoumdjian 2012). The views of these writers imply that effectiveness of visual media can be analysed in terms of its ability to stimulate understanding of concepts taught, increase retention and recall of information learned as well as boosting learners' interest for learning a particular topic or concept (Soley & Kramer 2001; Souza, Ankolekar, Kotian, Souza & Hosapatna 2014).

From the literature reviewed, experts are of the view that visual media are effective if it can make teaching of complex topics easier, stimulate understanding of topics taught, increase retention of information learnt as well as help learners to recall information learnt. This study will therefore analyse the effectiveness of visual media based on the factors identified by these writers. Thus, effectiveness of visual media will be analysed in this study in relation to medical students' views on how visual media were effective in stimulating their understanding of topics taught under Anatomy; how it helped them retain information learned and how it enabled them sustain interest for learning Anatomy as well as recall information learned.

- **Philosophies Reviewed**

A study of this nature in human research requires interpreting data from the Positivist philosophy and the Interpretivist philosophy viewpoints.

2.15 Positivist and Interpretivist Philosophy of Studying Phenomenon

The developer of Positivism Auguste Comte (1798-1857) postulates that positivism emphasizes the use of scientific method and rational thought to understand and control phenomenon. The positivist philosophers discard metaphysical and subjective ideas of studying phenomena with the reason that internal human behaviours, their actions and institutions cannot be studied objectively (Auguste Comte 1798-1857 as cited in Fisher 2007). This movement believes that the purpose of science is simply to stick to the things that can be observed and measured. Knowledge of anything beyond that, which can be observed and measured, is impossible and should be overlooked. Therefore, advocates of positivist philosophy stress on empirical research based on scientific procedures that allow for quantitative analysis of findings in terms of significance, generalizability, reliability, validity, objectivity and causality (Kurki 2006; 2012; Fisher 2007).

In contrast to the positivist's approach to studying phenomena, McQueen (2002) as cited in Thanh and Thanh (2015) asserts that interpretivist researchers employ research methods that help them understand in detail the connection between human beings and their environment, and the role of those human beings in creating social elements that concern them. This research approach allows researchers to appreciate the things that happen within the environment through the perceptions and experiences of the research participants. Thus, interpretivist researchers make efforts to understand and interpret research data gathered in the context in which the study was conducted with the participants (Willis 2007 as cited in Thanh & Thanh 2015). Willis argued further that the aim of interpretivist is to 'value subjectivity' and challenge the notion that achieving objectivity on human behaviour is possible. Instead, they prefer to collect data on reality from research subjects who own such experiences.

2.15.1 Implications of Positivist and Interpretivist Philosophies for Research in Interdisciplinary Studies

Though, believers of both positivist and the interpretivist philosophies hold divergent views about how researchers go about studying phenomena especially in human research, each view point is unique and applicable to this thesis for interpreting data in a manner that can best be understood and appreciated by readers. Thus, both philosophical viewpoints enabled the collection of quantitative and qualitative data for the study.

2.16 Integrative Practice in Interdisciplinary Studies

Integration is necessary to expose students to a wide-range of learning options to enable them achieve set learning outcomes. Baber (2009) pronounces integrative practice refers to educational practices that deliberately help students to make connections to other concepts, methods and theories in different academic disciplines. It provides structures, strategies and activities for bridging different theories and practices, major and minor disciplines as well as bridging learning experiences within the classroom and out-of-classroom experiences (Haynes 2005; Klein 2005; Lattuca 2001 as cited in Barber 2009). Szostak (2007) also opines that integration is required in interdisciplinarity in the sense that it helps in analyzing insights of different academic disciplines for a common good. In search of a common ground that aims at integration, Szostak said experts involved in the different disciplines need to have open-minds, tolerate differing opinions and work towards exchange of ideas that will improve understanding rather than adhering to one-sided view point. In facilitating the process of open-mindedness, Szostak provided the following strategies that can be utilized when seeking a common ground in interdisciplinary studies:

- Find out the extent to which interdisciplinary perspectives are different in terms of terminology. Interdisciplinarians can often redefine concepts, or extend a concept from one discipline to the subject matter of another.
- When concepts from different disciplines disagree, place the concepts on a continuum or within a classification to determine the degree to which they disagree (Newell 2007).
- An attempt can be made to overcome some of the remaining differences by making possible alterations to the disciplinary assumptions.
- Different disciplines might shed light on different aspects of the question at hand.

An interdisciplinary understanding will generally contain a combination of understandings of the relationships between pairs of phenomena under study. In other words, interdisciplinarians hold the view that the worth of interdisciplinary research should be considered in terms of the contributions that research outcomes are able to make in increasing our collective understanding of phenomena (Szostak 2003 as cited in Szostak 2007). In connection with this Glassick, Huber and Maeroff (1997) as cited in Szostak (2007) also point out that "integration" in interdisciplinarity should not be overlooked among scholars, because complex problems can be resolved, or break-through in research can be realized if interdisciplinarity is seen from the perspective of integration. Repko (2008) expounds on the ideas of Newell (2007) and Szostak (2007) developing three guidelines on how scholars should carry out interdisciplinary research. These include the following:

- Determine whether a question is an interdisciplinary question or not. That is, ask whether the solution to the problem or answers to the question will involve theories, or methods of two or more academic disciplines
- Gather relevant disciplinary insights by considering the nature of different academic disciplines and recognizing those that can help address the issue.
- Find out what specific phenomena, theories, or methods are involved and then determine which disciplines best study each phenomenon identified and then apply each method or theory appropriately.

This implies that medical educators and art educators have to reflect on the weaknesses of medicine and then identify and integrate aspects of visual arts relevant to medical education that can correct those weaknesses Szostak (2007), especially in teaching and learning of Anatomy.

2.17 Pragmatist Philosophy of Education

John Dewey's (1859-1952) philosophy of education is based on the idea that learning occurs through experience and requires hands-on activities that directly relate to the learner's learning needs. In view of that, Dewey called for an interdisciplinary curriculum that focuses on connecting multiple subjects in which students are allowed to pursue their interests and construct their own paths for acquiring and applying knowledge. Dewey stressed that the role of the teacher in an interdisciplinary teaching and learning setting is to serve as facilitator rather than instructor. The idea is not to allow students to do whatever they please, but rather for the teacher to use professional judgment to shape teaching and learning processes (Akinsanya 2014). Although Dewey believes that the interest of students is important in determining the learning environment, the role of the teacher in the learning process is equally important in shaping students' learning. In linking theory to practice, Dewey appealed to teachers to give learners opportunities to construct their own learning. However, he cautioned that the role of the teacher should not be ignored, because without an important grasp of the content and the direction of a well-trained teacher, student's education would not progress as expected. This philosophy supports the course of this thesis as far as the use of visual media is concern. Medical students should be allowed to explore the use of visual media in an experiential teaching and learning environment without overlooking the important role of lecturers handling the subject matter in the learning process.

Theories Reviewed

Having discussed the philosophies underlying this study, it is important to look at some theories that also support this research.

2.18 Theories of Interdisciplinary Studies

It has been observed that medical students require a combination of multiple intelligences from disciplinary and interdisciplinary perspective to tackle complex health issues affecting humanity. Interdisciplinarians like Newell (2001), Casey (2009), Mathison and Melissa (1997) view interdisciplinary studies as educational approach that combines insights from two or more academic disciplines in its pedagogy and creates teams of teachers and students to enhance the general educational experience for both the teacher and the learner.

That is, interdisciplinary approach provides graduate students the grounding to deal with more multifaceted research issues, to be more 'creative, and to take greater risks' in solving societal problems (Hartesveldt & Giordan 2009 as cited in Borrego & Newswander 2010). In support of interdisciplinary among disciplines, d'Hainaut (1986, p.6) says the debate in favour of interdisciplinarity does not suggest that individual disciplines utilized alone connote a false theory of knowledge "but rather that they are not (and never will be) a complete statement if we take them on their own. It is in the interconnections, and the integration that they attain their most effective use".

Thus, it is only when students are able to 'integrate knowledge and modes of thinking' from more than a single academic discipline that they can be said to have exhibited interdisciplinary understanding (Mansilla et al. 2000 as cited in Repko 2008). In view of this, Repko cautioned that in the interdisciplinary studies any attempt to do away with integration as a key element, can greatly disturb the link between teaching, learning and research.

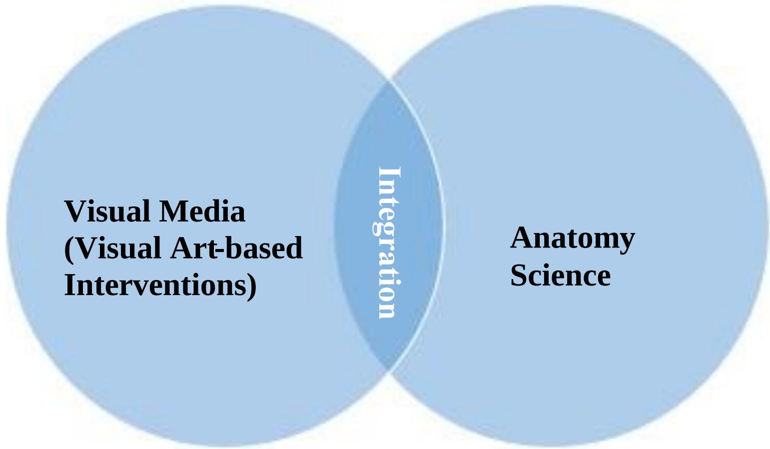


Figure 2. 1: Interdisciplinary Integration Framework

Source: Adopted from Repko 2007; Fogarty (1991) as cited in Lake 2000

2.18.1 Integration in Interdisciplinary Studies

Integration is to make whole a process in which ideas, data and information, methods, tools and concepts from two or more disciplines are synthesized, connected or blended (Quizlet 2019). Interdisciplinarians largely agree that integration is central to interdisciplinarity studies and interdisciplinary research process. Although the quest to seek integration is not the main aim of interdisciplinary work, experts believe that integration is the means to attain interdisciplinarity in understanding complex phenomena or finding answers to solving perplexing issues. That is to say, interdisciplinary studies require triangulation of depth, breath and integration to achieve holistic thinking and understanding of complex concepts or theories (Cornwin 2019). Interdisciplinarians fall under two categories: that is, the Generalists Interdisciplinarians and Integrationists Interdisciplinarians (Repko 2007). The generalists refer to interdisciplinarity as any method of communication between two or more disciplines without seeking to integrate insights from that discourse. But Integrationists like Klein and Newell (1997, pp.2-3) as cited in Repko (2007) define interdisciplinarity as a means of finding answers to a question, a solution to a problem, or tackling an issue "that is too broad or complex to be dealt with adequately by a single discipline or profession and drawing on disciplinary perspectives and integrating their insights by producing a more comprehensive understanding". From the above literature reviewed, this study adopted the integrationist interdisciplinary studies approach in which integration of insights from two or more disciplines is emphasised. Integrationists further provided methodologies as a guide for integrating insights from minor disciples with major disciplines (Fogarty 1991; Harden 2000).

2.18.2 Methodologies for Integration

Integrationist interdisciplinary experts have explained that interdisciplinary studies involve integration of ideas or insights from minor disciplines. Atwa and Gouda (2014) describe two methodologies for integration. These are Harden's (2000) Methodologies for Integration and Fogarty's (1991) Ten Methodologies for Integration as cited in Lake (2000). In addition, there is Barber's (2009) model for integrating students' learning.

2.18.2.1 Harden's (2000) Integration Ladder for Development of Integrated Curricula

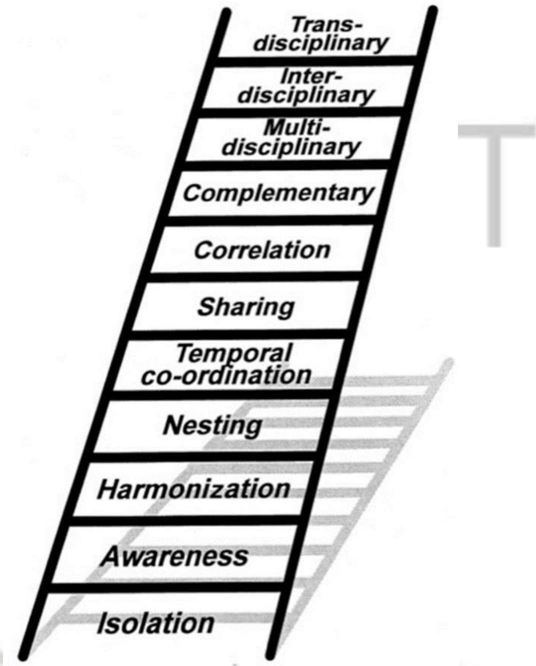


Figure 2. 2: Steps on the integration ladder for development of integrated curricula.

Source: Harden (2000)

A careful observation of the integration ladder as shown in Figure 2.2 indicates eleven steps from subject-based to integrated teaching and learning level. In the first four steps on the ladder, the emphasis is on integration within similar subjects or disciplines. In moving up the ladder, the next six steps emphasize integration across several disciplines. In the final step, the student takes more responsibility for the integration and he or she is given the tools to do so. Haden (2000) explains how the various components of the integration ladder works.

Step 1: Isolation

At the isolation level teaching is subject based, and departments or subject specialists organize their teaching without consideration of other subjects or disciplines.

Step 2: Awareness

The advantage that the awareness level approach provides is that a teacher can take account of the content that colleague teachers have covered in other disciplines of the course when planning his or her teaching.

Step 3: Harmonisation/Consultation

At the harmonization level of the ladder, teachers responsible for teaching different courses or aspects of the same course consult each other and discuss their courses. The consultation process occurs through informal discussions between teachers or through more formal curriculum planning committees in meetings. With the use of the harmonization approach, the overall curriculum objectives are more likely to be achieved. However, the disciplines still remain separate.

Step 4: Nesting

Nesting involves drawing content from different subjects in the curriculum to enrich the teaching of one particular subject. At this stage of integration, teachers "analyze" the separate objectives of a subject and identify ways in which these broad objectives can be refined into existing subjects.

Step 5: Temporal Coordination/Parallel Teaching

This level of integration also means that each subject remains responsible for its own teaching programme. However, the timing of the teaching of topics within a subject is done in consultation with other disciplines. The timetable is adjusted so that topics within the subjects or disciplines which are related are scheduled at the same time. Students study the concepts of the different subjects separately, and are left to uncover the relationships themselves. This approach has been described also as ‘parallel’ or ‘concurrent teaching.

Step 6: Sharing/Joint Teaching

At this level of integration, two disciplines, which are complementary subjects with overlapping concepts or ideas emerging as organizing elements, may agree to plan and jointly implement a teaching programme. The disciplines emphasize shared concepts, skills, and attitudes. The motivation for shared programmes often comes from the subjects or departments themselves through the identification of common areas of teaching, or the need to include a new topic in the curriculum. What is required is that the two disciplines should have overlapping concepts and ideas, but the integration is not fully emphasized.

Step 7: Correlation/Concomitant Programme

At the correlation integration level, emphasis remains on disciplines with subjectbased courses taking up most of the curriculum time. This session brings together areas of interest common to each of the subjects. Within this framework, an integrated teaching session or course is introduced in addition to the subject-based teaching. However, the integrated disciplines should have areas of common interest. Also, the integration is not fully emphasized, as the emphasis is still on the separate disciplines or subject.

Step 8: Complementary/Mixed Programme

This approach has both subject-based and integrated teaching. The integrated sessions now represent a major feature of the curriculum. These sessions are recognized to be more important in terms of time, allocated resources and assessment than the subject-based teaching. The focus for the teaching may be a theme or topic to which the disciplines can contribute.

Step 9: Multi-Disciplinary/Webbed

With the multidisciplinary approach termed “webbed”, Harden brings together a number of subject areas in a single course with themes, problems, topics, or issues as the focus for the students' learning. The themes selected as the focus in an integrated course may outline an area in which practical decisions have to be made and which serve as a focal point of interdisciplinary thinking. In multidisciplinary teaching, the contributions of the individual disciplines to the theme are stated implicitly in the curriculum documents and the timetables.

Step 10: Interdisciplinary/Monolithic

In interdisciplinary integration there is a further shift of emphasis to themes as a focus for the learning and a search for commonalities of ideas across the disciplines as they relate to the theme. This approach allows the move from a multidisciplinary perspective to an interdisciplinary approach.

Step 11: Trans-Disciplinary/Authentic /Fusion/Immersion

In trans-disciplinary, as in interdisciplinary integration, the curriculum transcends the individual disciplines. The concentration of trans-disciplinary integration for learning, however, is not a theme or topic selected for this purpose, but the field of knowledge as exemplified in the real world. The teacher provides a structure or framework of learning opportunities, but the integration is done in the mind of the student, based on hi-fidelity situations in the real world of clinical care. Thus, in a trans-disciplinary approach the disciplines become part of the learner's real world of experience and through these they filter the broader aims and goals of the integrated curriculum.

2.18.2.2 Fogarty Methodologies for Integration

Fogarty (1991) also describes ten levels of integration and these are grouped under three forms.

Form One: Within a Single Discipline

 Fragmented

The fragmented methodology is a traditional curriculum design which separates topics and courses into distinct disciplines. In this model, courses are separated into traditional areas of study. Each area is defined as an independent course of study.

 Connected

A connected methodology focuses on the details, subtleties, and interconnections within an individual discipline. It is this focus on making connections (that is, one topic to another, one skill to another or one concept to another) which makes this methodology a simple form of integration. This approach is important to the concept of integration because it directly relates ideas within a discipline.

Form Two: Across the Disciplines

 Nested

The nested model focuses on curriculum integration by taking advantage of natural combinations that allow teachers to develop the thinking skills of students through cause and effect experiments. It also provides students with learning opportunities to develop skills through exploration and practice.

 Sequenced

With sequenced integration topics and units are taught independently, but they are arranged and sequenced to provide a framework for related concepts. Teachers arrange topics so that similar units are comprehensible.

Shared

The shared model brings two distinct disciplines together into a single focus. The shared methodology overlaps concepts as the organizer. Advantage of the shared model is that instructional experiences with two teachers on a team are less difficult to collaborate.

Webbed

The webbed approach requires thematic teaching using a theme as the base for instructions in many disciplines.

Threaded

The threaded approach to integration is a meta-curricular approach where big ideas are enlarged. This methodology threads thinking skills, social skills, study skills, graphic organizers, technology, and multiple intelligences approach to thinking throughout all disciplines. The threaded approach supersedes all subject matter content. Using this approach, interdepartmental teams can focus on thinking skills to integrate with content information. The threaded approach takes learning to a synthesis level.

Integrated

In an integrated methodology interdisciplinary topics are arranged around overlapping concepts and emergent patterns. This process blends the disciplines by finding overlapping skills, concepts, and attitudes found across the disciplines. Much like the shared methodology, integration is a result of shifting related ideas out of the subject matter content. An important process of the integrated methodology is that teachers work together on the topics or themes as commonalities emerge.

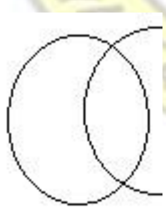
Form Three: Within and Across Learners

- **Immersed**

The immersed methodology focuses all curricular content on interest and expertise. With this methodology, integration takes place within the learners, with little or no outside intervention. This immersed study is often undertaken in a field of intense interest or passion.

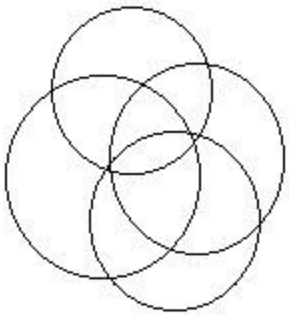
- **Networked**

A networked methodology creates multiple dimensions and directions of focus. Like brainstorming, it provides various ideas and ways of discovering. The networked methodology is totally student-centered. It professes that only the learner can direct the integration process. The methodology proposes that learners know their topic and can self-direct their focus on the necessary resources both within and across subject areas. The underlying diagram (Figure 2.3) outlines the Fogarty's Chart for Curricula Integration.



Shared

Team planning and, or teaching that involve two disciplines focuses on shared concepts, skills and attitudes.



Integrated

Priorities that overlap a multiple disciplines are examined for common skills, concepts and attitudes.

Figure 2. 3: Framework for Curricular Integration

Source: Fogarty (1991) as cited in Lake (2000)

The study employed the shared and integrated frameworks for the study because these frameworks allow Art Educators and Medical Educators to share ideas that are relevant for integration for learning of Gross Human Anatomy. That is, while the Shared framework allows for team planning and team teaching on shared concepts and skills, the integrated concept allows for students to identify common ideas, skills and experiences that are necessary for integration during learning of Gross Human Anatomy.

Therefore, the integrationist interdisciplinary approach conformed to the study because it does not only provide opportunities for drawing ideas from minor and major disciplines to solve complex problems or understand complex concepts. It also provides a methodological approach to integrating the ideas. Also, this approach was chosen because it guided the researcher in finding out how ideas, skills and concepts from a minor discipline like visual media can be integrated with medicine as a major discipline to improve teaching and learning of Anatomy. Further, this approach provides lecturers and medical students at the SMHS with opportunity to explore and integrate relevant visual media with medicine to address the challenges they face in teaching and learning of complex topics under Anatomy.

2.18.2.3 Barber's Model for Integrating Students' Learning

In thinking about integrating knowledge from disciplinary perspectives, Barber (2009) looked at the content of knowledge to be integrated, the context in which knowledge is to be integrated and the process for integrating it. The context filter relates to the learning environmental factors that facilitate how students interact, connect and integrate things that matter as far as their studies are concerned. That is, the context in which learners learn new information determines how they process what they learn, and whether they should integrate that new information with other concepts of learning. Students' developmental level is crucial in how they handle and reflect upon new information for evaluation and integration.

Based on this model, Baber recommends that educators should intentionally create opportunities for learners, be mindful of how students make meaning of things learnt based on their developmental levels, help students engage in contextual integration of learning across multiple perspectives by incorporating opportunities for connection, application and synthesis of disciplinary concepts into their pedagogy. This approach to making sense and integrating new knowledge demands that students reflect upon and evaluate new information through content, contextual and meaning making lenses from multiple perspectives. In situations where students become disinterested in integrating new information immediately, Baber believes that they can take a second look at the new information and reconsider integration at a later time in the learning process.

This study has adopted Barber's (2009) model for integrating learning. This comprises five sections and they are outlined below:

1. It deals with the content to be integrated with medicine.
2. It discusses the context within which integration will occur.
3. It explains how students make meaning of ideas, concepts, experiences and skills learnt.
4. It delineates on how students reflect and evaluate to see ideas, concepts, experiences and skills from other disciplinary perspectives.
5. It describes how students integrate, evaluate and apply ideas, concepts, experiences and skills to indicate connection of concepts learnt, or ignore integrating the skills and experiences to indicate isolation of concepts learnt but to reconsider integrating the concepts at a later time.

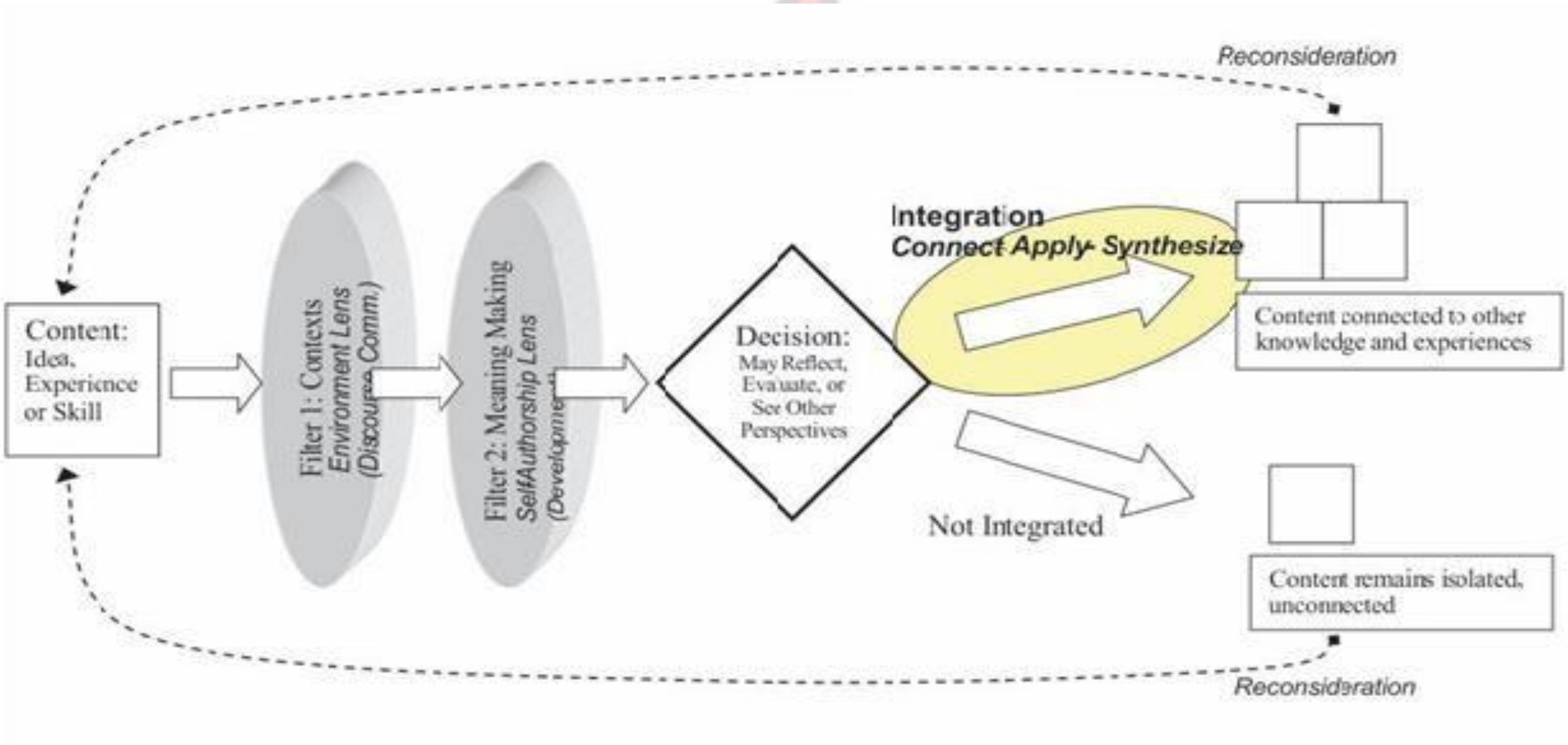
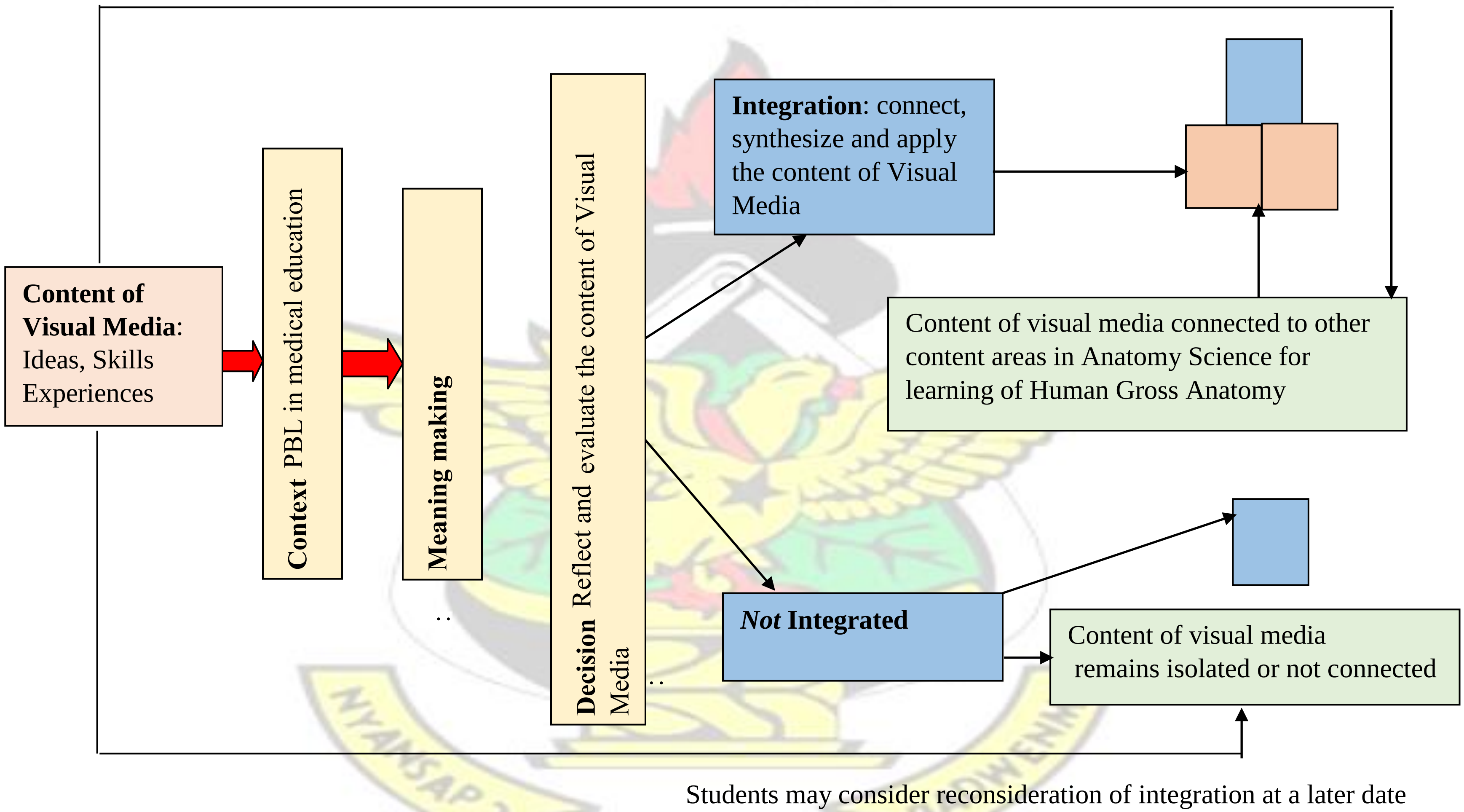


Figure 2. 4: Model on students integration of learning. *Source: Barber (2009)*



Content of Visual Media: Ideas, Skills Experiences
Context PBL in medical education
Meaning making
Decision Reflect and evaluate the content of Visual Media
Integration: connect, synthesize and apply the content of Visual Media
Content of visual media connected to other content areas in Anatomy Science for learning of Human Gross Anatomy
Not Integrated
Content of visual media remains isolated or not connected
Students may consider reconsideration of integration at a later date

Figure 2. 5 Researcher's Conceptual framework for the Study (Adapted from Barber 2009; Lake 2000).

- **Figure 2.4 illustrates Components of Barber (2009) Model on Students Integration of Learning**

Content for Integration: The content for integration in this study includes critical observation and analysis of visual details of artistic and medical images, sketching and shading of images of three-dimensionality, and doing appreciation and perception of visual details of images. This will also expose students to develop skills and attitudes for compassionate care through interaction with artifacts of relevance to medicine.

Context for Integration: This integrates critical thinking and observational skills training to provide students opportunity to interact with relevant visual media individually or in groups to sharpen their observational skills. At the School of Medicine and Health Science, medical students are expected to utilise multiple skills from across disciplines to answer a question, complete a task to resolve a medical scenario.

Meaning Making: This enables students to make meaning of ideas, experiences and skills acquired through visual art-based interventions and see how these skills and experiences relate to learning of Anatomy.

Decision: This provides students with opportunity to reflect and evaluate observational skills acquired and its relevance to medicine before considering integration of observational skills and experiences with medicine.

Integration: This allows integration of critical observational skills with medicine to be optional. The students may evaluate, apply and synthesis observational skills acquired or refuse to integrate the skills temporally, but to reconsider integration at a later time.

Therefore, reviewing Baber (2009) and Fogarty (1991) as cited in Lake (2000), this study developed the conceptual framework for the study as shown in Fig. 2.5.

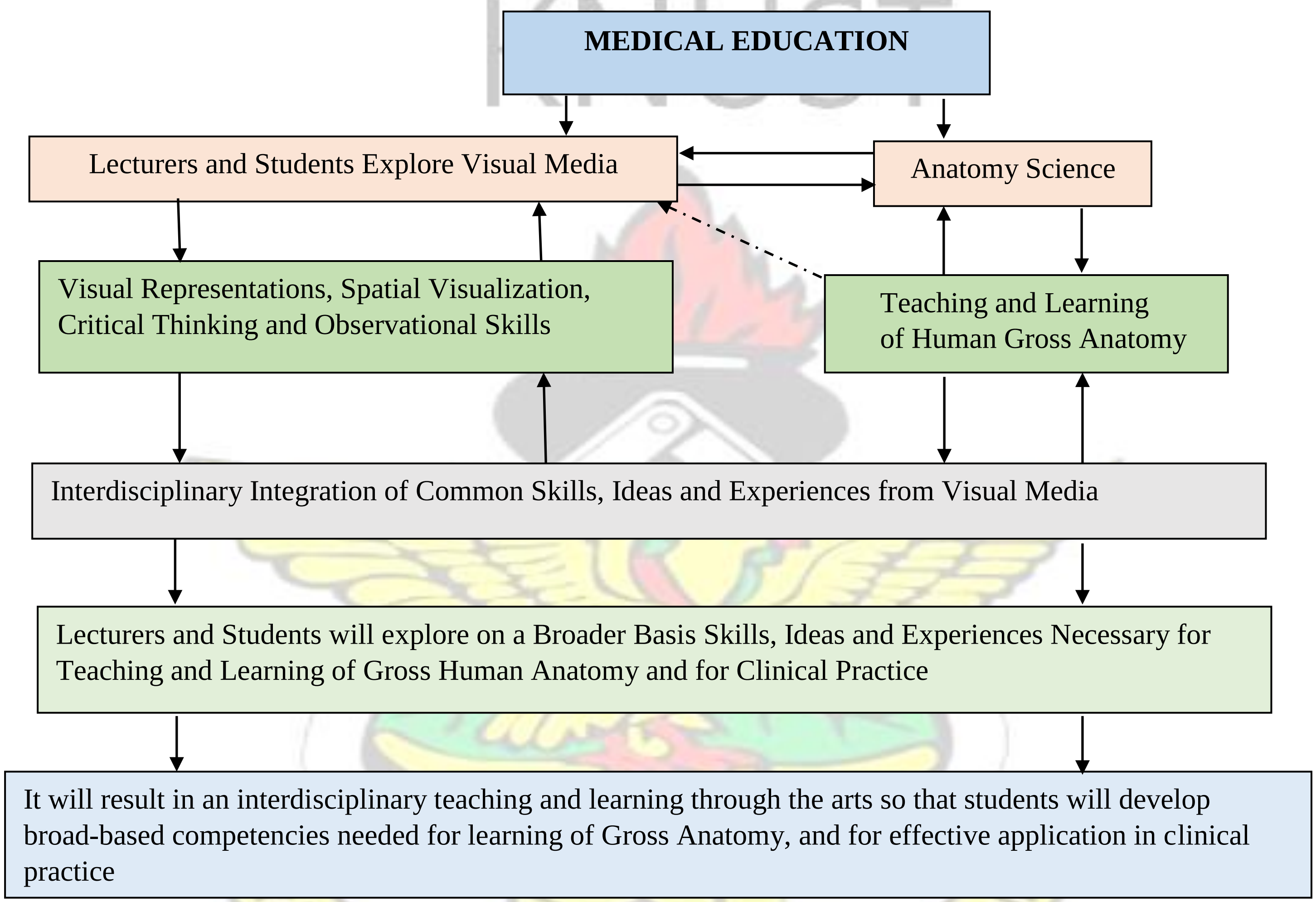


Figure 2. 6: Conceptual Framework for Integrating Visual Art-Based Intervention with Medical Education to Improve Teaching and Learning of Gross Human Anatomy.

Source: Researcher's Construct

Medical Education: The arrows connecting "Medical Education", "Anatomy" and "Visual Media" show that both Anatomy as a course and Visual Media as instructional material occur in medical education for preparing medical students as future doctors.

Visual Media, Anatomy Science and Students' Learning: The horizontal arrows between Visual Media and Anatomy indicate that both concepts are interconnected. The vertical arrows between Anatomy Science and Students Learning illustrate an interaction between the students and anatomy concepts on one hand, and the diagonal arrow towards Visual Media also indicate that students interact with visual media in the learning process to ease understanding of concepts learned under Anatomy rather than for clinical practice. That is, Anatomy can not be learned effectively without utilizing visual media.

Students' Learning and Visual Thinking and Observational Skills Sessions: This shows a higher level of students' interaction with various visual media through visual art-based intervention with visual images to hone their observational skills for clinical practice in the area of physical examination and diagnosis of disease conditions. Interaction in this context involves critically analysing physical features and other visual details of visual media.

Reflection and Evaluation: This is the stage students examine skills and ideas that overlap with medicine for integration.

Interdisciplinary integration: This is the stage common skills and ideas considered by the students are effectively integrated to solve a learning task or find solution to a clinical problem.

Developed Framework: This visual art-based framework, as an approach to interdisciplinary studies in medical education, is meant to bring about interdisciplinary teaching and learning through the arts so that students will develop broad-based competencies needed for learning of Anatomy, and for effective application in clinical practices.

2.19 Summary of the Review

In summary, this review has discussed interdisciplinary concept and established that artifacts collectively termed as visual media, in context of this study, play a key role in medical education in general and anatomical science education in particular. Pragmatist philosopher like John Dewey affirmed that effective teaching and learning in the Sciences require an interdisciplinary approach. In pursuing this agenda of interdisciplinarity in medical education, several authors have pointed out that the application of visual media and for that matter artifacts relevant to medical education cannot be overlooked especially in teaching and learning of Anatomy. Theories of learning including art theories reviewed in this thesis all pointed to the fact that physical and virtual instructional materials in the form of audiovisuals, models, skeleton and diagrams as teaching-learning materials are essential for teaching and learning science related subjects including Anatomy. Theories of learning such as constructivism and pragmatists in particular have stressed the need for opportunities to be created for learners to explore their own styles of learning in teaching and learning processes. However, the literature also pointed out that inadequate supply of two-dimensional physical and virtual visual media, lack of adequate classroom space for small group learning activities, and time constraints on the part of lecturers to transmit volumes of medical information to students are some of the factors that affect teaching and learning of Anatomy in medical schools. The literature reviewed also traced the history of medical education as originated in Ancient Greek, Italy and Europe through to Ghana. Specifically, the literature expounded on the PBL medical education concept that has been implemented at the University for Development Studies School of Medicine and Health Science, Tamale.

CHAPTER THREE

METHODOLOGY

3.0 Overview

This chapter discusses the research design employed in investigating an interdisciplinary approach to medical education with a focus to understand the role that visual media plays in Anatomy education at the School of Medicine and Health Sciences at University for Development Studies (UDS), Tamale. Also, it discusses the population for the study, the sample and sampling techniques, instruments used for collecting data, validity and reliability of research instruments, ethical consideration and data analysis plan employed for the study.

3.1 Research Design

This study employed the quantitative-led mixed method, with true experimental and descriptive research methods. It entails the collection, analysis and integration of both quantitative and qualitative data in a 'single research to comprehend new questions, complex phenomenon or interactions that usually occur in medical education research (Schifferdecker & Reed 2009; Maudsley 2011; Tariq & Woodman 2013; Leech & Onwuegbuzie 2009 as cited in Lavelle, Vuk & Barber 2013).

Specifically, the explanatory sequential mixed method was employed to investigate the role of visual media in teaching and learning of Anatomy at the School of Medicine and Health Sciences of UDS, Tamale from interdisciplinary perspective.

3.1.1 Explanatory Sequential Mixed Methods

In mixed methods design, data is collected in phases depending on the specific type of mixed method the researcher chooses for his or her study. Curry, Krumholz, O'Cathain, Clark, Cherlin and Bradley (2013) state four of the mixed methods as explanatory sequential method, exploratory sequential method, convergent parallel method and concurrent embedded method. According to Curry et al., the explanatory sequential approach demands that the collection of quantitative data precede the collection of qualitative data. The results from the qualitative data are then used to explain the outcomes of the quantitative data to enable the researcher understand the problem areas.

The explanatory sequential mixed method was adopted because quantitative data was collected through the use of questionnaire and experiment whiles qualitative data was collected using focus group discussions, interview and observations so that the researcher could generalise the results (Creswell 2003). This method enabled the researchers to expound results, or decrease flaws emanating from the use of a single method. It also helped "deepen our understanding about teaching and learning of Anatomy in medicine" (Warfa 2016; Cameron 2014; Cook, Bordage & Schmidt 2008 as cited in Lavelle, Vuk & Barber 2013, p.272).

- **Advantages and Disadvantages of Mixed Method Research Design** In terms of the benefits of the mixed method approach, Khalid (2016) states that mixed method strategies can offset the weaknesses encountered in research by allowing for both quantitative and qualitative analysis in the same study, resulting in a broader perspective of the overall issue or research problem. Also, mixed method reduces the personal biases of the researcher. Fillmore (2016) also says utilizing the strengths of mixed methods research in medical education provide researchers with unique and vital understanding into the challenges affecting the education of medical students. The use of mixed methods research design does not only unravel issues to aid understanding of how medical students learn Anatomy, but it generally provides educators with the necessary tools to increase our understanding into multifaceted, non-academic issues that propel learning that may otherwise remain concealed.

In spite of the benefits derived from using mixed methods approaches, Creswell (2014) points out that it is difficult to determine how much literature to review when conducting a review of the literature in mixed method research. In support of Creswell's assertion, Khalid (2016) states that it is more time-consuming to collect both quantitative and qualitative data and the study may require more resources to collect both qualitative and quantitative data. The research procedures are more complicated and may be out of the comfort zone of the researcher. Investigators are often trained solely in quantitative or qualitative methods and may need assistance crossing over or integrating both approaches.

- **Justification for Using Mixed Methods Approach**

This study employed the mixed method design because it enabled the researcher to analyse and interpret both quantitative and qualitative data collected to explain how the application of visual media affect the teaching and learning of Anatomy at the School of Medicine and Health Sciences from interdisciplinary perspective.

The comprehensive and mixed approach answer questions in a rich and meaningful fashion. It also provides new insights and raises new questions on the nature of learning and instruction. That is, the mixed methods approach provided the researcher with opportunities to explore and reveal meanings that any of the single approaches when used alone may not be able to uncover.

Also, the rationale for using mixed methods design for this research was to increase the range and scope of inquiry, to discover new dimensions that may emerge, to triangulate, or corroborate data evidence, or to use methods sequentially to increase construct validity (Greene et al. as cited in Schifferdecker & Reed 2009 as cited in Lavavelle et al. 2014). Since teaching and learning of Anatomy is complex and require interdisciplinary approach with sub-disciplines to ensure effective teaching and learning outcomes, the use of 'single' research design alone was too inadequate to help the researcher explore the issues under study. Figure 3.1 provides the type of mixed methods employed.

Explanatory sequential Mixed Methods

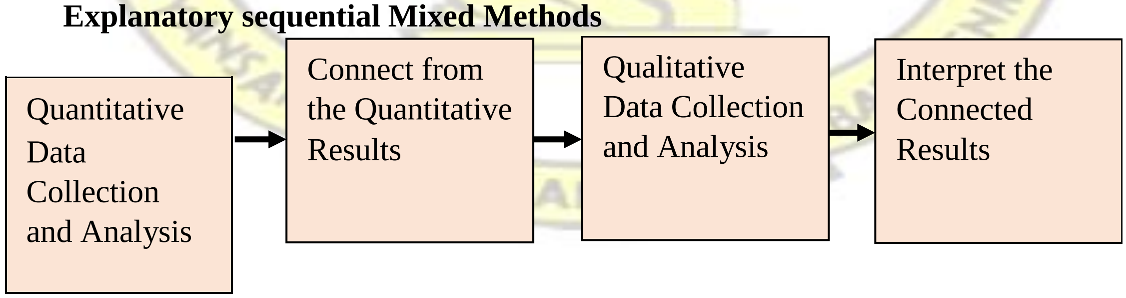


Figure 2. 7: Framework for mixed methods design.

Source: Adopted from Curry et al. (2013)

3.1.2 Experimental Research Design

The study employed the posttest only of true experimental research design. Ross and Morrison (2014) assert that researchers in experimental research are interested in environmental change by designing standardized procedures to hold all conditions constant except the independent (experimental) variable. This helps in ensured high internal validity (experimental control) in comparing the experimental group to the control group. According to Personal (2019), true experimental research is most accurate because it relies on statistical analysis to prove or disprove a hypothesis by establishing a cause-effect relationship within a group. It involves treatment group and control groups, a variable to be manipulated by the researcher and random distribution of the research subjects (personal 2019). Cirt (2019) and Personal (2019) have outlined some advantages and disadvantages of true experimental research as discussed below.

 Advantages of True Experimental Research

1. It is useful in identifying general trends from the results.
2. It minimizes the challenges with ethical concerns that may surround the pre-selection and random assignment of test subjects.
3. It results in genuine results due to the natural setting in which the research is conducted.

 Disadvantages of True Experimental Research

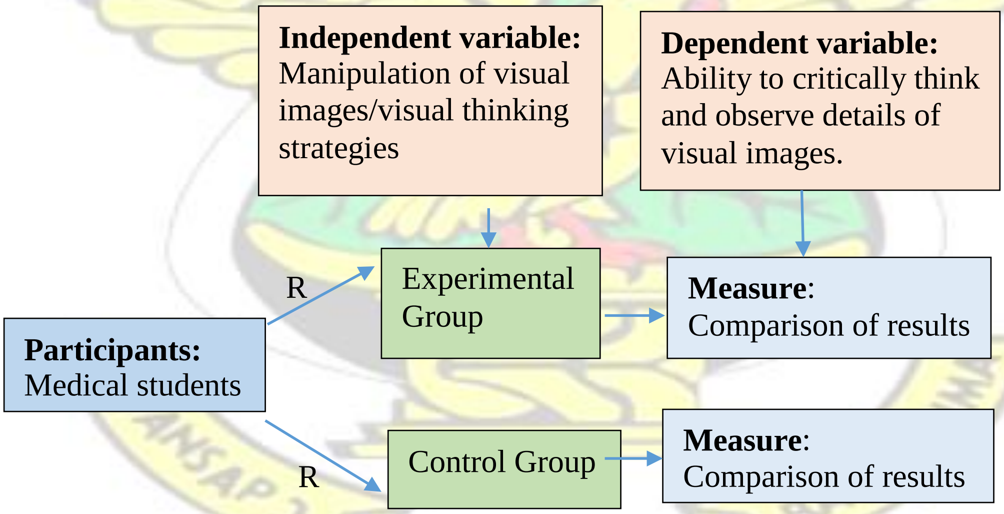
1. The lack of random assignment of research subjects can limit the

generalizability of the results to a larger population.

2. The research must adhere to ethical standards in order to be valid.
3. The lack of random assignment of research subjects may render statistical analyses less meaningful and this can be a threat to internal validity.

- **Justification for Using Experimental Research**

This study employed posttest of the true experimental design because it made possible random assignment of research subjects to experimental and control groups. It also made possible manipulation of visual images (independent variable) on students' ability and knowledge level in critical thinking and observational skills (dependent variable) in a natural medical school setting to achieve internal validity.



Key= 'R' represents random assignment of research subjects to conditions.

Figure 3.1: Diagram for posttest only experimental design.

Source: Adopted from Personal (2019); Orrange Coast College (2019)

3.1.3 Descriptive Research Method

The descriptive research method was employed to enable the researcher gather answers to the research questions. Descriptive research help to describe the characteristics of phenomenon as it is with high degree of precision. In the process, researchers describe what events they have observed and how events occurred (Saunders, Lewis, & Thornhill 2007).

Advantages of Descriptive Research

1. The descriptive research method enables researchers to conduct a study by observing and noting details of how events unfold in a natural environment.
2. It provides respondents with opportunity to express their views in their own words.
3. It allows for a triangulation of interview, focus group discussion and observation in the data collection process.

Disadvantages of Descriptive Research

1. With descriptive research, it is difficult to observe several events occurring at the same time.
2. The researchers' own biases can influence the results of the study.

Justification for Using Descriptive Research

In spite of the demerits, the use of descriptive research was appropriate because it enabled the researcher to observe teaching and learning of

Anatomy as they occurred in the natural medical school environment. It again assisted the researcher to describe observations made on visual media used, experiment conducted as well as interpreted the views of lecturers and students collected through questionnaire, focus group discussion and interviews.

3.2 Population

Explorable (2019), Bret and Bret (2011) and University of Missouri-St. Louis (2019) define population as a complete set of elements (persons or objects) that have similar characteristics or the entire group of people or objects to which the researcher wishes to generalize the study findings. According to University of Missouri-St. Louis (2019), a population is composed of two groups; the target population and accessible population. In choosing a population for a study, Banerjee and Chaudhury (2010) express that the researcher should be guided by the research questions or purpose of the study before defining the population to be studied in terms of location and restriction to a particular course of study, occupation, age group or sex. However, the population must be fully defined so that those to be included (inclusion criteria) and those to be excluded (exclusion criteria) are clearly indicated.

The population for this study comprised two hundred and eleven (211) Level 300 and one hundred and thirty-eight (138) Level 400 undergraduate medical students as well as four (4) Lecturers who teach Anatomy at the SMHS of the University for Development Studies, Tamale. Therefore, the population for the study was 211+138+4=**353**.

- **Inclusion Criteria**

Panacek and Cheryl (2007) articulate inclusion criteria as the selection of research participants that meet the requirements of the researcher for the study. This includes research subjects that will give their consent verbally or in written in order to be eligible for the study. That is, exclusion criteria helps to ‘predict or to eliminate’ possible study challenges or confounding variables. These writers stated that research participants who are difficult to recruit or keep in the study can create problems and for that matter might be excluded from the study. Following explanations provided by Panacek and Cheryl on mode of selection of research subjects, this study ensured that students who participated in the research met the following criteria:

- The participants were medical students pursuing Anatomy as a course of study**.**
- The participants were Levels 300 and 400 students in pre-clinical years in the school.
- The participants were in school and participating in all the teaching and learning activities that went on at the UDS-SMHS at the time the research was conducted.

3.2.1 Target and Accessible Population

Mohsin (2016) and Fraenkel, Wallen and Hyun (2012) state that target population refers to the complete cases of individuals or objects of interest that meet a chosen set of criteria for a particular study (Umair 2018; Fraenkel, Wallen & Hyun 2012). The target population for the study focused on the total population of 4 lectures in addition to 211 and 138 Levels 300 and 400 students respectively.

According to Umair (2018), accessible population is the population in research to which the researchers can apply their conclusions. The accessible population is a subset of the target population and it is also known as the study population. The study population, which can also be used as accessible population, is the actual sampling frame from which we randomly draw our sample. This is the group to whom we can generalize our findings because we sampled from it.

Therefore, the target population was the same as accessible population which comprised 211 Level 300 and 138 Level 400 medical students plus 4 Lecturers, totaling 353.

3.3 Sample and Sampling Techniques

Kendra (2018) and Bret and Bret (2011) mention that a sample is a subset of a population that represents the entire group as a whole. If the sample is truly representative of the population in question, then researchers can generalize their results to the larger group from which the sample was drawn. The objective of selecting a sample is to achieve maximum accuracy in your estimating results within a given sample size whiles minimising biases (Indiana University Bloomington 2019). Mohsin (2016) also articulates that a sample is said to be representative when the characteristics of elements selected are similar to that of the entire target population. That is to say that, the more the sample is representative of the population, the higher the accuracy of the inferences, and the better the results are generalisable. Gaganpreet (2017) describes sampling as a technique employed by researchers in systematically selecting a relatively smaller number of representative items or individuals from a pre-defined population to be used as subjects for observation or experimentation based on the objectives of the study. Thus, the entire process of sampling is done with each subject selected independently of the other members of the population. This study employed the purposive and stratified random sampling techniques.

3.3.1 Purposive Sampling Technique

Purposive sampling is the non-probability sampling procedure in which the researcher uses his or her own judgment to select the cases that make up the sample (Saunders, Lewis & Thornhill 2007), based on the researcher's prior knowledge that those selected can provide the needed information (Fraenkel, Wallen & Hyun 2012). This sampling technique involves careful selection of participants in order to obtain the needed information to help answer the research questions or satisfy the research objectives (Etikan, Musah & Alkassim 2016). With the use of purposive sampling the researcher 'knows what needs to be known' and goes out to identify people who can and are eager to offer the information based on the knowledge and experiences of those people identified (Cresswell & Clark 2011; Patton 2002 as cited in Palinkas, Horwitz, Green, Wisdom,
Duan & Hoagwood 2015).

- **Advantages and Disadvantages of Purposive Sampling**

Etikan et al. (2016) affirm that one of the advantages of purposive sampling is the array of sampling techniques that can be used in qualitative research designs. That is, in research situations involving multiple phases such as occur in mixed methods, purposive sampling becomes useful because it offers an array of non-probability sampling techniques. However, purposive sampling has some limitations. One major disadvantage of purposive sampling is that the researcher is subjective and bias in selecting the subjects of the study. This approach limits the researcher's ability to draw inferences about a population (Etikan et al. 2016).

- **Justification for Using Purposive Sampling Technique**

The purposive sampling enabled the researcher to select Lecturers who teach Anatomy to Level 300 and 400 students for interview in order to obtain comprehensive information on the issues under investigation. Although, the purposive sampling technique does not concern so much with 'transferability' of results to other situations, information obtained from respondents provided clues to support analysis of quantitative data collected (Teddlie & Yu 2007 as cited in Lavavelle et al. 2014).

3.3.2 Stratified Random Sampling Technique

In conducting a research, the stratified random sampling is employed when the target and accessible population show sub-populations and the population (elements) are heterogeneous between the strata, and the elements within-stratum are homogenous then, it is highly recommended to use this sampling technique to design the sample (Ahmed 2009). The stratified sampling is when samples are taken from each stratum or subgroup of the population to represent the entire population (Leedy 2005). This implies that, stratified sampling techniques are generally used when the population is heterogeneous, and where certain homogeneous or similar sub-populations can be isolated. In this case, the sub-groups are Level 300 and Level 400 medical students employed for this study.

 Advantages and Disadvantages of Stratified Random Sampling In terms of the merits, Elfil and Negida (2017) opine that the stratified random sampling technique permits investigators to achieve an appropriate sample size from each of the strata separately as if it was a different study. These writers assert that since the simple random sampling technique usually represents the whole target population, researchers can better employ the stratified random sampling technique to attain an adequate sample from all strata in the population. Ahmed (2009) also points out that stratified random sampling technique allows researchers to study stratum variations, increases precision in results when variance is smaller as well as reduce sampling errors.

Concerning challenges researchers face with the use of the stratified random sampling technique, Ahmed (2009) observes that a sample size is required for each frame and analysis can be complex because sample size estimation is difficult in practice to determine the correct variance estimation.

 Justification for Using Stratified Random Sampling

For the purpose of this study, this technique ensured that each subgroup of the larger population, that is, all medical students in Level 300 and Level 400 who offer Anatomy at the School of Medicine and Health Sciences, University of Development Studies were equally represented in the sample. A sample proportion of 66% of the target population was appropriate for this study, as it exceeds the minimum 50% proposed by Leedy and Ormrod (2005) for any given population. This is explained diagrammatically in Figure 3.2 below.

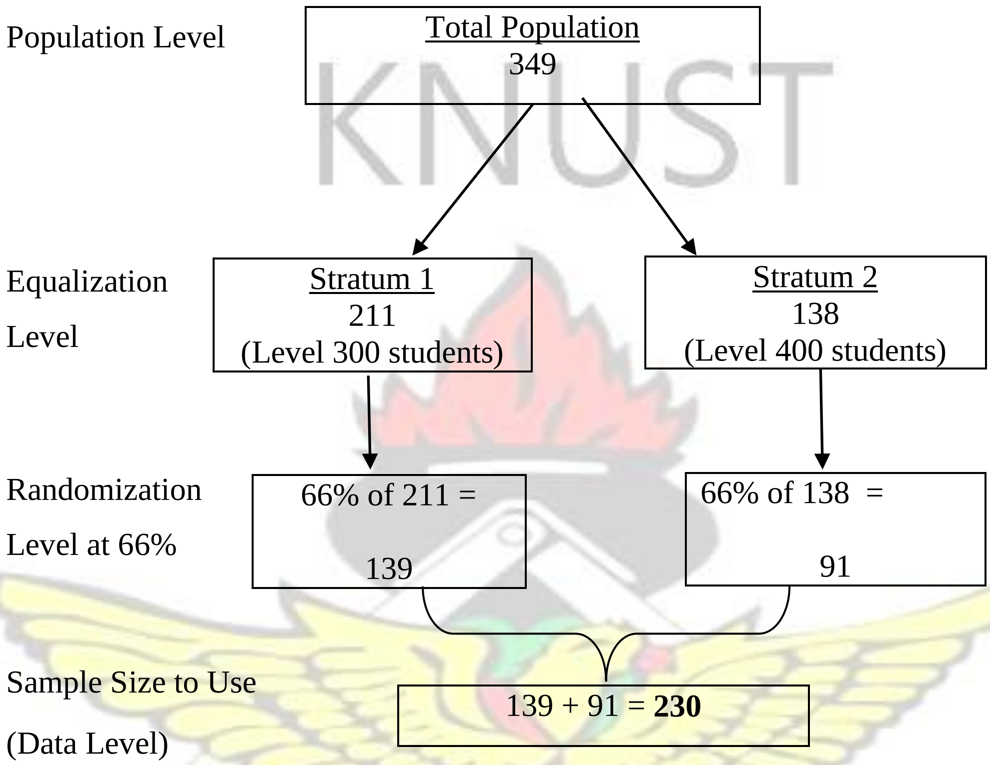


Figure 2. 8: Graphical representation of the Stratified Random sampling. technique employed to achieve the sample size for the study.

3.4 Data Collection Instruments

Although various research instruments are used in collecting data, Zohrabi (2017) states that mixed method approaches usually use closed-ended questionnaire (numerical data), interviews and classroom observations (text data) to collect data. In order to triangulate the data, the researcher can obtain information through different procedures to heighten the dependability and trustworthiness of the data and their interpretation.

This study therefore employed questionnaire, interview, focus group discussion and observation as research tools for the collection of data. An interdisciplinary research of this nature required a mix of research instruments to collect comprehensive data on students' opinion and feelings on how teaching and learning are carried out with visual media for analysis and interpretation; hence, the combination of interview, focus group discussion, questionnaire and observation as data collection instruments for this study.

3.4.1 Questionnaire as Data Collection Instrument

In line with mixed method research design, questionnaire was developed and employed for the data collected based on the research objectives. The Department of Health and Human Services (2008) defines questionnaire as a set of questions for collecting information from individual persons by mail, telephone, as handouts or electronically by email or through webbased. Richards and Schmidt (2002) as cited in Zohrabi (2017) insist that on the whole, questionnaire can appear in three types, that is, closed-ended

(structured) questionnaire, open-ended (unstructured) questionnaire, as well as mixture of closed-ended and open-ended questionnaire (semistructured). The semi-structured questionnaire was used for collecting quantitative data for this study.

 Advantages and Disadvantages of Questionnaire

The Department of Health and Human Services (2008, p.1) points out that questionnaire is useful when resources are limited for the researcher to collect data from a large number of people. Additionally, questionnaire is helpful in maintaining participants' privacy because participants' responses can be anonymous or confidential. This is especially important when researchers have to gather sensitive information.

In spite of the usefulness of questionnaire, researchers usually have to do a lot of follow up in order to obtain adequate response rate and that can be expensive. Additionally, some of the respondents may leave gaps when completing the questionnaire. This can affect the validity of the analysis if the copies of the questionnaire are not adequately completed (Department of Health & Human Services 2008; Richards & Schmidt 2002 as cited in Zohrabi 2017).

3.4.21.1 Designing and Administering of the Questionnaire

The questionnaire administered to the participants in this study contained both open-ended and closed-ended questions. While the closed-ended questions restricted the participants' responses to specific issues, the openended questions solicited responses based on the respondents own opinions expressed in their own words. Additionally, provision was made on the questionnaire for the respondents to provide recommendations if they had any. Moreover, the respondents were given opportunity to provide responses on issues of concern that were probably not covered in the questionnaire. In all, a total of 45 questions were asked on the questionnaire, 10 questions were asked on the visual thinking evaluation questionnaire and another 10 questions were asked to gather responses from the focus group discussion (refer to Appendix E).

Since the researcher sought to ensure validity of the participants' responses, particular attention was paid to the data collection process to minimise biases. Therefore, the questionnaire and the visual thinking evaluation instrument for the visual thinking exercises were all administered within the same time. First, a day prior to the actual day of meeting with the students for the experiment, the questionnaire, the images for observation as well as the evaluation questionnaire were uploaded and posted on the group WhatsApp platforms for both the treatment and control groups.

3.4.2 Focus Group Discussion

A focus group discussion is a kind of interview with a minimum of six and a maximum of twelve people who have similar characteristics. The data collected using this method is subjective and descriptive, and it is usually conducted between 60 and 90 minutes (Evaluation Brief 2018). Prasad and Garcia (2017) and Dilshad and Latif (2013) also lament that focus group discussion is a qualitative research approach in the form of pre-determined structured interview that enables social science researchers to gain indepth understanding of issues or responses that had already been collected from respondents using questionnaire. Although, Eliot and Associates (2005) support the views of Prasad and Garcia (2017) on the number of questions to be asked in a focus group, Eliot and Associates opine that twelve (12) is the maximum number of questions for focus group discussion, ten (10) is better, but eight is ideal.

- **Advantages and Disadvantages of Focus Group Discussion**

Concerning the merits and demerits of focus group discussion, Evaluation Brief (2018); Gorman and Clayton (2005) as cited in Dilshad and Latif (2013), Krueger (1994) and Morgan (1988) as cited in Freitas, Oliveera, Jenkins and Popjoy (1998) have said that focus group discussion generates opportunity to collect data from group interactions by focusing on issues of interest to the researcher. Additionally, it offers the researcher the opportunity to better understand responses obtained through questionnaire that needed further clarification. Although, focus group discussion has its importance, it also comes with some associated disadvantages. In focus group discussion, few individuals may dominate the discussion. The moderator may be biased in moderating the discussions. Also, data analysis is difficult and time consuming and the information obtained from participants may not represent the views of the larger group in situations where the sample size is large.

- **Rationale for Using Focus Group Discussion**

The rationale for employing the focus group discussion was to gain deeper understanding of the students' responses to some of the questions by asking for clarification through the questionnaire (Prasad & Garcia 2017).

3.4.2.1 Planning the Focus Group Discussion

The focus group was conducted following three stages as proposed by Freitas, Oliveera, Jenkins and Popjoy (1998) and they are: planning, conducting the focus group discussion and analyzing the data.

At the planning stage, the quantitative data was analysed and aspects of the students' responses that needed clarification were identified and included for the focus group discussion. First, in consultation with the lecturers the participants for the focus group discussion were purposefully selected. These were students who took part in completing the questionnaire and participated in the critical thinking and observational skills experiment.

In all, twenty (20) students comprising 8 females and 12 males from both Level 300 and Level 400 respectively were selected for the focus group discussion. Also, the researcher contacted each of the selected students on phone and had preliminary conversation on issues that were to be discussed at the conference room located at the Medical School block which was to last for about 1 hour 30 minutes starting at 6.30am. Again, the selected participants for the focus group discussion were informed that the session will be tape-recorded and video-recorded and salient points written down in the researcher's diary. The participants were also assured of anonymity and confidentiality. Having gained the consent of the students to participate in the group discussions, the researcher sent them WhatsApp message to remind them a day before the scheduled focus group discussion (Eliot & Associates 2005).

3.4.2.2 Conducting the Focus Group Discussion

The focus group discussions were conducted in March, 2018 with the selected participants from Level 300 and Level 400. It was necessary to hold separate focus group discussions for both year levels because of disparities in their experiences with the teaching and learning of Anatomy with visual media at the different year levels. That is, focus group participants of each year group should be more willing to freely and comfortably express their views in their year groups without one particular year group dominating in the discussions (Eliot & Associates 2005; Prasad & Garcia 2017). The researcher and the moderator adopted Krueger's (2002) recommended pattern for conducting focus group discussions. These included welcoming the group, giving an overview of the topic, setting ground rules and then asking the first question. First and foremost, the researcher arrived and organised the seating arrangement 30 minutes before the arrival of the participants. The researcher stood in front of the door and welcomed the participants as they arrived. The researcher again briefed the participants about the rationale for the discussion. The participants sat in a circle around a table with each participant's name visible for identification so as to enable the researcher and moderator identify and mention the participants by their names to share their views. All the participants introduced themselves before they shared their individual views on a particular question until the moderator exhausted asking all ten questions. The researcher recorded all proceedings since it assured accuracy and consistency of the responses that were gathered from the participants. Although, the students were in two different year groups, the fact that all the participants were medical students and learned Anatomy at the medical school made it possible for the focus group discussions to be conducted with ease.

3.4.2.3 Validating the Transcribed Data

After the focused group discussions were transcribed, the researcher engaged the services of an expert who played back the audiovisuals and the audio recordings and cross-checked the discussions against the transcribed version. Additionally, the researcher forwarded the soft copy of the transcribed version to the moderator who also replayed the recordings and cross-checked to ensure that the recordings were accurately and objectively transcribed and represented what the participants said without any biases from the transcriber (Bryman 2008 as cited in Alsaawi 2014). After a thorough scrutiny of the transcribed data, the researcher then incorporated main findings of the discussions in the thesis to clarify and explain issues on the quantitative data as shown in chapter four.

Analysis of the focus group discussions was based on 'thematic coding approach' for analyzing focus group interviews, which involves five stages as listed below: (Robson 2011 as cited in Alsaawi 2014, p.153).

- Familiarizing yourself with the data
- Generating the initial codes
- Identifying themes
- Integrating
- Interpreting themes

In connection to this, researchers should "highlight aspects of group interview responses that are of interest to the study" and "label it and put it into particular category" to facilitate interpretation of the responses (Seidman 2012 as cited in Alsaawi 2014, p.153).

3.4.3 Interview as Data Collection Instrument

An interview "is a conversation with the aim of collecting data to describe interviewee's life experiences in the natural setting so as to offer interpretations of the meanings the interviewee ascribes to the phenomenon under study" (Richards 2003; Kvale 1996 as cited in Alshenqeeti 2014, pp.39-40). The interview as data collection instrument enabled the researcher to solicit information from the lecturers through face-to-face interaction. The adoption of interview for collecting data from the lecturers was appropriate because of its effectiveness in collecting firsthand information directly from knowledgeable individual respondents about their feelings, thoughts and how they interpret the world around them (Zohrabi 2017; Burns 1999 as cited in Zohrabi 2017).

- **Advantages and Disadvantages of Interview**

Johnson and Turner (2003) postulate that interview is good for soliciting information on respondents' feelings and attitudes. Interview allows probing by the interviewer and provides in-depth information. However, Ayin (2011) points out that structured interview is limited in its ability to capture information in real context that relates to respondents' experiences across their lifetime. Also, data analysis can sometimes be time-consuming for open-ended items and face-to-face interviews are costly and timeconsuming (Zohrabi 2017).

3.4.3.1 Procedure for Conducting Interview with Lecturers

The focus group discussions revealed issues that needed further clarification from lecturers at the Department of Anatomy, particularly; those who teach Anatomy as a course at the medical school to help the researcher obtain further understanding of the issues affecting the students as far as teaching and learning of Anatomy with visual media are concerned.

3.5 Observation as Data Collection Instrument

Observation as data collection instrument is used in qualitative research to ensure detailed notation of behaviours, events and the contexts surrounding the events and behaviours (Best & Khan 1998). It is one of the important techniques for obtaining firsthand information in qualitative research. Especially, when the researcher seeks to collect data through the use of the human sense organs such as the sense of sight, touch, taste, hearing or smelling whatever is to be observed (Annum 2017). It can take the form of non-participant and participant observation. In non-participant observation, the observer only observes and records the classroom activities without involving himself or herself in the teaching and learning process. In that situation the researcher becomes a spectator, and his identity as a researcher is made known to all concerned (Zohrabi 2017; Fraenkel & Wallen 2003 as cited in Zohrabi 2017).

The use of observation as data collection instrument enabled the researcher to see, touch, critically examine and record details of scientific artifacts or visual media used for teaching and learning of Anatomy and how the students participated in lessons taught. For the purpose of this study, the researcher employed the non-participant observation for collecting the data. The adoption of non-participant observation enabled the researcher to obtain high degree of external validity (Gravetter & Forzano 2009) since teaching and learning of Anatomy were observed in their natural settings at the medical school.

- **Advantages and Disadvantages of Observation**

Observation as a technique for data collection permits the researcher to directly see or listen to events or practices that go on in the classroom (Zohrabi 2017). It gives researchers the advantage to observe students' learning activities, how teachers teach students, students' behaviour and the distribution of classroom time (Ross 1996 as cited in Zohrabi 2017). In spite of the benefits that observation offers to researchers, it also possesses some challenges. Flick (2006) as cited in Zohrabi (2017) outlines that analyzing observational data is time-consuming; observing large population is difficult; there is the possibility of observer bias; and participants may react differently because of the researcher's presence in the classroom (Flick 2006).

- **Rationale for Using Observation as Data Collection Instrument**

The researcher found the use of observation as data collection tool very appropriate for this study because it made possible the collection and recording of observations. For instance, the researcher sat in lessons taught and observed how teaching and learning of Anatomy with visual media were done. It also gave the researcher opportunity to observe the general environment of the medical school to identify how interactive the classroom environment facilitated students' learning of Anatomy with visual media.

3.5.1 Undertaking the Observation

Two forms of observations were done. The first observation that was done by the researcher was the non-participant observation, and the students did the second, which was visual thinking and critical observation of twodimensional images during an art-based experiment. The researcher observed various visual media in the lecture halls, how the lecturers and students utilized the availability of visual media for teaching and learning of Anatomy as well as the effectiveness of the visual media on the teaching and learning of the course. These observations were made within a period of eight weeks but at different trimesters, that is, during 2016/2017 academic year including the first trimester of the 2017/2018 academic year. That is to say that, during this period, the researcher specifically sat in lessons taught and observed how teaching and learning of Anatomy were carried out in some of the lectures, tutorials and skills sessions. The outcome of the observations informed the researcher's decision on how the research questionnaire, interview, focus group discussion and visual thinking and observational skills experiment were fashioned for the study.

3.6 Selection of Participants (Students) for Visual Thinking and Observational Skills Experiment

After using the Microsoft Word for generating “Yes (T)” for Treatment group, “Yes (C)” for Control group and “No” for Exclusion in the sample, they were printed and cut out on 349 small pieces of paper that represented all the students and mixed together in a big brown envelop that helped attain a sample size of 230. The researcher then went round with the envelop for the students to pick at random without returning what has been picked from the envelop and these students were prepared for the experiment. From a sample size of 230, the researcher achieved a response rate of 181, comprising 115 (83%) from Level 300 and 66 (73%) of Level 400 students represented the Control and Treatment groups respectively and participated in the experiment as well as responded to the evaluation questionnaire. Therefore, the overall response rate attained was 181 (79%) of the sample size of 230. Mundy (2002) stated that there is no fixed response rate for a study; 60% would be marginal, 70% is reasonable, 80% would be very good and 90% would be excellent. Based on the explanation provided by Mundy on adequacy of response rate for a study, the researcher considered the total response rate of 79% from both year levels as adequate and representative enough for analysis, conclusions and generalizations of the findings.

3.6.1 Selection of Images for Visual Thinking and Observational Skills Experiment

On the issue of the selection of images for the experiment, firstly, four thought-provoking visual images with varying degree of complexity were obtained and labeled “Image 1”, “Image 2”, “Image 3” and “Image 4”.

Images 1 to 3 were printed in colour and laminated except for "Image 4" which was observed as a virtual image only. In all, 130 hard copies of Images 1 to 3 were produced and distributed to the students so that they could view the images manually, except the Image 4 which was viewed either on a computer or smart phone. The fourth image was purposefully uploaded onto the Google Form and WhatsApp platforms to be viewed solely as a virtual image, since the effectiveness of both virtual and physical media were looked at.

The visual thinking experiment was divided into two parts: One aspect contained detailed information that guided the Treatment group while the other aspect for the Control group did not contain additional information. Each of the research instruments was divided into three parts. Part one solicited demographic information of the research participants; part two sought for information on the participants' background knowledge in visual art and part three gathered responses to closed-ended and openended question items, as well as five Likert scale questions ranging from 1='Strongly Agree', 2='Agree', 3 ='Not Sure', 4='Strongly Disagree' to 5='Disagree'. The visual thinking experiment was based on twodimensional intriguing images, which the selected respondents had to observe and analyse. Samples of the images utilized for the experiment have been presented in Appendix E.

3.6.2 Piloting the Questionnaire and Visual Thinking and Critical Observational skills Experiment

A pilot study is a small study conducted to find out the effectiveness of research instruments designed for data collection and sample collection before the main study is conducted (Zailinawati, Schattner & Mazza 2006; Mubashir, Campbell & Lancaster 2010). Wijk and Harrison (2013) as cited in Dikko (2016) postulate that the rationale for piloting a study is to enhance the credibility of the research by effecting the necessary corrections in order to ensure that the final research instruments used in the main study are effective in collecting the data required to satisfy the research objectives.

Besides, it was necessary to pilot the instruments in order to ensure that the target audience understood the question items on the questionnaire so that they could provide meaningful responses (Perneger, Courvoisier, Hudelson & Gayet-Ageron 2014).

The sample size for piloting the study was selected based on the recommended sample size of 10 to 30 participants for pilots in research to enable easy calculation as well as the ability to test hypothesis (Michael 1995). In the medical field, a minimum sample size of 12 participants from the target population is sufficient for a pilot study (Julious 2005; Michael 1995 as cited in Johnson & Brooks 2010).

For piloting the questionnaire and the critical thinking observation, the questions were converted into online google forms. Copies of the google questionnaire and the observation forms were completed by one of the students at the medical school as a trial test. It was necessary to complete the questionnaire and the observation to ascertain the difficulty level the students will encounter in answering the questions. After corrections were made the instruments were piloted on 23 students randomly selected, that is, 11 and 12 participants (students) from Levels 300 and 400 respectively. After piloting, the responses from the participants were analysed and the feedback obtained revealed that the students were satisfied with the content, wording, length of sentences and general layout of the research instruments. The outcome from the pilot study indicated that the research instruments could be used to collect data from the larger population sampled for the study. Analysis of the piloted questionnaire yielded a Cronbach Reliability Coefficient of .717. This implied that the questionnaire was reliable and could be used for the main study.

- **Step-by-Step Approaches in Conducting the Visual Thinking and Critical Observational Skills Experiments and Evaluation Questionnaire**

Step One: Advance Preparation

In order to ensure the success of the experiment with the visual images, measures were put in place to provide information to participants (students) on the conduct of the visual thinking and critical observational skills experiment. Some of the information shared with the students included the following:

1. Separate WhatsApp platforms were created for treatment group and the control group for each year group. Information about time of meeting, place of meeting and the period of time to complete the experiment were additionally communicated to the participants.

Through these platforms, participants were able to clarify issues of concern regarding the experiment and indicated their readiness to participate in it.

2. Arrangements were made for spaces in two of the lecture rooms at the medical school block.
3. Internet data was bought and distributed to all participants to enable them use their smart phones to complete the questionnaire online. Additionally, extra smart phones were provided as backup to cater for any technical challenges with any of the participants' phones.
4. Snack was provided to support the participants who did not eat breakfast before reporting for the experiment at 6.30am after which they attended lectures. This encouraged students in both treatment and control groups to report on time to take part in the experiment concurrently in order to minimise biases.

Step Two: Administration of both Instruments

For the purpose of this thesis, the researcher followed the phases involved in the explanatory sequential mixed method. That is, the data were collected in two phases. Firstly, quantitative data comprising the use of questionnaire and visual art-based experiment were collected whiles qualitative data comprising the use of focus group discussions and interviews were also gathered in the second phase. The Treatment Group was placed in Room 1 whereas the Control Group was accommodated in Room 2. The first set of questionnaire in google form was administered to the respondents on their smart phones. Both the Treatment and the Control groups answered the questions simultaneously in the separate classrooms. In all, about one and half hours was spent on collecting the data on the questionnaire. Afterwards, the researcher then conducted the visual thinking and critical observation experiment with the treatment and the control group using two-dimensional images. The purpose of this instrument was to test the hypothetical statement that visual art-based intervention with visual images will not improve medical students' visual thinking and critical observational skills which will translate into their ability to accurately diagnose the physical characteristics of disease conditions on the human body. Concerning the experiment, four (4) fascinating visual images were given to both treatment and control groups to observe and analyze. Detailed instructions were given to the treatment group by the researcher who is an artist on how to use visual thinking strategies to analyze the images. But the control group was asked to look at the images and then analyse them without any additional instruction. An additional purpose of this experiment was to establish the basis upon which a suitable framework could be developed to satisfy research

objective three.

A scoring scheme was prepared and used in rating the respondents visual thinking and critical observational skills performance on the images. In order to ensure objectivity and consistency in the scoring of respondents' the researcher together with one of the Anatomy lecturers identified and listed elements in each of the images that needed to be identified by the students. Marks were allotted to each of the elements based on the degree of difficulty in identifying and analyzing them. This marking scheme has been presented in Appendix G.

Figure 3.1 below is a schematic framework used for developing and administering visual thinking and critical observation instruments for experiment.

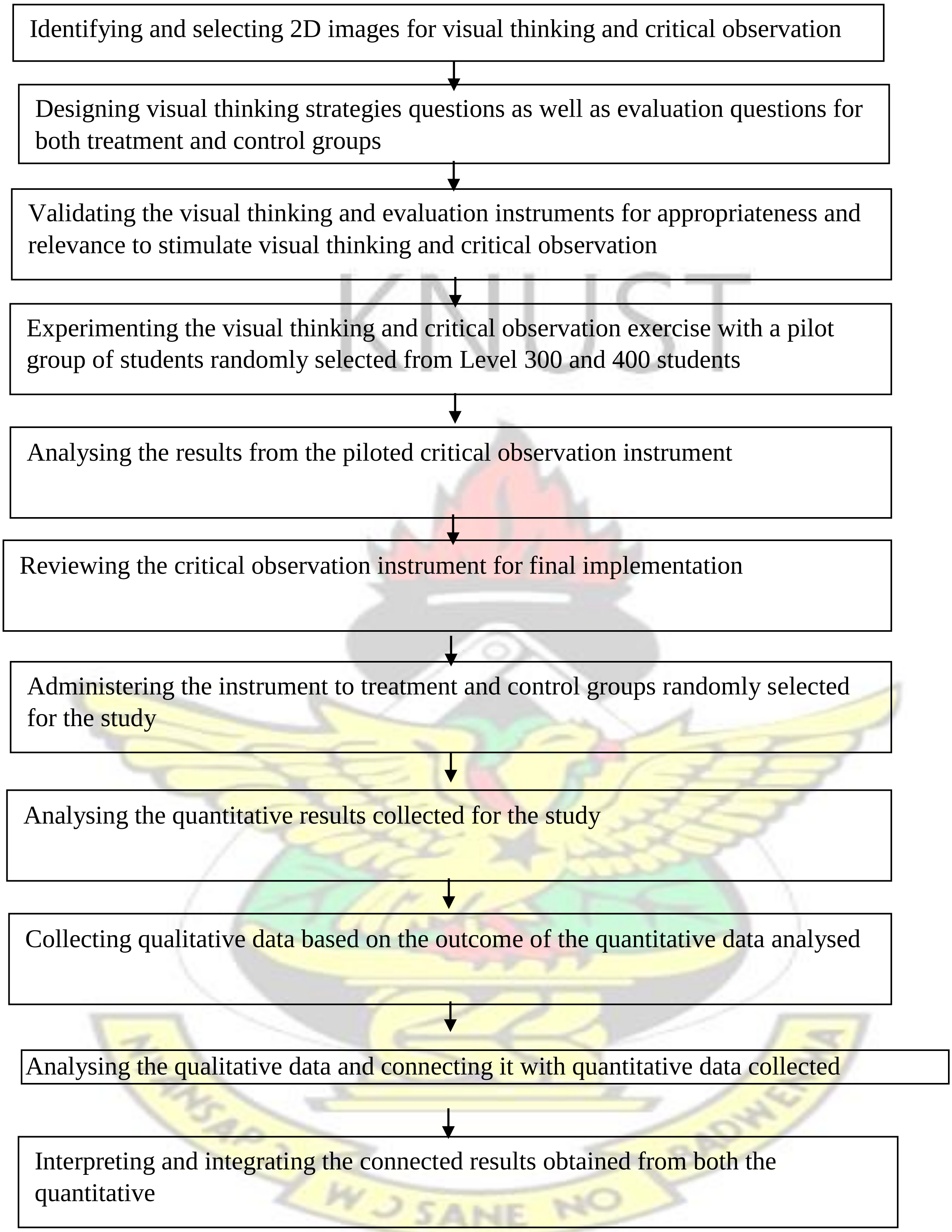


Figure 2. 9: Framework for developing and administering visual thinking and critical observation instruments for the experiment.

Source: Researcher's construct

3.7 Validity of Research Instruments

Yardley (2008) defines validity as 'the degree to which data is accepted as sound, legitimate and authoritative such that valid findings are regarded as trustworthy and useful. Guinevere (2010) says in qualitative research, the need for validity, reliability and generality has been the subject of debate regarding their appropriateness in the qualitative paradigm as opposed to quantitative paradigm. Yardley (2008) as cited in Guinevere (2010) explains that quantitative research relies upon the elimination of error caused by the influence of the researcher. Tobin and Begley (2004) assert that if validity and reliability are rejected, then the basic concept of rigour is also rejected. To ensure the validity of the research instruments the researcher submitted the questionnaires, observation checklist and interview guide to his supervisors for cross-checking and editing to ensure the research instruments employed achieved both content and face validity. Also, each of the questionnaire items was carefully checked by the supervisors and other experts in Art Education against objectives set. Further, the researcher submitted the research instruments to the Anatomy Lecturers at the SMHS, Tamale for further scrutiny and validation. Additionally, all the experts scrutinized the format and layout of the research instruments and established that the wording and length of sentences were appropriate to avoid ambiguity. Thus, the words and sentence constructions of the questions were clear and understandable enough to the respondents.

3.8 Ethical Consideration

- **Gaining Access into the University**

The quest to gain access to an institution for research is key to conducting a successful study. The researcher contacted the authorities of the University for Development Studies in person and also in writing to 'gain permission to undertake the research at the School of Medicine and Health Sciences (SMHS) of the University. The researcher explained to the "gatekeepers" of the university the purposes and benefits of the research. The researcher consulted the Registrar of the university, Registrar of SMHS, Dean of SMHS, Head of Department and Lecturers of the Department of Anatomy. According to Cohen, Manion and Morrison (2007), access to the institution where the research is to be conducted, and acceptance by those whose permission the researcher needs before embarking on the task is very important. They writers again believe that it is not automatic that investigators can expect access to a College or University as a matter of right. Researchers have to demonstrate that they are worthy as researchers of being accorded the facilities needed to carry out their investigations, in order not to infringe upon the rights of the University and its students and lecturers. Consequently, the researcher sought permission from lecturers to meet with the students and explain the rational for the research. In all, the university authorities including lecturers and students of the School of Medicine and Health Sciences were assured of confidentiality and anonymity.

3.9 Data Sources

Primary data for the research were collected from questionnaire, interview, focus group discussion, visual thinking and critical observation experiment as well as observation whereas secondary data were gathered from publications, books, textbooks, articles from journals, theses and dissertations in both printed and electronic form.

3.10 Data Analysis

The analysis of the data collected was guided by stages proposed by experts in mixed method research. Onwuegbuzie and Teddlie (2003, p.64) as cited in Leech et al. (2010) proposed seven stages of the mixed data analysis process as: "data reduction, data display, data

transformation, data correlation, data consolidation, data comparison and data integration". Onwuegbuzie and Teddlie explain that 'data reduction' involves decreasing the size of both the qualitative and quantitative data.

'Data display' entails describing qualitative data in the form of graphs, charts, networks, matrices, lists, Venn diagrams and photographs; and also describing quantitative data in the form of tables and graphs.

Concerning the 'data transformational stage' (which is optional), quantitative data are changed into descriptive essays that can be analyzed qualitatively. 'Data correlation' demands that qualitative data are linked with quantitative data. 'Data consolidation' involves combining qualitative and quantitative data to produce new or 'consolidated variables or data sets'. 'Data comparison' involves comparing data obtained from the qualitative and quantitative data sources and finally, 'integration stage' outlines that data generated from both qualitative and quantitative sources are combined into either a 'coherent whole' or 'two separate sets' of coherent wholes (Onwuegbuzie & Teddlie 2003, pp.64-65).

3.11 Use of Statistical Package for Social Scientists (SPSS)

Furthermore, the Statistical Package for Social Scientists (SPSS) was employed to compute the quantitative data and presented in descriptive statistics such as graphs and tables indicating the percentages. The statistical significance on the experiment conducted was set at 99% confidence interval. Also, the Cronbach's Reliability Coefficient Alpha was used to determine the reliability of the questionnaire items on whether the students found it easy in identifying and analyzing visual details of images presented to them. The results from the experiment and hypotheses were also presented and tested in inferential statistics with means, standard deviation and p values of (0.01) and a significance confidence level of 99% for easy interpretation and understanding of the results.

3.11 Philosophies that Underpinned the Study

The philosophies that underpinned the study are the Positivist, Interpretivist and Pragmatist philosophies of studying a phenomenon in educational setting at University for Development Studies, School of Medicine and Health Sciences in Tamale. The positivist philosophy guided the researcher in interpreting quantitative data collected through the use of questionnaire and visual art-based experiment while the interpretivist philosophy guided the researcher in interpreting qualitative data collected through the use of focus group discussion, and interview. The pragmatist philosophy guided me in understanding the context in which visual media was utilised practically in teaching and learning of Gross Human Anatomy at School of Medicine and Health Sciences at Tamale.

CHAPTER FOUR

PRESENTATION AND DISCUSSION OF FINDINGS

4.0 Overview

This chapter presents the analysis that emerged from findings obtained from interview, focus group discussion, questionnaire and visual art-based critical thinking and observational skills experiment, which were all prepared considering the objectives of the study. This chapter again interprets the findings in context of the related literature reviewed.

4.1 Profile of the School of Medicine and Health Sciences of University for Development Studies

The School of Medicine and Health Sciences (SMHS) of the University for Development Studies (UDS) was established in 1996 and implemented the conventional curriculum until 2006/2007 academic year when it switched onto running the Problem-Based Medical Education curriculum. The SMHS-UDS was the first public medical school in Ghana to switch from teaching through the conventional curriculum to implementing the Problem-Based Learning (PBL) medical education curriculum. Since then the graduates from SMHS/UDS are trained using the problem-based learning (PBL) methodology and the community-based education and service (COBES), which allow students to stay in a community and learn from it and at the same time provide some health services (University for Development Studies 2018*)*. According to Ameade and Amalba (2015), in the PBL curriculum, the students have to take foundation first year courses to prepare them for medical education training course in second year. The foundation courses included Anatomy, Biochemistry, MicroAnatomy, Immunology, Physiology and Neouroscience. Other disciplines included Pathology, Pharmacology and Medical Microbiology, among others. Mainly, the lecture teaching method was employed in transmitting medical information from year two to four in the preclinical year (Mogre, Amalba Saaka & Kyei-Aboagye 2014).

The PBL curriculum comprises three years of pre-clinical training and post-clinical training with emphasis on 'small-group, student-centred, selfdirected learning of basic and clinical science materials. Four to six weeks are spent on teaching and learning of the various integrated disciplines through tutorial meetings, skills training and practical laboratory training as well as didactic lectures. Regarding tutorials, students meet twice a week, beginning from year, one to discuss scenarios for two-hour sessions in groups of eight to ten. Those tutorial meetings offer students the opportunity to brainstorm on learning tasks that influence their selfdirected learning and guide small-group discussions.

Additionally, the students benefit from a two-hour interactive lectures which are organised two or three times a week to offer them opportunity to seek clarification on concepts discussed at tutorial meetings which they did not understand or found challenging to cope with due to the complexity of the subject matter. Further, the students are allotted two hours of training per week in medical skills training organised at the skills laboratory, and a two-hour practical dissection or laboratory training. They are also taken through PBL clinical clerkship in which they applied the functional knowledge and clinical reasoning skills they have acquired during the first three years of the PBL course. During clerkship, students are tasked with paper scenarios to identify and hypothesize solutions to a variety of clinical problems that occur in real patients. A combination of teaching approaches such as PBL tutorials, case presentations, case write-ups, bedside teaching sessions, expect resource sessions, practical procedures, and ground rounds are employed in addressing students' learning needs. During this experiential learning, the students keep discipline-specific logbooks and record important clinical problems that they encounter and become conversant with them throughout the three years of clinical clerkship (Mogre, Amalba Saaka & Kyei-Aboagye 2014).

4.2 Activities Undertaken for Objective One

Objective one was to find out the kinds of visual media employed for teaching and learning of the Nervous system, Digestive system, Musculoskeletal system, Gastrointerstinal Track and Embryology in Gross Human Anatomy at the School of Medicine and Health Sciences of UDS in Tamale.

4.2.1 Findings from Observations Made on Lectures (Teaching and Learning) of Selected Topics in Anatomy at the Lecture Halls

To achieve this, the researcher observed the teaching and learning activities of six topics namely: Brain Area, Digestive System, Reproductive System, Musculoskeletal System, Physical Examination and Gastrointestinal Tract (GIT).

✓ **Lecture One**

Course Tittle: The Nervous System

Course Code: SMS 120 **Credit Hours:** 4 **Level:** Year: One

Semester: Second

Objectives:

The objectives of the course are, students are to:

1. Describe the composition and functions of the central nervous system
2. Describe the anatomy of the nervous system i.e. central and peripheral
3. Describe the physiology of the nervous system i.e. autonomic and somatic
4. Explain the generation and transmission of impulses in the nervous system
5. Outline the action and regulation of the nervous system
6. Describe the relation and control of the interaction between the nervous system and associated glands
7. Explain biological cycles and their significance
8. Describe the pharmacology of the autonomic nervous system

 Teaching Session

First and foremost, the lecturer introduced the topic and engaged the students in discussing previous knowledge they had on the topic. With regards to the usage of visual media, the lecturer displayed colourful still images of the brain on the classroom wall using the projector. The lecturer facilitated students' discussion on the structure and location of the Occipital Lobe, Temporal Lobe, Parietal Lobe, Frontal Lobe, Cerebral Cortex and Cerebellum. It was explained that the brain consists of the cerebrum, the cerebellum and the brainstem. The lecturer taught with the aid of visual image of the brain. He explained that the cerebrum is the largest component of the human brain which is made up of the right and left hemisphere which enables humans to interpret the sensation they get through touch, vision, hearing, speech, reasoning, emotions, learning and control of movement. Concerning the cerebellum, the lecturer explained that its function is to coordinate muscle movements, maintain posture and balance. This part of the brain is located under the cerebrum. The brainstem functions as a central point that links the cerebellum and the cerebrum to relay information to the spinal cord. The brainstem enables humans to breathe, manage breathing, heart rate, body temperature and swallowing.

- ✓ **Lecture Two**

Course Tittle: The Digestive System

Course Code: SMS 120 **Credit Hours:** 4

Level: Year One **Semester:** First

Objectives:

The objectives of the course are, students are to:

1. Describe embryological development of the gastrointestinal tract (GIT)
2. Explain normal anatomy and physiology of the GIT
3. Explain congenital malformation of the digestive system
4. Explain histology of the GIT
5. Describe the mechanism of digestion
6. Explain the role of the various digestive hormones

7. Explain metabolism, absorption, distribution and elimination of waste from the GIT
8. Classify normal flora and various pathogens of the GIT
9. Outline enzyme catalysis
10. Explain carbohydrate and protein metabolism and their inborn errors

 Teaching Session

With this topic, the lecturer introduced the lesson and reviewed previous knowledge about human organs. The lecturer explained that the human digestive system is made up of the gastrointestinal tract and other accessory organs for digestion. Students contributed to the discussion by explaining that the digestive system breakdown food into smaller particles enough to be absorbed into the body. With the aid of a physical 3-D model, the lecturer explained the different stages digestion processes occur. Students were given opportunity to discuss the stages which included the function of the mouth as an entry path for food, the pharynx (throat) through which food transits to the esophagus and finally settles down in the stomach for further processing until it is excreted as waste, all with the aid of the model. Other organs discussed included the functions of the liver for producing bile for fat digestion, the lung for respiration, small intestines where most of the digestion occurs, the rectum through which stool passes and finally leaves the body through the anus. Refer to Plate

4.1.

✓ **Lecture Three**

Topic: Gastrointestinal Tract (GIT)

- **Teaching Session**

The lecturer facilitated a discussion on previous concepts about the human digestive system. The lesson was presented in the form of a lecture about the pathway of food into the human body, generally referred to as gastrointestinal tract (GI Tract). The class discussed the structure of the esophagus as a tube that connects the human mouth and stomach.

The lecturer started by introducing the topic, reviewing previous knowledge on the topic and engaged the students in discussions. The lecturer also utilized models and skeleton as teaching aids to explain concepts to all the students at the same time.

However, the students were not divided into smaller groups to discuss and visualize the spatial relationships of anatomical objects. This situation where the students were not asked to sit in smaller groups around anatomical objects to discuss the models was not consistent with the views on Azer and Azer (2016).

Additionally, equally important anatomical images such as Anatomy diagrams and charts were not available at the lecture halls for the students to appreciate them. Moreover, Virtual media in the form of videos were rarely incorporated in topics taught during lectures. A student confirmed this revelation by commenting, *"Anatomy is inseparably connected to physiology. That is why the audiovisuals part even in learning Anatomy is important. So we don't expect models only to help us but we also need the audiovisuals".* This approach to learning meant that the visual media identified were ineffectively utilized to serve the purpose for which they were made available (Davies 2001).

✓ **Lecture Four**

Course Tittle: Anatomy of the Musculoskeletal System

Course Code: SMS 213 **Credit Hours:** 4

Level: Year Two **Semester**: First

Objectives:

The objectives of the course are, students are to:

1. Describe the structure and function of the muscle, ligaments, tendons, bones and associated soft tissue
2. Describe the development of the musculoskeletal system
3. Describe the histology and classification of the musculoskeletal system
4. Describe the energy metabolism of the musculoskeletal system
5. Outline the mechanisms of muscular cramp
6. Describe the bones of the skeletal system
7. Describe joint and articulation
8. Explain thermoregulation
9. Explain adaptation and exercise
10. Describe the pharmacology of analgesics

 Teaching Session

The lecturer taught this topic with the help of a 3-D physical model and a skeleton. Key concepts discussed were how the fibrous are connective, how the muscles are composed and the manner in which the bones in the human body are joined. The lecturer and students discussed how musculoskeletal system provide support, stability and form to maintain the body's position to enable humans move in a controlled and precise manner. The class also discussed the axial skeleton, the vertebral column and the thoracic components of the skeleton. The lecturer adopted the 3-D model to explain that the axial skeleton; which consists of the skull protects the brain and supports facial structure. The vertebral column concerning the spine was also discussed. The lecturer explained that the vertebral protects the spinal cord and also supports the head. Refer to Plates 4.2 and 4.3.

✓ **Lecture Five**

Topic: Block Clinical Session for Skills: Palpation, Percussion, Respiratory System Auscultating and Inspection.

 Teaching Session

At this point, the researcher observed activities performed during physical examination at the skills laboratory and these included palpation, percussion, inspection and auscultation. The lecturer demonstrated these concepts practically by using living human body for the examinations, then giving students the opportunity to do same as it got to their turn.

Palpating involves pressing gently on the body to notice any discomfort or pain in the patient whiles percussion involves tapping gently on the body to listen to abnormal sound on the body. Sometimes, both activities were performed separately and sometimes in combination. After the lecturer had demonstrated the steps involved in the physical examinations, the students took turns and role played by each introducing himself or herself to the patient, seeking the patient's consent to do the examination of his or her abdomen. The student then placed one hand and pressed gently to identify tenderness or resistance to his hand. Sometimes, they placed both hands concurrently to palpate for abdomen pain or shape of a lump.

Occasionally, they placed one hand on top of the other to palpate deeply to see if the patient will show any sign of discomfort or pain. The one examining the patient also looks into the patient's face to see if the facial expression of the patient will indicate signs of pain. As the patient laid on the examination couch supine, the student doctor palpates deeply the entire part of the abdomen. They also performed head and neck palpation to check for muscles to feel for any abnormalities. The students also percussed the borders of the abdomen and other relevant parts of the body to listen to abnormal sounds. They placed one or two fingers on the part of the body to be percussed and then gently hit the fingers with the other hand. These activities were performed to check for patients body mass.

- **Percussion for Sounds**

Percussion is a technique taught to the medical students on how to place the left fingers on the patients and then use the fingers as a hammer to hit gently on the patient's body to listen to normal and abnormal sounds. A student performs this activity by flexing the wrist of the hand to be used as hammer whiles hitting on the middle finger placed on the patient's ~~check or~~ abdomen. Percussion allows the medical students to feel the pitch of percussed notes. The students also placed their left hands on the lung and liver areas of the body and percussed.

- **Respiratory System Auscultating**

This involves physical examination of the thorax and checks for breath sounds, vocal resonance, added sounds like pleural friction rubs, wheezes and crackles. With the aid of a statoscope, the medical students listened to bowel and lung sounds among others. Students were asked to listen to sounds around the anterior thorax, lateral thorax and posterior thorax using living human beings.

- **Inspection**

During general physical examination, the students were made to inspect colleagues from head to toe critically for pathologies, normal and abnormal sounds, among others. Inspection involves helping the patients to lift their hands, legs or supporting the patient to sit up for the sound of their lungs to be listened to from the posterior position. These included students feeling for lumps, texture, swelling and listening to heart sounds on the colleague that role-played as a patient. The students were guided and taught to communicate with the patients at every stage of inspection so they will get feedback to make informed decisions.

Observation studies conducted at the Skills Training Laboratory revealed that the skills laboratory was enriched with various anatomical objects. The lecturers taught surface Anatomy using a variety of anatomical structures and the student’s role played using their own bodies for demonstration purposes. The observation study revealed that the students were allowed to interact with anatomical structures available at the skills laboratory. Also, students were allowed sufficient time to ask questions to gain deeper understanding on lessons taught.

Mainly, the lecturer employed the lecture and demonstration teaching method concurrently therefore, student-teacher interaction during skills training was high, thereby resulting in students exploring the visual media on their own but under the guidance of the skills lecturers as upheld by the constructivist learning approach (Sivalingam, Nalliah & Nazimah 2014; Khadeer, Khan & Rajkumar 2014).

4.2.2 Achievement of Learning Objectives on Lessons Taught As an indication of achievement of learning objectives on the above stated lessons taught, the students demonstrated understanding of lessons taught on the Nervous System. That is, the students were able to describe, outline and explain the structure and location of the central nervous system and its peripheral as well as the generation of impulses in the nervous system. The students also were able to explain concepts on the brain areas in relation to the cerebellum, the cerebrum. Concerning lessons taught on the Digestive System, the students were able to explain the mechanism of the digestive system as well as explain the role of the various digestive system. With regards to lessons taught on Anatomy of the Musculoskeletal System, the students were able to explain how musculoskeletal system provide stability and form to maintain the body to enable humans move in a controlled and precise manner. The students also demonstrated understanding by explaining interconnections between the axial skeleton, the vertebral and the thoracic components of the skeleton. On achievement of objectives of lessons taught during Block Clinical sessions on Palpation, Percussion, Respiratory system auscultating, the students demonstrated practical skills by using their own bodies to palpate and percuss. This practical activity helped them to understand the concepts taught under physical examination concerning normal and abnormal sounds produced by the human body. Hence, the students developed skills in identifying texture, colour, lumps, swelling sounds during physical examination of the human body.

However, though the lecturer effectively utilised models and still images to explain concepts taught, the deficiency in the lessons taught was that the students were not guided to produce visual representations of aspects of the anatomical objects used for the lessons taught. Also, the students were not divided into smaller groups to visualize the spatial relationships of anatomical models in relation the location and structure of the organs in the model.

Plates 4.1 to 4.3 are samples of visual media that lecturers employed for teaching and learning of selected topics observed in the lecture halls and skills laboratory by the researcher.

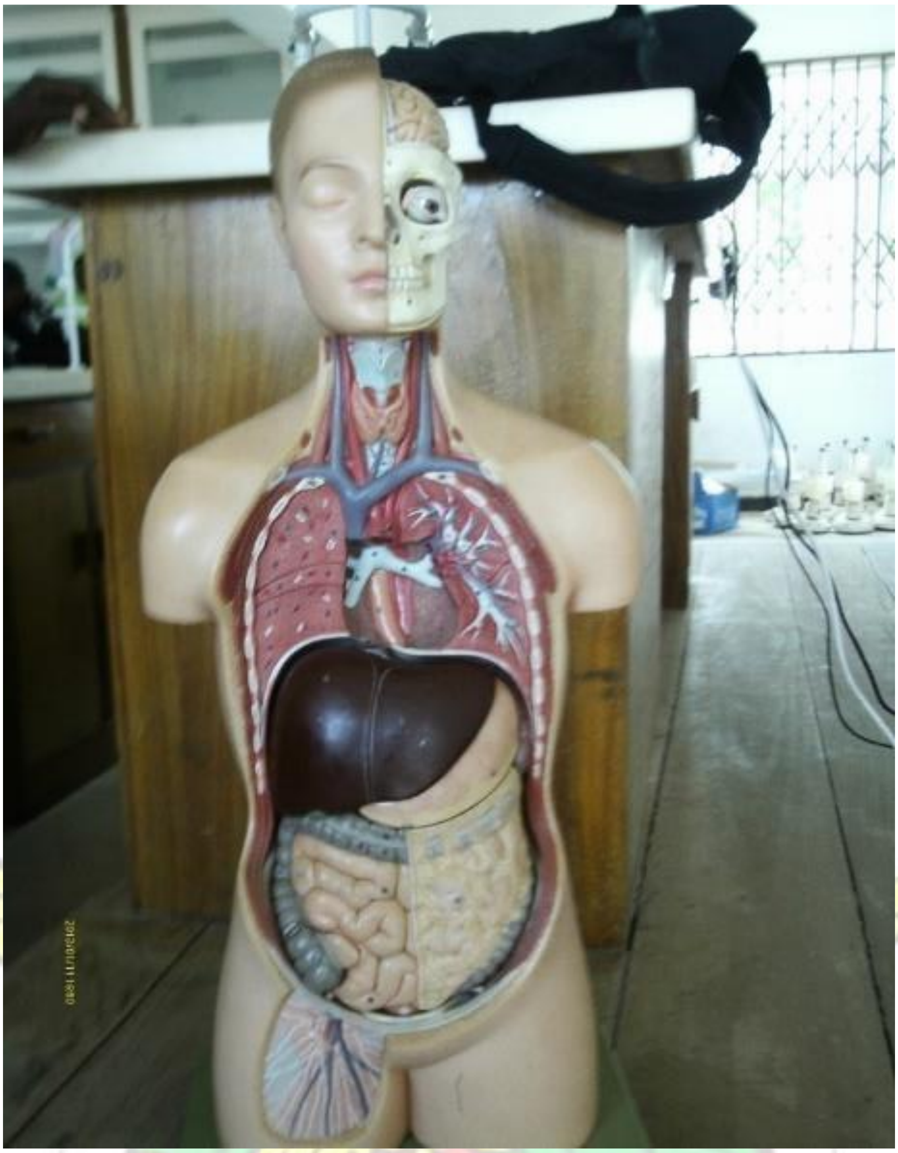


Plate 4 1: A 3-D model showing esophagus, liver and intestinal system.

Plate 4 2: A model of 3-D human skeleton structure hanged on a metal pole without one leg.

Plate 4 3: A model showing the structure of human skull made of plastic.

- **Tutorial Meetings**

On this activity, the students held several tutorial meetings. The lecturers facilitated most of the tutorial meetings. The topics discussed varied and depended on the topics that were taught during the block lecture sessions. In tutorial meetings, students took turns to discuss the tasks that they have been assigned to research on. Mostly, the students sketched on a white board to illustrate certain concepts. In most of the tutorial meetings, in terms of using visual media to facilitate discussions, the researcher observed that no models or images in the form of audiovisuals were projected for the students to appreciate, instead students immediately sketched on the board. Therefore, students relied on their own skills in sketching on the white board for their colleagues to understand the concepts that they want them to understand.

4.2.2 Findings from Questionnaire Administered to Students on Visual Media Used for Teaching and Learning of Anatomy

Table 4. 1: Demographic data of respondents

Variable	Sub-group	Frequency	Percentage
	Male	109	60.2
Sex	Female	72	39.8
Year of study	Level 300	112	61.9
	Level 400	69	38.1
	18 – 20	50 86	27.6
Age	21 – 23		47.5
	24 – 26	32	17.7
	>26	13	7.2
	Control	95	52.5
Experimental group	Treatment	86	47.5

Source: Field Data, 2018

The demographic features of the respondents as shown in Table 4.1 indicate that majority of the respondents which is 60.2% were males with the rest 39.8% being females. In terms of age, 86 out of 181 of the respondents fell within the age bracket of 21 to 23 years. This finding could be that due to the new educational reforms in Ghana that reduced the number of years spent in school at the Junior and Senior High School (J/SHS) levels of the Ghanaian educational system, most students enrol into tertiary level of education at a younger age. As a result, it can be assumed that most of the students were in their youthful ages and enrolled on the medical school programme from SHS. The small percentage of students 6(3.3%) and 1(6%) who were within the ages of 25 and 34 respectively, might be attributed to the fact that they did not have the requisite qualification to enter medical school early or they engaged themselves in working to raise financial support before they could further their education at the tertiary level of education.

Table 4. 2: Students' responses on whether they have background knowledge of visual arts (N=181)

Item	**(Level 300)**	**(Level 400)**	**Total**
No	72(62.6%)	51(77.3%)	123(68.0%)
Yes	43(37.4%)	15(22.7%)	58(32.0%)
Total	**115**	**66**	**181**

Source: Field data, 2018

Students' responses from Table 4.2 indicate that majority 123(68.0%) of the students from both Levels 300 and 400 agreed they had no background knowledge in visual arts. Only 58(32.0%) of them responded positively that they had background knowledge in visual arts. Mulu and Tegabu (2012) assert that the study of Anatomy involves the use of atlases, models and cadavers as a unique visual media in the pedagogy of medical schools that every medical student is familiar with. This indicated a gap in the knowledge base of most 123(68%) of the students about visual media and that need to bridge it as this thesis sought to do.

Table 4. 3: Students' responses on whether they know or can identify visual media (N=181)

Item	(Level 300)	(Level 400)	Total
No	48(41.7%)	22(33.3%)	70(38.7%)
Partially	42(36.5%)	23(34.8%)	65(35.9%)
Yes	25(21.7%)	21(31.8%)	46(25.4%)
Total	**115**	**66**	**181**

Source: Field Data, 2018

From Table 4.3, the students' responses show that 70(38.7%) of them did not know of visual media whereas 65(35.9%) of the students said they partially had some of the visual media. Only 46(25.4%) stated they could identify visual media. The responses from the students imply that the lecturers have to explain to the students to understand that the kind of teaching aids they interact with are classified as visual media. This means that the students who partially know or had no idea that what they use during teaching and learning are termed as visual media might face challenges in applying their visual literacy skills to appreciate fully the spatial relationships of anatomical models and this might affect their learning of Anatomy.

Table 4. 4: Students' responses on whether having background knowledge in appreciation of visual images is necessary for learning of Anatomy

Item	(Level 300)	(Level 400)	Total
Agree	42(36.5%)	18(27.3%)	60(33.1%)
Disagree	1(0.9%)	1(1.5%)	2(1.1%)
Not sure or neutral	3(2.6%)	2(3.0%)	5(2.8%)
Strongly agree	68(59.1%)	45(68.2%)	113(62.4%)
Strongly disagree	1(0.9%)	0(0.0%)	1(0.6%)
Total	**115**	**66**	**181**

Source: Field Data, 2018

Regarding the students' responses on whether having background knowledge in appreciation of visual images is necessary or not, Table 4.4 illustrates that majority 113(62.4%) and 60(33.1%) of the students strongly agreed and agreed respectively, that having background knowledge in appreciation of visual images is necessary for the learning of Anatomy. Only 1(0.6%) and 2(1.1%) of them strongly disagreed and disagreed respectively that having background knowledge in appreciation of visual media is necessary for the learning of Anatomy, with 5(2.8%) unsure whether having background knowledge in appreciation of visual media is either necessary or not. Harvard Medical School (2008) as cited in McMaster University (2017) agrees with the majority who believe that knowledge in appreciation of visual images is important to medical education. It emphasizes that the usefulness of Visual art-based intervention to medical education has been explored by Harvard Medical

School when the school took a group of medical students through Art Appreciation course at Harvard University museum. The findings indicated these students had the opportunity of observing various works of art and it improved their observational, analytical and communication skills since they could make accurate medical diagnoses than their counterparts who did not take part in the course (Harvard Medical School 2008 as cited in McMaster University 2017). Thus, the absence of visual arts-based interventions at the School of Medicine and Health Sciences to expose its medical students to alternative learning opportunities may impede the students' learning of Anatomy. The implication is that, medical students at the SMHS, UDS may complete school with limited observational skills for physical examination of health conditions of patients.

Table 4. 5: Meaning of Visual Media from respondents' (students') perspectives

Understanding of Visual Media by Respondents	**Total**
Visual media are referred to as 3D Physical media such as models, sculpture and dummies, and 2D Physical media such as pictures, charts, diagrams, illustrations, paintings, photographs and text.	73 (40%)
Visual media are 3D virtual media such as videos, animations, audiovisuals and simulations for presenting information to learners to facilitate understanding	64 (35%)
Visual media are used to stimulate vision of the senses to present information and to aid teaching and learning.	44 (25%)
Total	**181 (100%)**

Field Data, 2018

On the issue of the respondents' understanding of visual media, they expressed the following definitions. It can be seen from Table 4.5 that the various items mentioned by respondents fell within a category of artifacts, which are termed as visual media in medical education. That is, 73(40%) of the students said visual media included three-dimensional physical media such as models, sculpture and dummies, as well as two-dimensional artifacts such as pictures, charts, diagrams, illustrated images and paintings.

In describing what visual media are, 64 (35%) mentioned that they are videos, animations, audiovisuals and simulations used in presenting information to learners to facilitate understanding of concepts taught. In terms of usage of visual media as instructional media, only 44(25%) of the respondents described visual media as either visuals that are used in stimulating vision of the human senses for analyzing and interpreting information graphically, or in aiding teaching and learning. These responses from respondents are consistent with what experts like Shabiralyani, Hasan, Hamad and Iqbal (2015) consider as visual media. These writers describe visual media as any devices that can be employed to make learning experiences more concrete, more accurate and more active. 44(25%) of the respondents also said visual media are tools that help to make an issue or lesson clearer or easier to understand and know; visual media are pictures, models, charts, maps, videos, slides, real objects, chalkboard, bulletin board and slides. As pointed out by artists like Davies (2001), Bernejee (2011), Waldemar and Anthony (2004; 1986), a function commonly assigned to a visual artifact is to provide a satisfying experience to the person using it. Therefore, the students' description of visual media as instructional material is in line with the functionalist's view that anything considered visual media or artifact in a school setting must serve a purpose to meet the needs of the user. Again, 73(40%) of the students' description of visual media were no different from Bernejee's (2011) description of artifacts which included drawings, paintings, sculpture, or anything "visual in nature" that stimulates the human senses for its intrinsic value (Waldemar & Anthony 2004; Waldemar & Anthony 1986). Therefore, it will not be out of context to conclude that the things that are considered as visual media among medical educators are similar things that art educators also consider as artifacts.

Concerning the kinds of visual media mostly employed by the lecturers for teaching of Anatomy, Figure 4.1 below reveals respondents (students) views on it.

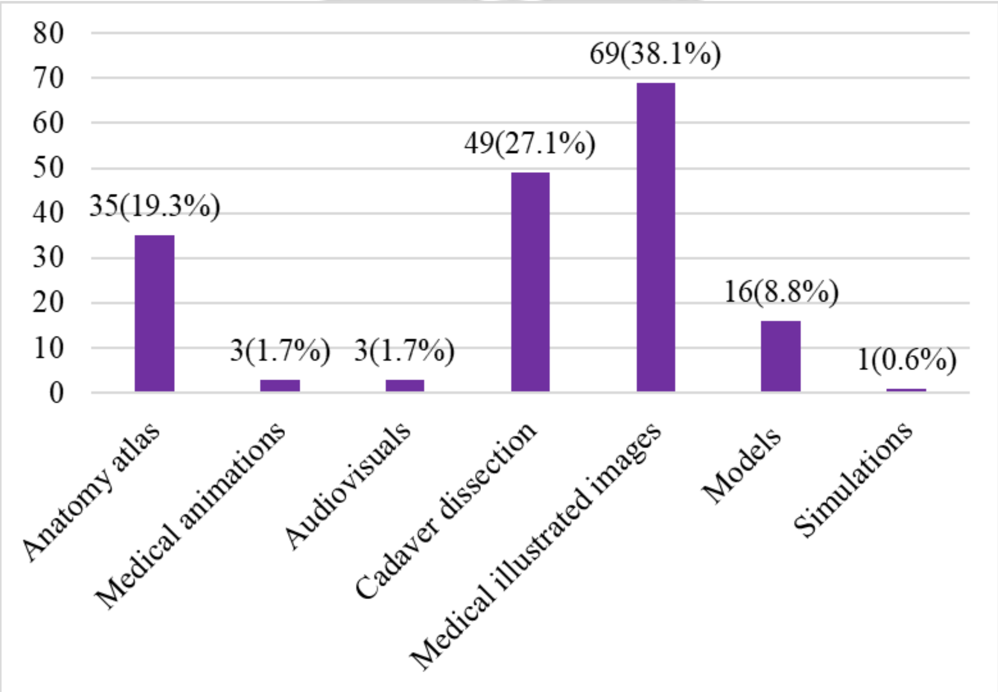


Figure 4. 1: Respondents' views on the kinds of visual media mostly employed by lecturers during the teaching of topics in Gross Human Anatomy.

Figure 4.1 above shows that 69(38.1%) of the students stated illustrated images as visual media mostly employed for the teaching and learning of Anatomy whiles 49(27.1%) of the respondents said cadavers were mostly employed followed by 35(19.3%) who also outlined Anatomy atlas as the most utilized visual media. It can be seen from this bar chart that animations 3(1.7%), audio visuals 3(1.7%) and simulations 1(0.6%) were the least kinds of visual media employed by the lecturers for teaching topics under Anatomy in the school.

Although audiovisuals, models and animations were used in the teaching and learning processes, illustrated images and cadaver were the kinds of visual media that are mostly employed by the lecturers for teaching Anatomy as shown in Figure 4.1. Though, the use of illustrated images was in the right direction, this situation where models and skeleton were under-utilized could affect students' ability to develop spatial visualization skills (Azer & Azer 2016). This situation where little attention is given to the use of audiovisuals and models might adversely affect the students' understanding of Anatomy and skills development in spatial visualization (Azer & Azer 2016).

In the case of respondents' views on whether lecturers used the visual media identified in combination or separately from one another, majority 137(75.7%) of the students stated lecturers employed the visual media identified mostly in combination with others whiles only 44(24.3%) mentioned that the lecturers used them separately to teach topics under Anatomy. This approach to teaching

Anatomy where the lecturers employed visual media in combination is consistent with the views of Busan (2014) that visual media used in combination for teaching is appropriate in meeting learning needs of all learners equally.

Figure 4.2 shows the topics under Anatomy that lecturers taught with frequent use of visual media.

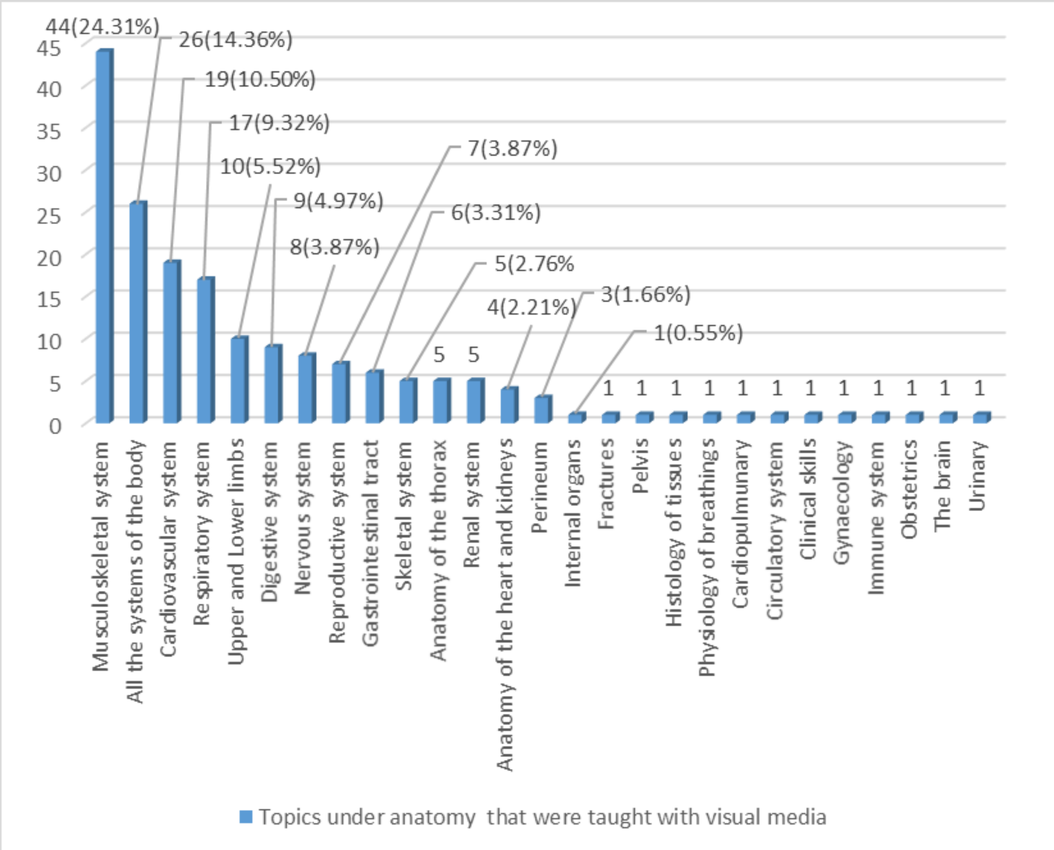


Figure 4. 2: Respondents views on topics under Anatomy that are taught with frequent use of visual media.

Figure 4.2 displays responses from respondents on topics mostly taught with visual media. As can be seen in the above Figure, Musculoskeletal System 44(24.309%), All Systems of the Body 26(14.365%), Cardiovascular System 19(10.497%), and the Respiratory System 17(9.392%) were among the topics mostly taught with visual media in highest order. Other topics skewing to the right as shown in Figure 4.2 might suggest that there was not enough visual media to be employed for teaching those topics. It could also be that those topics mainly needed to be taught using lecture method and for that matter required minimal application of visual media in explaining concepts taught under those topics.

Table 4. 6: Students' responses on whether lecturers guide them to critically observe the physical features of anatomical objects (N=181)

Item	Level 300	Level 400	Total
No	32(27.8%)	21(31.8%)	53(29.3%)
Sometimes	53(46.1%)	26(39.4%0	79(43.6%)
Yes	30(26.1%)	19(28.8%)	49(27.1%)
Total	**115**	**66**	**181**

Source: Field Data, 2018

The responses from the students as shown in Table 4.6 portray that 53(29.3%) of the respondents were of the view that their lecturers did not guide them in critically observing the physical features of anatomical objects, whiles 79(43.6%) said their lecturers sometimes guided them in critically observing the physical features of anatomical objects. But 49(27.1%) of the students affirmed that their lecturers guided them in critically observing physical features such as shapes, colour and texture of anatomical objects.

Table 4. 7: Students' responses on whether lecturers ask them to draw or sketch anatomical structures (N=181)

Item	Level 300	Level 400	Total

No	103(89.6%)	56(84.8%)	159(87.8%)
Sometimes	9(7.8%)	9(13.6%)	18(9.9%)
Yes	3(2.6%)	1(1.5%)	4(2.2%)
Total	**115**	**66**	**181**

Source: Field Data, 2018

It can be seen from the responses as shown in Table 4.7 that majority 159(87.8%) of the respondents said their lecturers did not ask them to draw or sketch anatomical structures, 18(9.9%) of the students said their lecturers sometimes asked them to draw and only 4(2.2%) of them mentioned that their lecturers asked them to sketch or draw anatomical objects. Meanwhile, in an interview two out of the four lecturers interviewed conceded that the ability to draw or sketch parts of the human organs is fundamental to learning Anatomy and it is a requisite skill every medical students must develop for diagnosing and communicating disease conditions graphically to patients and colleague physicians. Therefore, the absence of skills training in sketching at the medical school may limit the students' ability to communicate graphically to patients and colleague physicians the location of certain disease conditions identified on the body for surgery or treatment. The consequences of this limited sketching of medical students on humanity can only be imagined (Orr 1996) if nothing is done to improve their skills in sketching. This gap may be corrected through Visual art-based interventions as this thesis proposes.

Table 4. 8: Students' responses on whether lecturers use visual art forms in training them on critical thinking and observational skills acquisition
((N=181)

Item	Level 300	Level 400	Total
Agree	52(45.2%)	20(30.3%)	72(39.8%)
Disagree	4(3.5%)	17(25.8%)	21(11.6%)
Not sure or neutral	59(51.3%)	17(25.8%)	76(42.0%)
Strongly agree	0(0.0%)	4(6.1%)	4(2.2%)
Strongly disagree	0(0.0%)	8(12.1%)	8(4.4%)
Total	**115**	**66**	**181**

Source: Field Data, 2018

The responses in Table 4.8 indicate that 4(2.2%) and 72(39.8%) of the respondents strongly agreed and agreed that lecturers employed visual art forms in training them on critical thinking and observational skills development, while majority of the students 76(42.0%) could not tell whether or not lecturers used visual art forms in training them on visual thinking and observational skills acquisition. Only 8(4.4%) and 21(11.6%) strongly disagreed and disagreed respectively that lecturers used visual art forms in training them on critical thinking and observational skills acquisition.

When respondents were asked whether visual images is essential for enhancing critical thinking and observational skills training, greater percentage 74(40.9%) and 102(56.4%) of the students strongly agreed and agreed that visual images are essential for enhancing critical thinking and observational skills training. Only 1(0.6%) of them strongly disagreed with none disagreeing that visual images are essential for enhancing critical thinking and observational skills training.

This suggests that, the situation where the use of Visual art-based intervention is overlooked may be attributed partly to insufficient time on the part of the lecturers to include Visual art-based interventions on their schedules. It could also be that the lecturers themselves may not have some background knowledge in visual arts to have been able to take the students through some form of Visual art-based observational skills training (Academy Medical 2004; Holmboe 2014, p.19).

Furthermore, on the question of whether the medical school allows them to go on educational trips to medical museums, responses indicate that almost all 167(92.3%) responded negatively that the medical school does not allow them to go on educational trips to medical museums to enhance their observational skills. Only 14(7.7%) students said the medical school should facilitate educational trips to medical museums.

However, on the question on whether the school should allow them opportunities to go for such educational trips, almost all the respondents 177(97.8%) argued that the medical school should allow them to go on educational trips to art museums where they could interact with artifacts relevant for learning of Anatomy. Conversely, only 4(2.2%) of them alleged the medical school should not allow them to embark on

educational strips to art museums because they do not see the usefulness of this exercise, but rather the medical school should establish an Anatomy lab in the school. One out of the four lecturers interviewed buttressed this assertion by the minority of the students, she said, *"I honestly doubt that it would be the effort. That would probably be in Kumasi then. I don't know what the quality is also there. I think the school just needs to prioritise the Anatomy lab/mortuary and also invest in good software programmes to learn Anatomy".*

However, Harvard Medical School (2008) as cited in McMaster University (2017) postulates that artifacts as learning materials in museums in general and medical museums in particular, play a vital role in medical education in enhancing student's observational skills development. But the students' responses as shown in Figure 4.12 illustrated that almost all the students 167(92.3%) said the medical school did not have educational trips as part of its pragramme. The absence of educational trips on the medical school's programme to medical museums may leave a gap in the students' observational skills development necessary for clinical observation (Brooks 2016).

Additionally, when a question on the establishment of learning resource centre was posed to respondents (students), overpowering responses 179(98.9%) of them desire the establishment of a medical museum. Only 2(1%) of the students indicated that they would not like an art museum to be established at the medical school. The reason might be that these students do not understand that an art museum is also a learning resource centre. McGill Centre for Medical Education (2019) adds that libraries, medical education journals and medical education presentations are all examples of resource centres for medical schools.

They expressed that since there is currently no Anatomy museum at the medical school, any effort made by the medical school to incorporate educational trips to Anatomy museums will be ideal, as it will expose students to interact with variety of artifacts that are currently not available at the school. Statements made by individual respondents are as follows:

"Yes, the thing about art work is that mostly it carries a message. The artist communicates something and if the moderator is well vested in art, and is able to critically lead you to get the message, it helps build up your critical thinking capacity. So you can apply the same principle when one is also looking at medical images or just in your medical carrier generally. So the critical thinking part, which is to get the message out of any artwork, is necessary and can be applied. Art gives some atmosphere for us to have sometime outside of the school that helps reduce stress among other things".

"Pictures speak a thousand words. You feel there is psychology behind pictures. The picture itself is speaking volumes of what the person was trying to depict. So you come into the medical field and see the normal picture of a heart and other pathological pictures of the heart and you are able to describe and express certain emotions towards it. This again opens ones mind. A colleague student and myself have developed the habit describing daily happenings and linking them to what medicine teaches us. For instance, when we see someone with lock knees we tell ourselves that the person has bowlegs or when a lady is carrying a baby at the back and carrying load on her head which is most tasking, we say she will suffer from certain pathologies of the back, back pain and other conditions.

Although, we make jokes out of it yet we have opportunity to learn".

Table 4. 9: Students' responses on whether computer technology will replace physical examination by humans

	Level 400	**Total**

Item	Level 300		
Agree	36(19.9%)	20(11.0%)	56(30.9%)
Disagree	20(11.0%)	8(4.4%)	28(15.5%)
Not sure or neutral	37(20.4%)	20(11.0%)	57(31.5%)
Strongly agree	18(9.9%)	11(6.1%)	29(16.0%)
Strongly disagree	4(2.2%)	7(3.9%)	11(6.1%)
Total	**115**	**66**	**181**

Source: Field Data, 2018

The responses as shown in Table 4.9 indicate that a total of 56(30.9%) and 29(16.0%) of the respondents strongly agreed and agreed that computer technology will replace humans in physical examination of patients; 11(6.1%) and 28(15.5%) strongly disagreed and disagreed whiles majority 57(31.5%) of them neither agreed nor disagreed that computer technology will replace humans in physical examination of patients.

The Fading Art of Physical Exam (2010) observed that for centuries, doctors diagnosed illness using their own senses by 'poking, looking and listening'. This is based on the use of the human sense organs in observing patients; a skill with which doctor is able to infer what caused a patient's illness. But things have changed and doctors now rely on technology as a tool for diagnosing disease conditions (Standford 2017). Even though, influx of technologies in medical examination is on the increase, Standford doubted that computer technologies would completely replace the human factor in physical examinations of disease conditions. That is, the use of X-

ray or Computed (Axial) Tomography (CT or CAT scan) alone is inadequate to provide all the information necessary for treatment. That is why medical experts like Abraham Verghese at Stanford Medical School is spearheading the campaign to restore physical examination to what he considers as ‘its rightful place’.

On whether the classroom seating arrangement in rows at the medical school was suitable for the learning of Anatomy, particularly, Anatomical Structures, majority 102(89%) of the students responded negatively. This implies that the classroom seating arrangement in rows is not suitable for learning Anatomy; especially, in lessons taught with models. Only 8(7%) of them said the current classroom seating arrangement is sometimes ideal for learning Anatomy while only 5(4%) argued that the current classroom seating arrangement was ideal for learning Anatomy.

Table 4. 10: Recommendations from the students on measures they believe will improve teaching and learning of Anatomy with visual media (N=181)

Responses	**Frequency**	**(%)**
Medical school should have well stocked E-library with audio-visuals	34	18.78
Lecturers should incorporate more interactive 3D software into teaching Anatomy	43	23.76
Medical school should establish own Morgue and Dissection Lab	42	23.20
Medical school should increase the number of physical models for practical sessions	46	25.41

Overhead projectors should be provided in each lecture hall for lectures and tutorial meetings	16	8.84
Total	**181**	**100**

Source: Field Data, 2018

Concerning the students' views on what the school could do to improve teaching and learning of Anatomy as shown in Table 4.10, majority 46(25.41%) of them recommended that the school should increase the number of physical media like models; 43(23.76%) advocated that lecturers should incorporate into lessons more audiovisuals for teaching and learning of Anatomy to make teaching and learning more interactive; 34(18.78%) suggested that the medical school should have a good Elibrary so that they can access and download audiovisual materials for learning; 42(23.20%) proposed that the medical school should establish its own morgue and dissection laboratory for practical sessions on dissection whereas 16(8.84%) of them offered that overhead projectors should be installed in all the lecture halls so as to enable both lecturers and students view audiovisual teaching and learning materials to enhance the understanding of concepts taught under Anatomy.

4.3 Recommendations from the students on measures that will improve teaching and learning of Anatomy with Visual Media

(N=181)

These responses were categorized and coded based on the frequency at which a particular recommendation was mentioned. As can be seen from

Table 4.10, the students' recommendation that lecturers should incorporate more interactive 3D virtual media occurred 26(24.3%) times, the school should increase the number of physical 3D models occurred 29(27.1%) times and the school should provide adequate cadavers for dissection sessions occurred 24(22.4%) times. The students' appeal for the medical school to increase the number of visual media including cadavers is reasonable since visual media is fundamental to teaching and learning of Anatomy (Sawant & Rizvi 2015, p.1). Last but not the least, suggestion from the students re-echoed their wish for proper integration of visual media with the pedagogy of the medical education through visual art-based interventions.

- Plates 4.3 to 4.11 are the existing visual media that the researcher found and respondents alluded to for the teaching and learning of topics under Anatomy.

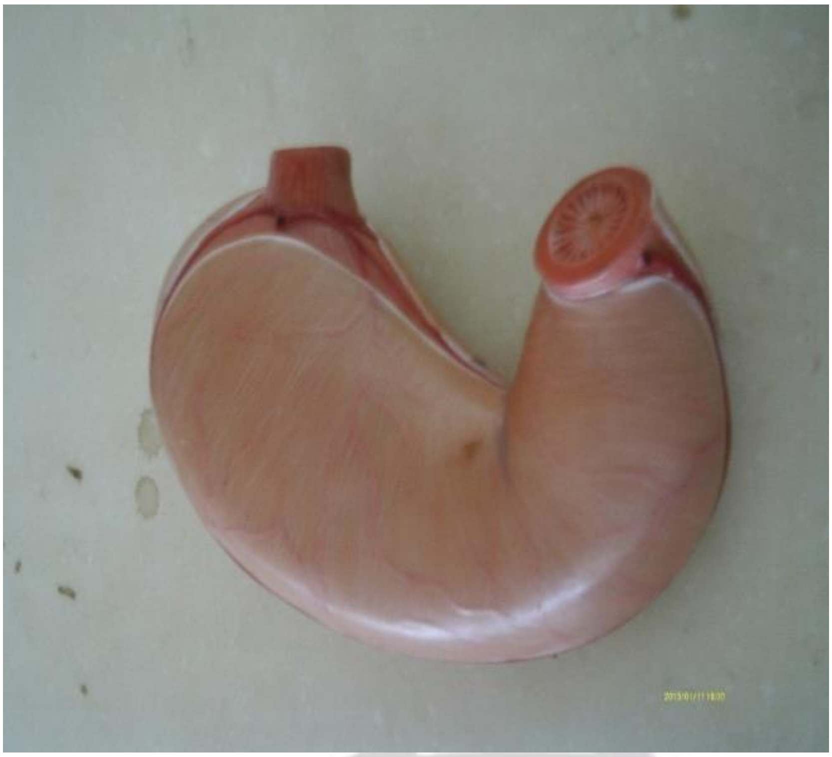


Plate 4 4: A model of stomach made of plastic resin

Plate 4 5: A model of liver made of plastic resin

Plate 4 6: A model of human heart made of plastic resin

Plate 4 7: A model of intestines, stomach and split liver made of resin

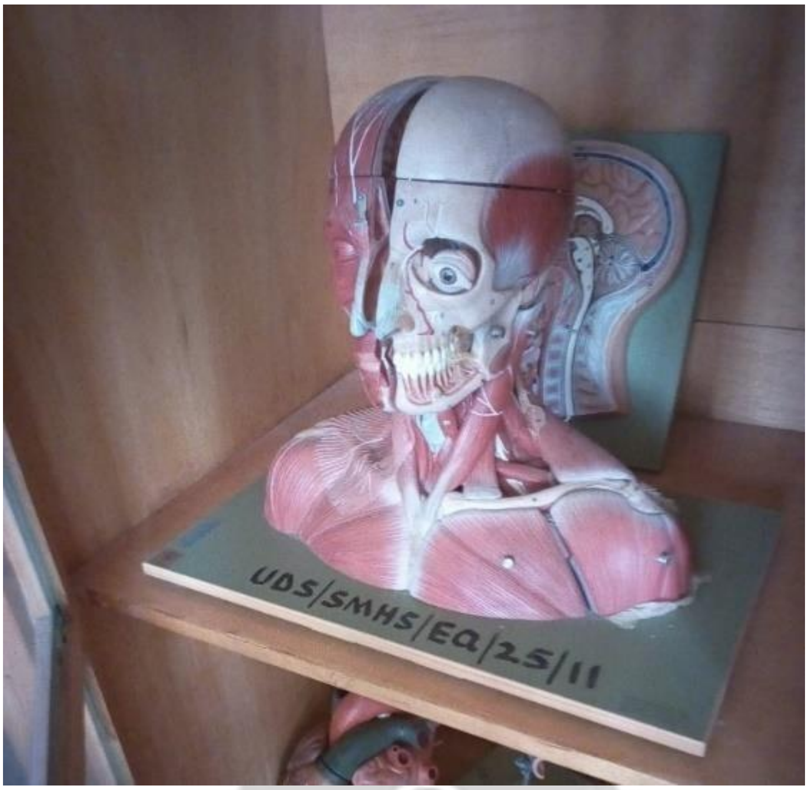


Plate 4 8: A model of thorax made of plastic resin

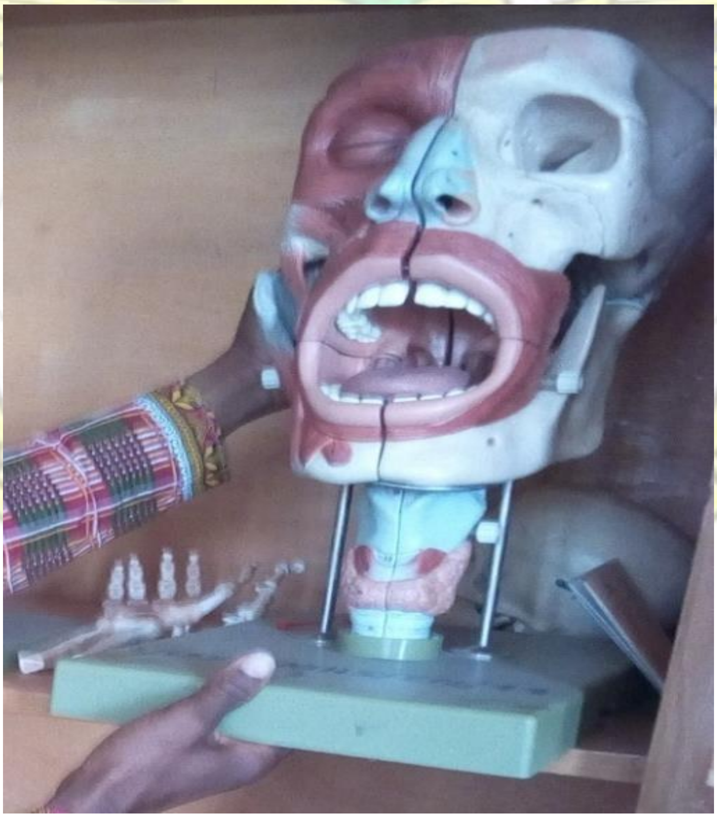


Plate 4 9: A model of oral cavity made of plastic resin

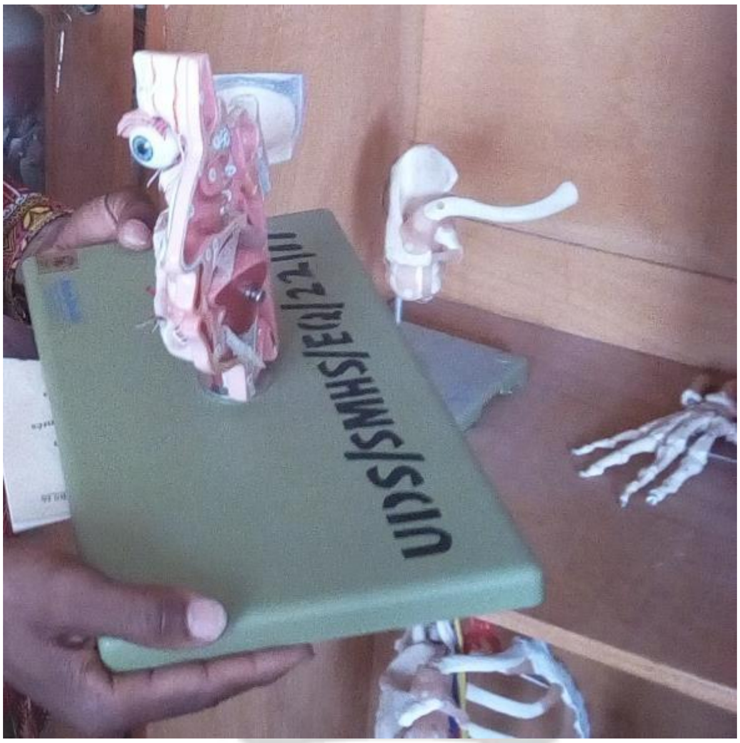


Plate 4 10: A model of eye structure made of plastic resin

Plate 4 11: A model of muscle of an arm made of plastic resin

4.4 Findings from Focus Group Discussion with Students

The following are responses from a total of twenty-four (24) students who were selected from both Levels 300 and 400 and engaged in the Focus Group Discussion on the availability, use and effects of visual media in teaching and learning of Anatomy. Responses obtained are indicated as follows:

- **How would visual media facilitate learning of Anatomy during tutorials?**

With regards to this, majority 21(87.5%) of the students replied in the affirmative whereas the remaining 7(12.5%) answered in the negative. In this regard two of the students said:

"*It's at the tutorials that individual students are able to ask questions for clarification since tutors are ready to answer them and so projecting visuals and audiovisuals of objects will help us".*

"I think we need the models most to practice with during tutorials so as to enhance students' memory.

- **How does a student's ability to identify colour, texture and shape help in his or her clinical practice?**

Concerning application of the elements of design such as colour, texture and shape for learning Anatomy, more than half 18(75%) of the students said acquired skills in these areas are important to the study of Anatomy whereas the minority representing 6(25%) argued that students' efforts to acquire these knowledge are not important for medical education, specifically, learning Anatomy". Skills in identifying colour for example, can be applied in Macro Urinalysi, because the first skill required in urinalysis is direct visual observation to determine color change that occurs on each segment of the paper strip is compared to a color chart to obtain results (Webpath, 2019). Similarly, medical students' skills in identifying colour, texture and shape can be applied in diagnosing diseases on the body during physical examination of patients (Standford, 2017).

For example, three of the students commented that:

"Diseases mostly present in the form of either a change in colour, texture or mass will define its shape. So, our knowledge about colour, texture and shape will help in diagnosis".

"*It will help during physical examination of the body, particularly, during palpation which involves the feeling for certain structure. That is, these knowledge assists students to know how the normal feels like (smooth) and then identify the abnormal feeling during diagnosis. For instance, most of the organs have specific features and students need knowledge in colour, texture and shape, among other elements and principles of art".*

- **Do you have to acquire skills in sketching components of anatomical structures?**

Again, majority of students, signifying 23(95.8%) responded positively that skills acquired in sketching are useful in the learning of Anatomy, meanwhile, only 1(4.2%) stipulated otherwise. The following are some students' expressions:

"*Sketching is very important in medicine. I went to Tamale Teaching Hospital for medical examination on my breast and after the doctor examined me he sketched the breast on a paper and located the problem. He then referred me for surgery to another doctor, and even when that* *doctor hadn't read the information he had written, a glance at the sketch and he could palpate and then find the lump".*

"*I also think knowing how to sketch the musculoskeletal system is very important. We've had an experience with one of our professors, though, we haven't had any clinical exposures he was trying to show us how they do some corrections on veins. He taught 'Veins' by sketching them on the white board so we could better understand the concept". On this assertion, another student continued by stating:*

"Yes, a medical doctor does not only treat illnesses but also teach other people including patients. So if you can sketch, you can really relay the information to patients' understanding".

"*In advanced countries, there is no way one would diagnose a patient with musculoskeletal problem without sketching to educate him or her in order to keep the muscle healthy".*

- **Are critical thinking and observational skills training with visual media important to the learning of Anatomy?** Similarly, majority of 21(87.5%) of students assumed training to acquire critical thinking and observational skills through visual art will help them in the learning of Anatomy medicine; whiles the remainder 3(12.5%) did not agree with the majority. Some students retorted:

"*Acquisition of critical thinking and practical observation of art works for learning is very important because most concepts taught are from textbooks which sometimes come with, distorted or unclear images".*

4.5 Mode of Assessment of Lessons Taught under Visual Art-Based Interventions

The students' responses as reflected in the focus group discussions implied that all of them would be interested in participating in visual art invention activities or lessons but it should not be examinable. This clearly indicate that the students were aware of their limitations in terms of skills development and would wish that opportunity is given to them to acquire the skills necessary for learning. Nonetheless, the researcher believes that although, students' participation should not be examinable, emphasis should be placed on assessment for learning. In this context, students will be required to informally carry out their own assessment through interaction with peers on knowledge of and skills in art such as visual elements, principles of organization, observational skills, and skills for art appreciation and criticism. These are skills that can be applied to strengthen students' learning of Anatomy. Thus, marks should be awarded for attendance to encourage participation in visual art-based intervention activities (Curriculum Development Council and the Hong Kong Examinations and Assessment Authority 2014).

4.6 Findings from Interviews with Lecturers on the Visual Media Used for Teaching and Learning of Anatomy

Issues that emanated from the focus group discussions with the students called for further interaction with the lecturers to clarify the concerns raised by the students. The four lecturers who were interviewed included the Head of Department for Anatomy, the Skills Coordinator and two others.

On the issue of the reasons students had difficulty understanding some topics taught even with visual media, one of the interviewees (Head of Department) said,

"musculoskeletal, nervous and cardiovascular systems make the bulk of information that are taught and learned under Anatomy. These topics are taught alongside other subjects within 6 weeks. So the manner in which topics are selected and taught in the context of relevance as required by the PBL system makes the basis for training students. Unlike the traditional system where a particular region will be taught for a whole period or session, in the PBL system scenarios are given and topics relevant to each scenario are selected and taught. Also, the time allotted for teaching the courses is not enough. For example four (4) hours is the normal time required to teach Anatomy but two (2) hours is taken out of this to teach dissection. So there is insufficient time to cover everything. With the PBL system, more Basic Sciences are taught at the lower levels while emphasis is placed on clinical practice from Level 400 up to Level 600. Another interviewee also mentioned *that another problem is the mode by which dissection is taught by means of pro-dissection of the cadaver. The lecturer dissects and shows to the students what a particular organ looks like rather than allowing the students to practice dissection themselves, because the cadavers are not available".*

He stressed that there were supposed to be ten (10) tables each with one cadaver so that the students are put in groups of 10 and each group to a table with a cadaver but the problem is that there are no dead bodies to be used to teach dissection where students in each small group will have a cadaver for dissection.

On classroom space, students reiterated that the medical school should have its own medical block where space could be allocated for lectures, medical museum, mortuary and dissection section. All the four lecturers interviewed responded that the uncompleted medical school building behind the office block is supposed to serve as Anatomy museum, the medical laboratory and E-library block but it has not been completed yet.

In response to whether there was need for the medical school to have a resource centre with relevant visual media, all the interviewees answered that the medical school had a resource centre with videos dedicated to the learning of Anatomy but it is currently not functioning. All of them expressed the view that there is the need to have a separate computer laboratory as resource centre for the medical school with Computer Assisted Learning where good videos can be made available for students. However, one of them stipulated that there is a video online called *"The Anatomy in YouTube which students can download for their personal or group studies"*. In connection to this, an interviewee (the Principal Librarian) explained that originally the medical school's library block was designed such that the first floor would have served as library for only medical students but due to lack of space, the medical students are now sharing library materials with five other faculties.

Concerning the students' appeal for the medical school to provide more overhead projectors to facilitate teaching and learning of Anatomy, the interviewees all admitted that the tutorial rooms should have projectors with computers connected to the internet so that audiovisuals can be downloaded and shown for discussion. In commenting on the use of visual media during tutorials, one of them (Skills Training Coordinator) articulated that:

"*I don't think it is fully necessary for students to have visual media during tutorial meetings but also admitted that visual media could add value to students' tutorials. He again articulated that the availability and use of visual media during tutorial sessions would be effective only if the entire curriculum is 'upgraded' to include audiovisual information. He argued that if students have access to visual media during tutorial meetings and they are not related to methodologies used, then visual media will not add much value to students' learning*".

4.7 Activities Undertaken for Objective Two

Objective two was to analyze the effectiveness of Visual Media on teaching and learning of some topics in Anatomy at the School of Medicine and Health Sciences of UDS in Tamale.

4.7.1 Analysis of Findings from Questionnaire Administered to Students on the Effectiveness of Visual Media on Teaching and Learning of some Topics in Anatomy in the School

On this objective, students expressed their views on effectiveness of visual media in relation to effectiveness of images of two and three dimensionality. The underlying discussions satisfy this objective.

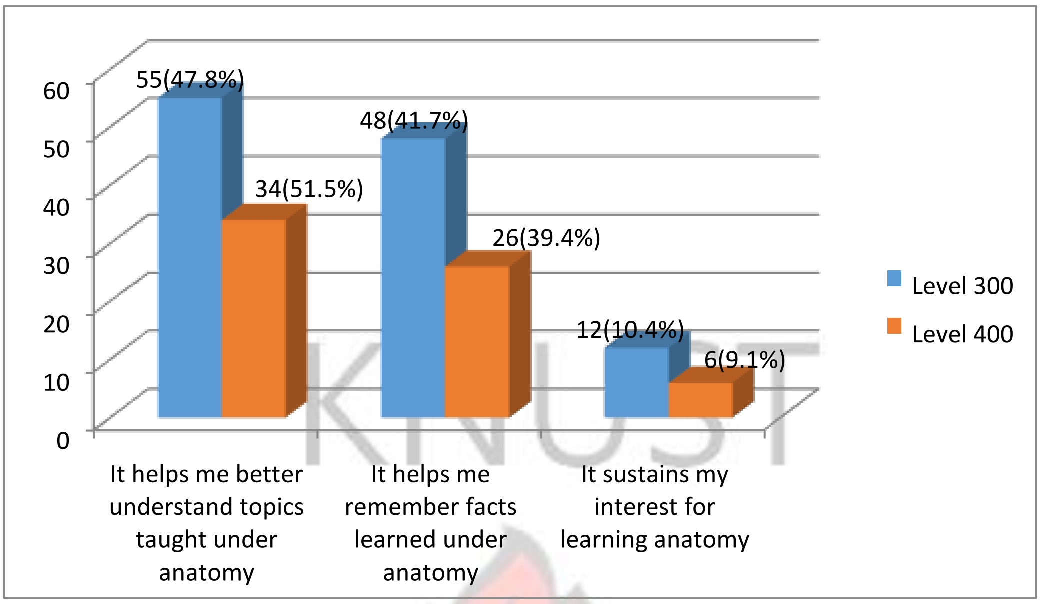


Figure 4. 3: Students' views on the effectiveness of 3-D Virtual media on teaching and learning of Anatomy.

Source: Field Data, 2018

In terms of the effectiveness of three-dimensional (3-D) Virtual media (videos and animations) in helping the respondents achieve their learning objectives, Figure 4.3 indicates that 55(47.8%) and 34(51.5%) of the respondents from both Level 300 and Level 400 respectively said 3-D Virtual media enabled them to better understand topics taught under Anatomy; whereas 48(41.7%) and 26(39.4%) of Level 300 and Level 400 correspondingly stated that 3-D Virtual media were effective in helping them remember facts learned under Anatomy. Further, 12(10.4%) of Level 300 and 6(9.1%) Level 400 respondents respectively argued that 3-D Virtual media were effective in sustaining their interest for leaning Anatomy. These responses from the students bring to the fore the important role visual media plays in enhancing students learning of Anatomy at the medical school. That is why El-Sayed and Samar (2013) articulate that video-based lectures have the potential of enriching educational curriculum in many teaching fields that are based on Science such as Human Anatomy and physiology. Thus, the utilization of videos enables students to see and learn complex skills that cannot easily be demonstrated through lectures.

On the issue of the effectiveness of 3-D Physical media on teaching and learning of Anatomy, Figure 4.4 explains respondents' responses as indicated below.

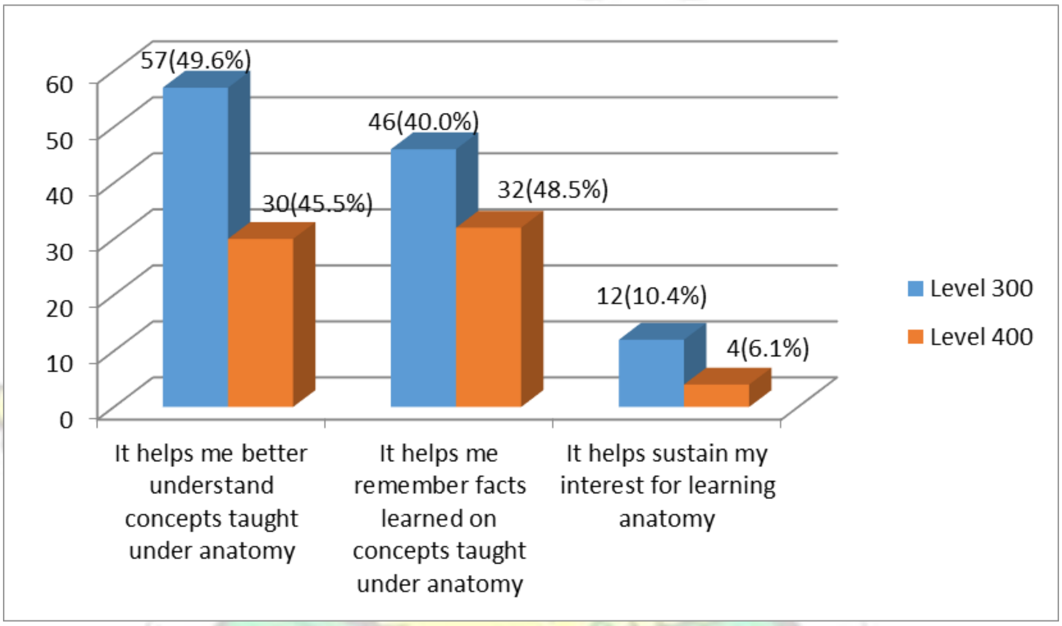


Figure 4. 4: Students' views on the effectiveness of 3-D Physical media on teaching and learning of Anatomy.

Source: Field Data, 2018

As shown in Figure 4.4, 57(49.6%) and 30(45.5%) of Level 300 and Level 400 students concurrently suggested that 3-D Physical media enabled them better understand concepts taught under Anatomy while 46(40.0%) and 32(48.5%) of Levels 300 and 400 students specified that 3-D Physical media helped them remember facts learned on concepts taught under Anatomy.

Further, 12(10.4%) and 4(6.1%) of Level 300 and Level 400 of the respondents also said the use of 3-D Physical media sustained their interest for learning Anatomy. Therefore, it was realized that 57(49.6%) in Level 300 formed the majority of respondents who understand concepts taught better when using Physical media whiles only 12(10.4%) of the same group mentioned that Physical media helps to sustain their interest in the course. On the other hand, 32(48.5%) and 30(45.5%) of respondents in Level 400 were at pair on the effectiveness of Physical Media as they outlined that Physical media directly aid to remember and understand concepts. Meanwhile, only 4 students representing (6.1%) said their interests are sustained with the use of Physical media. The views expressed by these students affirm assertions made by Azer and Azer (2016) that students appreciate learning Anatomy and understand better the structure of the human body when opportunity is given them to manipulate and interact with three-dimensional structures.

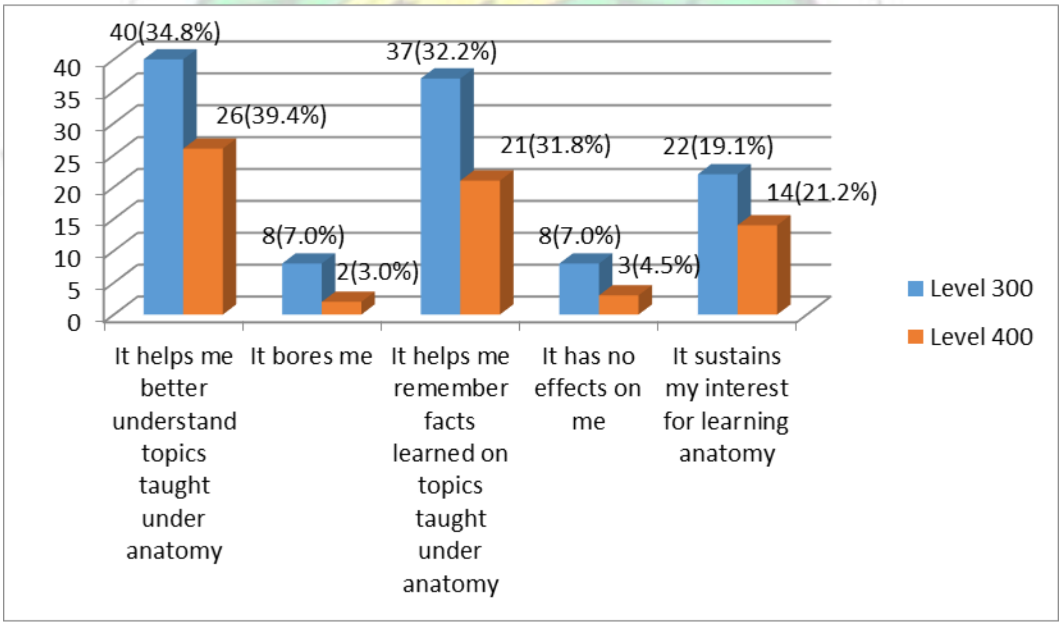


Figure 4. 5: Students' views on effectiveness of 2-D Physical media in enabling them achieve their objectives for learning Anatomy.

Source: Field Data, 2018

From Figure 4.5, 40(34.8%) and 26(39.4%) Level 300 and Level 400 students respectively expressed that 2-D Physical media enabled them understand concepts taught under Anatomy while only 8(7.0%) and 2(3.0%) of students from both year groups said the use of 2-D Physical media made them bored during teaching-learning sessions. On the issue of recall of information learned, 37(32.2%) and 21(31.8%) of students from Level 300 and Level 400 correspondingly believed the use of 2-D Physical media helped them remember facts learned under Anatomy.

Again, only 8(7.0%) and 3(4.5%) from both year groups stipulated that the use of 2-D Physical media had no effect on their learning of Anatomy. Further, 22(19.1%) Level 300 students and 14(21.2%) Level 400 students stated the use of 2-D Physical media helped sustain their interest for learning Anatomy. Even though, the responses of the students as shown in Figure 4.5 indicate that application of two-dimensional Physical media has positive effects on the students learning of Anatomy, it is interesting to note that 10(5.5%) and 11(6.1%) of the students found the use of twodimensional Physical media boring or not having any impact on their learning of Anatomy respectively. These responses affirm assertions made by Azer and Azer (2016) that the use of two-dimensional images is ineffective in helping medical students appreciate spatial relationships surrounding anatomical structures. If the goal of the medical school is to meet the learning needs of all the students equally (Busan 2014), then there is the need for the medical school to consider increasing the number of models and other anatomical structures and make them accessible to the students. Otherwise, these group of students who are dissatisfied with the use of two-dimensional Physical media may become frustrated and may not be able to develop spatial visualization skills as expected of them

(Azer & Azer 2016).

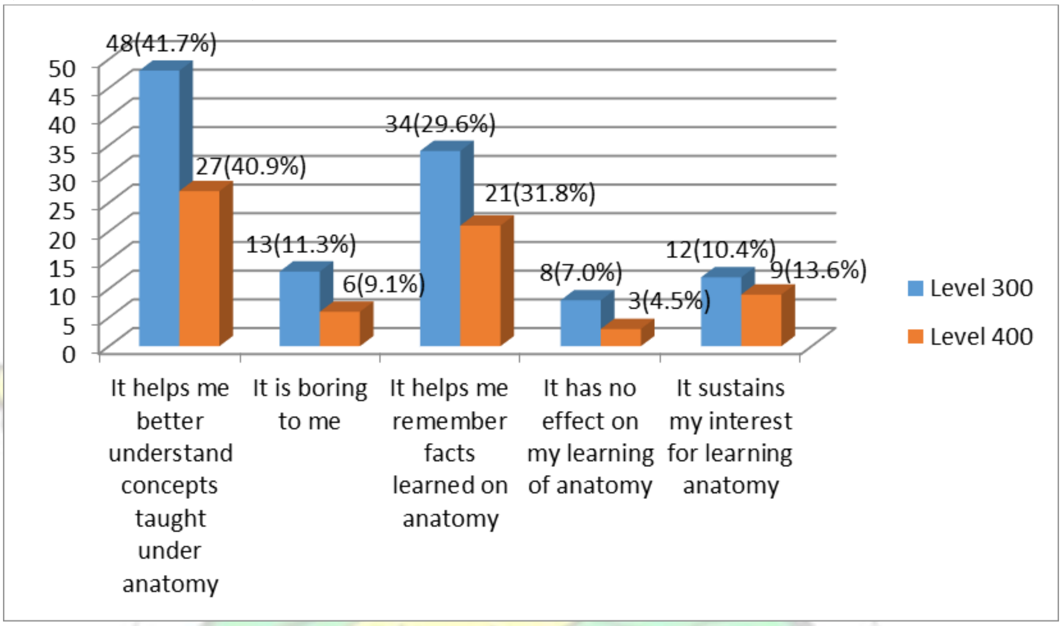


Figure 4. 6: Students' responses on effectiveness of Anatomy atlases in enabling them achieve their objectives for learning Anatomy.

Source: Field Data, 2018

Concerning the effectiveness of Anatomy atlases in enabling students achieve their objectives for learning Anatomy, Figure 4.6 shows that 48(41.7%) of Level 300 students and 27(40.9%) of Level 400 students opined that Anatomy atlases were effective in enabling them understand concepts taught under Anatomy. Additionally, 13(11.3%) and 6(9.1%) Level 300 and Level 400 students respectively, said the use of Anatomy atlases for learning Anatomy was boring to them, while 34(29.6%) and 21(31.8%) of students from both year groups accordingly revealed that the use of atlases helped them remember facts learned under Anatomy. Only 8(7.0%) and 3(4.5%) of the students from both year groups said the use of Anatomy atlases had no effect on their learning of Anatomy. Also, only 12(10.4%) and 9(13.6%) of the students from both year groups said the use of Anatomy atlases helped in sustaining their interest for learning of Anatomy.

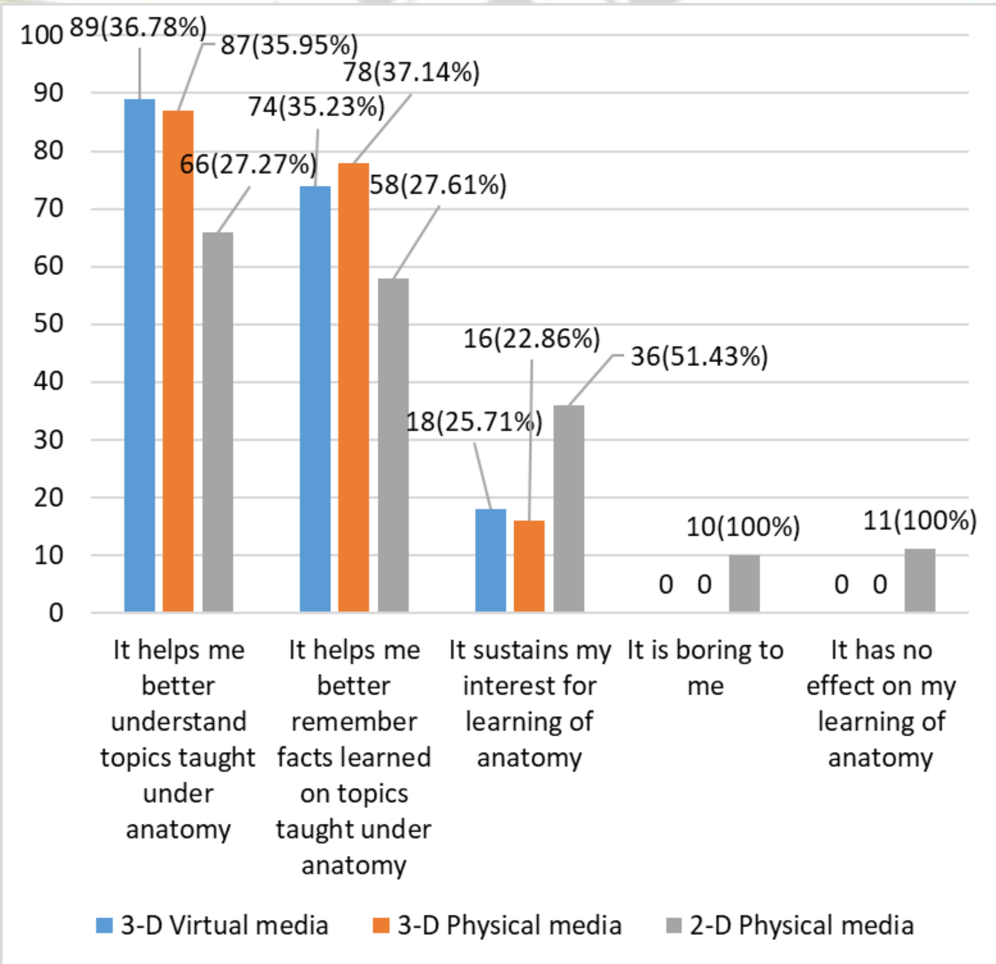


Figure 4.7: Ranking of effectiveness of visual media from students' responses

Figure 4.7 shows the ranking of effectiveness of visual media from the students' responses. It can be seen from this figure that in achieving effectiveness, virtual media of three dimensionality in the form of anatomical videos and audiovisuals ranked highest 89(36.78%) in enabling the students better understand concepts taught under Gross Human Anatomy; the second highest 87(35.95%) are physical visual media of three dimensionality in the form of anatomical models, manikins and simulations; and physical visual media of two dimensionality in the form of medical atlases, medial diagrams and medical photographs are the least 66(27.27%) concepts taught under Gross Human Anatomy.

Concerning effectiveness of visual media in helping the students remember facts learnt on concepts taught under Gross Human Anatomy, virtual media of three dimensionality ranked the highest 74(35.23%) in enabling the students remember facts learned under Gross Human Anatomy; physical media of three dimensionality are the second highest 74(35.23%) in helping the students remember facts learnt under Gross Human Anatomy; and physical media of two dimensionality are the least highest 58(27.61%) in enabling the students recall facts learnt under Gross Human Anatomy.

With regards to effectiveness of visual media on sustaining the students' interest for learning of Gross Human Anatomy, physical visual media of two dimensionality ranked the highest 36(51.43%) in sustaining the students interest for learning of Gross Human Anatomy; virtual images of three dimensionality ranked the second highest 18(25.71%) in sustaining the students' interest for learning of Gross Human Anatomy; and physical visual media of three dimensionality ranked the least highest 16(22.86%) in sustaining the students' interest for learning of Gross Human Anatomy.

Concerning negative effects that visual media have on medical students' learning of Gross Human Anatomy, the students responses indicated that only the use of physical visual media of two dimensionality is either boring 10(100%) or has no effect 11(100%) on their learning of Gross

Human Anatomy. The students' responses, based on the ranking of the various visual media are consistent with Farooq 2014 and Sousa 2011 assertions that application of virtual and physical visual media are indeed effective in facilitating students learning of concepts taught in Gross Human Anatomy.

Table 4. 11: Students' responses on effectiveness of cadavers for dissection and observation in enabling students achieve their objectives for learning Anatomy (N = 181)

Item	Level 300	Level 400	Total
It helps me better understand topics taught under Anatomy	51(44.3%)	26(39.4%)	77(42.5%)
It is boring to me	1(0.9%)	1(1.5%)	2(1.1%)
I have no access yet	0(0.0%)	2(3.0%)	2(1.1%)
It helps me remember facts learned on topics taught under Anatomy	49(42.6%)	25(37.9%)	74(40.9%)
It has no effect on my learning of Anatomy	3(2.6%)	12(18.2%)	15(8.3%0)

It sustains my interest for learning Anatomy	11(9.6%)	0(0.0%)	11(6.1%)
Total	**115**	**66**	**181**

Source: Field Data, 2018

With regards to effectiveness of cadavers in enabling students achieve their objectives for learning Anatomy, Table 4.11 indicates that a total of 77(42.5%) of the respondents alleged the use of cadavers helped them better understand topics taught under Anatomy, 74(40.9%) of them also said cadavers help them remember facts learned on topics taught under Anatomy whereas 11(6.1%) postulated that the use of cadavers helped sustain their interest for learning of Anatomy. Meanwhile, 15(8.3%0) argued that the use of cadavers had no effect on their learning of Anatomy, whiles 2(1.1%) of them said the use of cadavers bored them and 2(1.1%) also asserted that they had no access to manipulating with cadavers. This situation where some students found cadavers to be of no benefit to their learning of Anatomy can be worrying as it leaves one to wonder how well those students in question will be able to develop the requisite clinical skills for practice.

Table 4. 12: Students' responses on whether they participate with keen interest in lessons taught with visual media (N= 181)

Item	Level 300	Level 400	Total
No	4(3.5%)	3(4.5%)	7(3.9%)
Sometimes	27(23.5%)	14(21.2%)	41(22.7%)
Yes	84(73.0%)	49(74.2%)	133(73.5%)
Total	**115**	**66**	**181**

Source: Field Data, 2018

As can be seen from the students' responses as shown in Table 4.12, an overwhelming percentage of the students 133(73.5%) responded in the affirmative that they participated with keen interest when topics were taught with visual media whereas 41(22.7%) mentioned they sometimes participated with keen interest when topics were taught with visual media.

However, only 7(3.9%) of them said they did not participate with keen interest when topics were taught with visual media. In response to an inquiry at the focus group discussion on why students still participated with keen interest even without visual media, one of the students made the following revelations:

"Mostly, when we have an examination people focus on writing only the exams but not actually gaining the knowledge or understanding what they are learning. There are most of us who have passed certain blocks and exams but if we are asked to demonstrate any skills we've gained, we cannot demonstrate and so we write exam to pass because we have to pass".

Thus, discussions at the focus group revealed that the quest to pass examination was the motivating factor that propelled most of the students to participate with keen interest in topics taught even without visual media. This perception to learning Anatomy where the medical students focused mainly on passing examinations will not encourage them to explore learning opportunities practically to enhance their competencies for clinical practice. This Orr (1996) believes can have negative effects on the students overall competency and service to humanity if care is not taken to change the trend.

Table 4. 13: Students' views on whether visual images enable them better understand concepts taught under Anatomy

Item	**Level 300**	**Level 400**	**Total**
Agree	32(27.8%)	13(19.7%)	45(40.9%)
Disagree	0(0.0%)	0(0.0%)	0(0.0%)
Not sure or neutral	3(2.6%)	0(0.0%)	3(1.7%)
Strongly agree	80(69.6%)	53(80.3%)	133(73.5%)
Strongly disagree	0(0.0%)	0(0.0%)	0(0.0%)
Total	**115**	**66**	**181**

Source: Field Data, 2018

It is evident from the responses as shown in Table 4.13 that 133(73.5%) and 45(40.9%) of the respondents strongly agreed and agreed that visual images enable them better understand concepts taught under Anatomy. Only 3(1.7%) of them were neutral as to whether visual images enabled them better understand concepts taught. However, none of the students strongly disagreed or disagreed. Hence, the usefulness of visual media as reflected in the responses is supported by Brook's (2016) that Visual artbased intervention has the potential of augmenting students and lecturers efforts in teaching and learning processes particularly in training medical education.

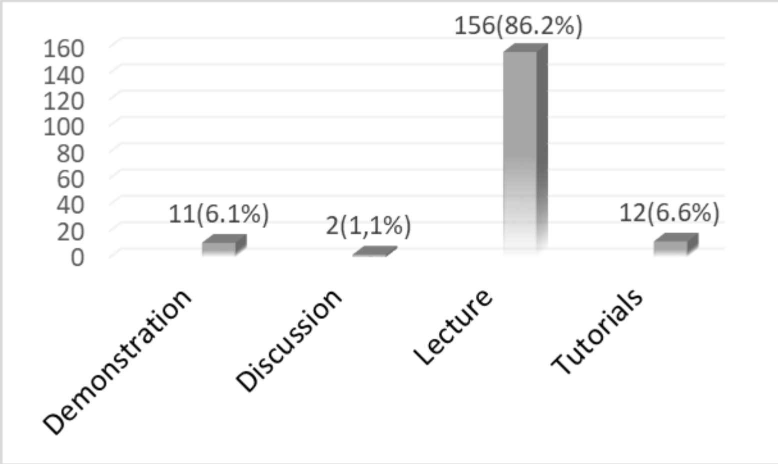


Figure 4. 7: Responses on teaching method(s) with visual media lecturers employed most for teaching Anatomy.

Source: Field Data, 2018

As can be seen from Figure 4.7, an overwhelming majority 156(86.2%) of the respondents from both Level 300 and Level 400 stated that lecturers employed mostly the lecture method to teach Anatomy. However, only 11(6.1%), 2(1.1%) and 12(6.6%) of the students affirmed the lecturers employed demonstration, discussion and tutorial teaching methods respectively with visual media. This implies that, there were no Anatomy diagrams or charts either on the classroom walls or fixed at convenient places for students to appreciate. Meanwhile, the skills training laboratory was enriched with various physical three-dimensional media except virtual media in the form of Anatomy videos and animations for students to explore.

Linked with effectiveness of visual media is the kind of teaching methods employed with visual media identified. Figure 4.7 showed that more than half of the respondents 156(86.2%) indicated that lecturers employed mostly the lecture teaching approach in lessons taught under Anatomy. In sharp contrast to teaching method employed by the lecturers, an overwhelming 147(81.2%) of the respondents indicated their preference for demonstration teaching method as depicted in Figure 4.8. The situation where lecturers mostly resorted to employing lecture method for teaching could be due to the large amount of content they needed to deliver to students in ‘very tight and narrow schedule’ while students are expected to ‘retain, remember and effectively interpret’ information they receive (Samarakoon et. al., 2013; Koh et. al., 2008 as cited in Salwani 2014). However, it must be emphasized that the frequent use of lecture method for teaching might disadvantage the category of students who learn best visually or kinesthetically, because individuals differ with regard to the mode of instruction that is effective for them (Busan 2014). Newble and Entwistle (1986) and Lubawy (2003) as cited in Salwani et al. (2014) have stated that familiarity with ‘learning styles’ have definite benefit for both teachers and students. Teachers can adapt new methods if they know the learning styles of learners (Newble & Entwistle1986; Lubawy 2003, p.48), “because teaching without learning taking place is sheer talking”.

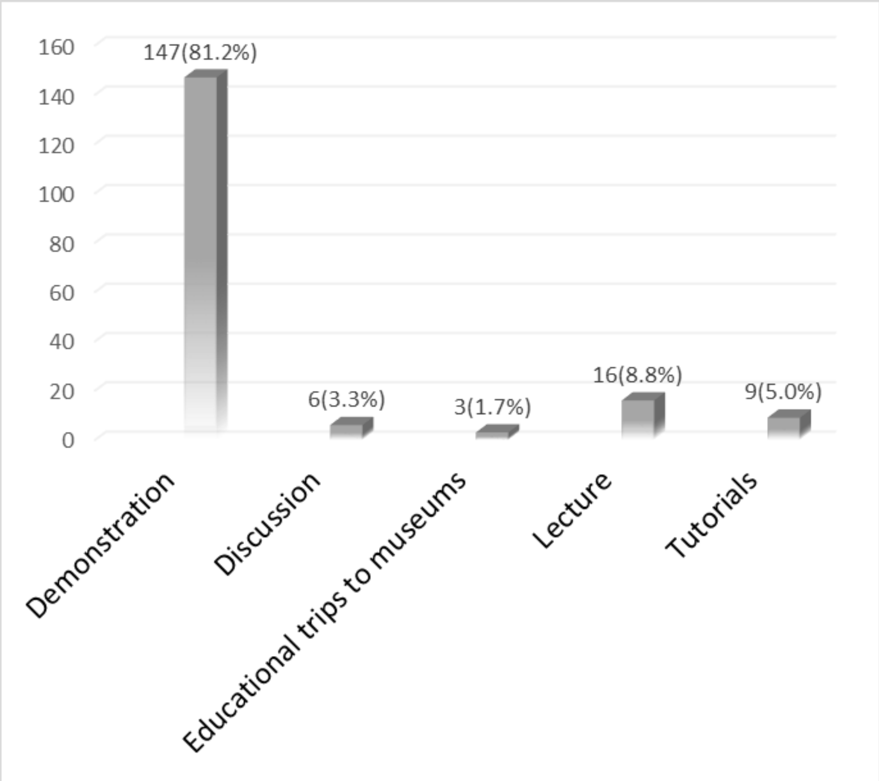


Figure 4. 8: Students' views on teaching method(s) with visual media that facilitate(s) understanding of concepts taught under Anatomy

Source: Field Data, 2018

On the other hand, concerning the students' preference for teaching methods with visual media that facilitated their understanding of concepts taught under Anatomy, Figure 4.8 depicts an overwhelming percentage, specifically, 147(81.2%) of respondents from both Level 300 and Level 400 indicated that demonstration method with visual media helped them understand concepts in Anatomy more easily than the other teaching methods. Only 6(3.3%), 3(1.7%), 16(8.8%) and 9(5.0%) of the respondents agreed that the use of discussion, lecture, tutorial teaching as well as educational trips facilitate their understanding of concepts taught under Anatomy. An instructional approach where emphasis is placed more on lecture method without incorporating visual media conflicts with the art functionalist's view which stresses on utilizing artifacts or visual media for the purpose of satisfying learning needs of students (Davies 2001). That is why Khadeer, Khan and Rajkumar (2014) pointed out that student-centred learning in the PBL is an active process where the students 'learn to learn' through their own 'digging' or study. So the frequent use of lecture teaching method denies students the opportunity to explore their style and manner of learning relevant information that satisfy their educational needs. It is in this respect that Anatomy lecturers must seek to know the learning styles of their students (Busan 2014), if the goal is to employ visual media effectively to enable the students perceive, process, store and recall what they are taught to learn (James & Gardner 1995 as cited in Salwani 2014). That is, teaching should be tailored to students' 'preferred method of gathering, processing, interpreting, organizing and analyzing information' (Kharb et. al. 2013 as cited in Salwani 2014).

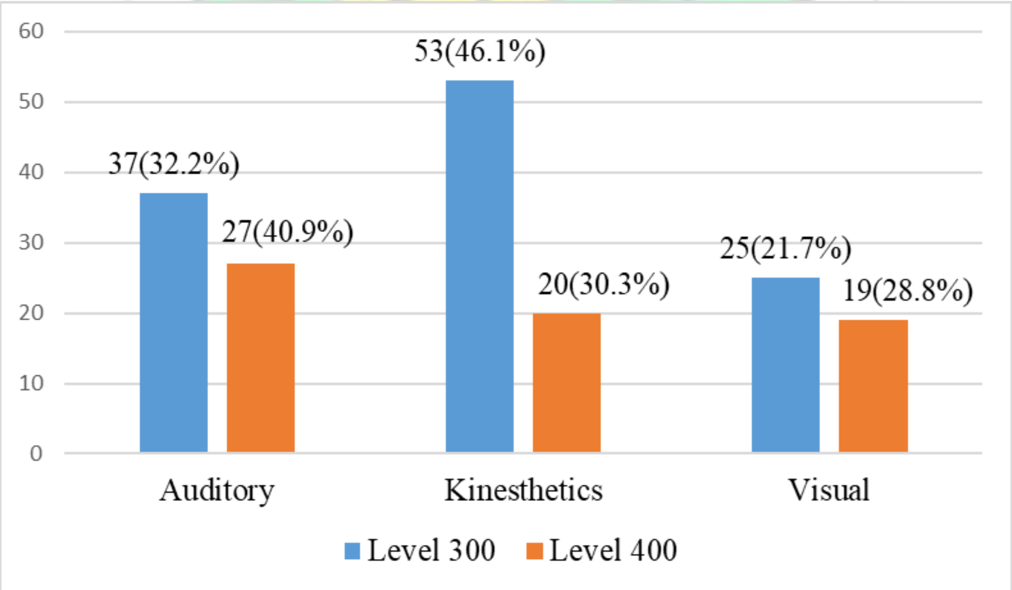


Figure 4. 9: Students' views on their preferred learning styles when learning Anatomy with visual media.

Source: Field Data, 2018

As can be seen from Figure 4.9, 53(46.1%) of Level 300 students indicated they were kinesthetic learners who preferred learning by touching and manipulating with anatomical structures, while 27(40.9%) of Level 400 students implied they were auditory learners. Again, 37(32.2%) and 27(40.9%) of Level 300 and Level 400 students also said they are auditory learners and preferred learning by listening to information being delivered to them by means of auditory. However, 25(21.7%) and 19(28.8%) of the respondents from both year groups said they are visual learners and therefore preferred learning by watching or seeing things as they happen. Busan argued that students who are visual learners implicitly become disinterested when sitting in classrooms where the main mode of lesson delivery is by auditory. It is therefore important that lessons are taught with relevant visual images to aid 'good visual memory' but without neglecting the learning needs of auditory learners (Busan 2014). In the context of this study, Busan postulated that medical information should be conveyed to students using 'both sensory channels equally' whiles combining the visual images with meaningful discussions, so as to attract and retain the attention of students with all types of learning styles. To achieve this, experts assert that there is global trend to reform medical curriculum from teacher-centred to student-centred learning, because medical students are adults who have already developed their own learning styles. It is therefore essential for medical educators to ‘tailor instructions’ in such a way that the medical students appreciate and follow them to learn (Collins 2004; Claxton & Murrell 1987 as cited in Salwani 2014).

Table 4. 14: Students' views on mode of learning with visual media that makes them appreciate learning of Anatomy (N=181)

Item	**Level 300**	**Level 400**	**Total**
Manipulating anatomical 3D models to understand medical concept	68(59.1%)	35(53.0%)	103(56.9%)
Use of Virtual 3D visual media to understand medical concept	29(25.2%)	16(24.2%)	45(24.9%)
Use of artifacts in Anatomy museum to reinforce learning of medical concepts	1(0.9%)	3(4.5%)	4(2.2%)
Use of Anatomy textbooks and atlases for learning	17(14.8%)	12(18.2%)	29(16.0%)
Total	**115**	**66**	**181**

Source: Field Data, 2018

Concerning the respondents’ mode of learning, Table 4.14 shows that majority of the respondents signifying 103(56.9%) preferred to manipulate physical three-dimensional Anatomical models for learning of Anatomy, 45(24.9%) of them preferred the use of Virtual 3-D visual media to understand medical concepts, 29(16.0%) preferred Anatomy textbooks and atlases for learning of Anatomy whiles only 4(2.2%) of the respondents want to interact with artifacts in Anatomy museum to reinforce learning of concepts taught.

Concerning the use of textbooks and atlases Azer and Azer (2016) have pointed out that although Anatomy textbooks and Anatomy atlases offer two-dimensional (2-D) static illustrations, they offer little benefits that enable students to understand or appreciate the intricacies of threedimensional (3-D) anatomical structures. That is why;

*"… collaborating scientists and visual researchers urged scientists to find ways to articulate and interpret the nuances of visual worlds, to work toward better collaboration across disciplines. Additionally, it is recommended that all Science and Engineering students have some exposure to creating visualizations; that any science programme should begin with a firm grounding in visual theory and practice from an intuitive and experiential perspective. Pedagogically, because lecture alone is the least effective way of reaching the whole learning being, learning should be structured so as to engage as many of the senses as possible and allow students to explore, engage in, and visually complete the meaning of scientific concepts" (*Gazzaniga 1998 as cited in Barry n.d, Pp.7-8).

Also linking this with teaching methods, students' learning styles and mode of interacting with visual media is the question of access to visual media by the students. That is, effectiveness of visual media to some extent borders on accessibility as discussed below.

Table 4. 15: Students' responses on how frequently they have access to manipulate anatomical structures during lectures (N = 181).

Item	Level 300	Level 400	Total
I have no access	49(42.6%)	37(56.1%)	86(47.5%)
It is not necessary to have access	16(13.9%)	6(9.1%0	22(12.2%)
I have access once a month	6(5.2%)	7(10.6%)	13(7.2%)
I have access once a trimester	29(25.2%)	5(7.6%0	34(18.8%)
I have access once a week	15(13.0%)	11(16.7%)	26(14.4%)
Total	**115**	**66**	**181**

Source: *Field Data, 2018*

The students' responses as shown in Table 4.15 indicates that majority 86(57.5%) of them stated they did not have access to anatomical structures to manipulate during lectures. Conversely, 34(18.8%) of them had access to the visual media once a trimester, 26(14.4%) of the students had access once a week whiles 13(7.2%) of them had access to the visual media once a month. However, 22(12.2%) of the students said it was not necessary to have access to visual media. On this issue, the respondents at the focus group discussion explained that the two-hour period allotted for lectures was not enough for the lecturers to enable them have access to the models.

Table 4. 16: Students' responses on how frequently they have access to manipulating with anatomical structures during Tutorials (N = 181).

Item	Level 300	Level 400	Total
I have no access	84(73.0%)	41(62.1%)	125(69.1%)
It is not necessary to have access	10(8.7%)	8(12.1%)	18(9.9%)
I have access once a month	2(1.7%)	6(9.1%)	8(4.4%)
I have access once a trimester	10(8.7%0	7(10.6%)	17(9.4%)
I have access once a week	9(7.8%)	4(6.1%)	13(7.2%)
Total	**115**	**66**	**181**

Source: Field Data, 2018

Again, it can be seen from the students' responses as indicated in Table 4.16 above, majority 125(69.1%) of the respondents said they did not have access to manipulate the various visual media during tutorials; 18(9.9%) of them mentioned that it is not necessary to have access to manipulate anatomical structures during tutorials. This buttresses the assertion that, only 8(4.4%), 17(9.4%) and 13(7.2%) of the respondents stressed they had access to manipulate anatomical structures once a month, once a trimester and once a week respectively.

It can be said that, this situation where students have no access to visual media for learning of Anatomy during tutorials is a deviation from the Problem-Based Learning system which operates based on the constructivist's theory of learning, in which learners are expected to construct their own learning by interacting with a wide range of instructional media (Sivalingam, Nalliah & Nazimah 2014) under the guidance of a facilitator (Khadeer, Khan & Rajkumar 2014). On this issue, of the respondents articulated that:

"Actually we are supposed to have a projector in each tutorial room. If there was a projector you could actually project images, be it video or just pictures. For tutorials, the number is smaller so we can have these models distributed to the various tutorial groups and it will be very easy, because you wouldn't have to crowd all around them since one person can demonstrate with one at a time. Again, you can actually have in-depth discussions and understanding of the whole thing. So some models could be given during tutorial sessions or they could actually adopt the practice of using the projectors as they are supposed to be used".

Also, another said *"It is at the tutorials that we get to ask about some of the things we didn't understand during teaching and learning sessions in the lecture hall. That is the time we have a tutor who is there to answer individual questions. I think the audiovisuals and the models can be used if we have it dedicated to only tutorials so we will not have to move them around".*

On the other hand, there were counter reactions gathered from the interviews with lecturers as one out of the four interviewees said that it was not necessary for students to have visual media during tutorial sessions, although, one more interviewee from the four selected for the study who is the Head of Department conceded that the medical school had a resource center for learning whereby students could have assess to visual media during tutorial meetings but it is non-functional at the time of the study.

Inferring from some responses earlier gathered from both interviewees and students it is clear that the medical school needs to do more to incorporate visual media to facilitate learning of Anatomy during tutorial sessions. This approach where students do not use audiovisuals, anatomical models and overhead projectors to enhance learning during tutorials defeats the Problem-Based Learning concept in which experiential learning is encouraged (Khadeer, Khan & Rajkumar 2014).

Table 4. 17: Students' responses on how frequently they have access to manipulate anatomical structures during Skills Training (N = 181)

Item	**Level 300**	**Level 400**	**Total**
I have no access	12(10.4%)	19(28.8%)	31(17.1%)
It is not necessary to have access	6(5.2%)	3(4.5%)	9(5.0%)
I have access once a month	8(7.0%)	5(7.6%)	13(7.2%)
I have access once a trimester	10(8.7%)	5(7.6%)	15(8.3%)
I have access once a week	79(68.7%)	34(51.5%)	113(62.4%)
Total	**115**	**66**	**181**

Source: Field Data, 2018

It is worthy to note from Table 4.17 that majority 113(62.4) of the respondents stated they have access to manipulate anatomical structure once a week during skills training. That is, 15(8.3%) of them alleged they have access once a trimester and 13(7.2%) also stipulated that they had access to manipulate anatomic structures once a month. However, 31(17.1%) of the respondents specified they had no access to manipulate anatomical structure whiles and 9(5.0%) claimed it was not necessary to have access to anatomical structures during skills training.

As argued by Khasawneh, Miqdadi and Hijazi (2014, p.14), “learners should be given opportunities to put into practice theoretical knowledge in actual conditions through experimental investigation”. An Art functionalist, Davies (2001) also supports this approach of utilizing artifacts during teaching and learning situation, including skills training sessions, when he said artifacts are of use only if they serve the needs of the user. What is even worrying is that 31(17.1%) of the respondents who claimed they have no access to visual media during skills training. When inquired from the participants at the focus group discussion why 31(17.1%) of the students did not have access to visual media, three of the respondents clarified that:

Respondent One: *“It could be true because it’s not all the skills training sessions that a model is placed in front of us to actually teach you. For instance, most of the time the skeleton, the heart and models of few organs are available. Again, dummies are always used for skills training of delivery of babies. Probably, the students did not understand the question but sometimes students outnumber the three or four dummies presented”.*

Respondent Two: *“I think during skills training, there are available visual media such as models for use so maybe those students didn’t understand the relationship between visual media and models. Sometimes, our own bodies are used for the acquisition of skills in surface Anatomy, which is very useful.*

Respondent Three: “*I think 31 students is quite a huge number to enable each of us have access to the models during skills training; if even we are divided into at least 13 or 15 groups or a maximum of 20. So I will not disagree with the students who say they don’t have access to visual media, but I think the number is quite huge. Maybe it might be a failure on the* *students' part just to struggle with other colleagues to touch the models because the person feels he or she should get one for herself, even though, there are some few skills sessions that models are not simply available for use.*

Based on the comments from the focus group as stated above, it can be concluded that the lecturers are doing their best by allowing the students access to practice with anatomical structures during skills training except that the models are inadequate for them to practice individually. According to Khasawneh, Miqdadi and Hijazi (2014, p.14), ensuring that students have access to visual media especially during skills training is important and it is consistent with the pragmatist's educational approach to learning in which learners have to put into practice theoretical knowledge that they have been taught in actual conditions through experimental investigation (Khadeer, Khan & Rajkumar 2014). Hence, lecturers confirmed this by arguing that lecturers' efforts in engaging the students actively in skills training with visual media where students 'learn to learn' through their own 'digging' or study suitable to their styles and educational needs is highly commendable.

Table 4. 18: Students' views on whether educational trips to Anatomy and Art Museums to interact with visual artifacts will enhance their observational skills (N=181)

Item	Level 300	Level 400	Total
Agree	39(33.9%)	22(33.3%)	61(33.7%)
Disagree	1(0.9%)	0(0.0%)	1(0.6%)
Not sure or neutral	3(2.6%)	1(1.5%)	4(2.2%)
Strongly agree	72(62.6%)	42(63.6%)	114(63.0%)
Strongly disagree	0(0.0%)	1(1.5%)	1(0.6%)
Total	**115**	**66**	**181**

Source: Field Data, 2018

Interestingly, the responses from majority 61(33.7%) and 114(63.0%) as shown in Table 4.18 agreed and strongly agreed respectively, that educational trips to Anatomy and Art Museums will enhance their observational skills development through interaction with visual artifacts. Only 1(0.6%) and 1(0.6%) of the students strongly disagreed and disagreed that these educational trips will enhance their observational skills.

The views of majority of the respondents 175(99%) are in line with assertions of Department of Basic Medical Sciences (2014) that medical school museums are a permanent educational resource that may be considered a supplemental approach to providing graduate and postgraduate medical students with materials for study of not only Anatomy, but also of other basic and clinical sciences, such as Embryology, Pathology and Surgery. As stated earlier in the literature, Kamath, Bhat, Asif and Avadhani (2016) assert that medical museums preserve and display a collection of artefacts and anatomical structures of scientific interest to medical students.

Thus, this state of affairs where the medical school does not encourage educational trips to Medical or Art Museums deny students the needed exposure and leaves a gap in their quest to expand their knowledge-base as far as critical observation and spatial visualization skills development are concerned (Azer & Azer 2016).

Table 4. 19: Students' responses on whether Visual art-based intervention when implemented will improve their observational skills development.

Item	**Level 300**	**Level 400**	**Total**
Agree	38(33.0%)	21(31.8%)	59(32.6%)
Disagree	0(0.0%)	1(1.5%)	1(0.6%)
Not sure or neutral	6(5.2%)	0(0.0%)	6(3.3%)
Strongly agree	71(61.7%)	44(66.7%)	115(63.5%)
Strongly disagree	0(0.0%)	0(0.0%)	0(0.0%)
Total	**115**	**66**	**181**

Source: Field Data, 2018

The responses on educational value of Visual art-based interventions as shown in Table 4.19, clearly shows students desire for visual arts-based interventions in order to augment other skills learned to better understand Anatomy. An overwhelming majority of respondents representing 59(32.6%) and 115(63.5%) agreed and strongly agreed respectively that Visual art-based intervention when implemented will improve their observational skills development. Whiles none 0(0.0%) of the students strongly disagreed, but only 1(0.6%) disagreed with 1(0.6%) of them who neither agreed nor disagreed.

Thus, the students' desire for Visual art-based interventions imply that any effort made by the medical school in implementing Visual art-based interventions to sharpen the students' observational skills will not be regretted. Lastly, the students' desire to have Visual art-based interventions implemented at the medical school to enrich their studies has been confirmed by their responses to evaluation questionnaire items after they had participated in the Critical Thinking and Observational Skills experiment.

4.7.2 Analysis of Results from the Critical Thinking and Observational Skills Experiment

The exercise on the experiment was scored over 10, 20, 30 and 25 for images one, two, three and four respectively.

Table 4. 20: Results of Critical Thinking and Observational Skills Experiment

Variable	Sub-group	M	SD	P-value
Experimental group	Control	11.81	6.70	0.0001
	Treatment	18.56	8.42	
Influence of Background knowledge in visual arts	No	14.47	8.10	0.197
	Yes	16.17	8.55	
Has this observation exercise improved your ability to observe images more critically than before	No	11.20	7.28	0.0001
	Yes	16.10	8.23	

Source: Field Data, 2018

With regards to whether the visual art-based critical thinking experiment made an impact, Table 4.20 shows the mean, standard deviation and p value of the students' knowledge scores. As shown on this table, the experimental group scored a higher mean of 18.56, and a standard deviation of 8.42 than the control group that scored a mean of 11.81, and a standard deviation of 6.70. However, the $p = 0.001$ indicated a significant positive impact of the critical thinking experiment. The students responses on whether their background knowledge in visual arts with $p = 0.197$ implied that medical students' background knowledge in visual arts does not have influence on their ability to identify and analyse visual details.

The students' responses on whether the critical observation exercise has improved their ability to observe visual images more critically with $p = 0.0001$ is an indication that the visual art-based critical thinking and observational skills exercise made a significant impact in improving the students' ability to identity and analyse visual details more critically than before.

Table 4. 21: Reliability statistics on whether the students found it easy in identifying and analysing the visual details of images presented to them.

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.983	.984	4

Source: Field Data, 2018

Table 4.21 presents Cronbach’s Alpha on the students responses based on a five-point Likert scale questionnaire items to determine the reliability of their responses on whether they found it easy or not in identifying the visual details of images of two-dimensionality presented to them for critical observation and analysis. The scale was, 1 = Agree, 2 = Disagree, 3=Neutral, 4 = Disagree, 5 = Strongly disagree. As can be seen from this table, the Cronbach’s Alpha, α= .983 is very high for us to conclude that the instruments used for the experiment were effective and appropriate, hence the students found it easy in identifying and analysing the visual images presented to them. This can be attributed to the visual thinking strategy questions given as a guide:

“Look at image one carefully and write down the kind of image(s) you see. What activity is going on there? What is the posture or position of the images you see? Ask yourself this question “what else do I see?” Be curious to look carefully to identify the hidden details that cannot easily be seen by the ‘untrained’ eye. “

Table 4. 22: Item-Total Statistics

Items	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Students found it easy to identify visual details of image one	6.6298	13.979	.973	.947	.973
Students found it easy to identify visual details of image two	6.8564	14.090	.955	.912	.978
Students found it easy to identify visual details of image three	6.5470	13.471	.957	.921	.979
Students found it easy to identify visual details of mage Four	6.5691	14.758	.950	.908	.980

Source: Field Data, 2018.

Reliability analysis was carried out on the values scale comprising four (4) items. Analysis using the Cronbach's alpha showed the questionnaires to reach acceptable reliability, α= .983 (Table 4.22). All items appeared to be worthy of retention, resulting in a decrease in the Cronbach's alpha if any of the items was deleted (Table 4.22). That is, the reliability coefficient alpha for image one, α = .973, the reliability coefficient alpha for image two, α =978, the reliability coefficient alpha for image two, α = .979, and the reliability coefficient alpha for image three, α = .980. Thus, retention of all the items was considered, because if any of the items was deleted it would result in a decrease in the

Cronbach's alpha reliability coefficient, α = .983.
Since the Cronbach's alpha has shown a very high reliability coefficient for each of the questionnaire items, the students' ability to identify and analyse the visual details of the images can be attributed to the visual artbased intervention provided. On the basis of this results, we can therefore conclude that the visual art-based intervention when provided will improve the students' critical thinking and observational skills and this will have positive implications for clinical practice.

Table 4. 23: Summary on critical thinking

		Available score			
Image	**Brief description**	Max.	Max.	Mean	SD
1	Two people interacting while sitting on the floor with one playing a guitar while the other listens with a hat on the head	10	9.0	2.81	2.18
2	A head depicting an old man, a lady with a baby, a dog lying on the ground and several other images at the upper background	20	15.0	4.46	2.99
3	A composition of an elephant made of a group of women arranged to form components of the elephant	30	29.0	3.56	3.55

4	A scene with waterfall, a stream, peacock, human face shaped with tree branches and a man on fire running towards the stream	25	14.0	4.19	2.69
	Total	**/85**	**67.0**	**15.02**	**11.41**
	Total	**/100**	**78.82**		

Source: Field Data, 2018.

Table 4.23 presents data on students who scored the highest marks against the available total marks 10, 20, 30 25 respectively, as shown in the third column of this table. For the first image, only one student scored 9 marks out of 10, resulting in a mean of 2.81 and a standard deviation of 2.81. For image two, one student scored 15 marks out of 20, resulting in a mean of 4.46 and a standard deviation of 2.99. For image three, only one student score 29.0 marks out of 30, resulting in a mean of 3.56 and a standard deviation of 3.55. For image four, only one student scored 14.0 marks out of 20 with a mean of 4.19 and standard deviation of 2.69. In total the high achieving students scored 67 marks out of 85 (78.82%) with a mean of 15.02 and a standard deviation of 11.41. Based on the performance of these students, it is possible that when the medical students are taken through relevant critical thinking and observational skills exercises using visual media, they will develop and apply the skills acquired in physical examination of the human body.

4.8 Testing of Hypotheses

The hypotheses formulated for testing concerning the experiment are as follows:

H_o1: There is no difference between medical students who are guided with visual thinking strategies and medical students who are not guided in their ability to observe and analyse visual images.

H_o2: Medical students' background knowledge in visual art does not influence their ability to observe and analyse visual images.

H_o3: Medical students will not find it easy to observe and analyse visual images

H_o4: Visual art-based critical thinking and observational skills training will not improve medical students' ability to observe and analyse visual images more critically.

These hypotheses were tested at statistical significance (alpha) level of 0.01 at 99% confidence interval. Concerning the medical students' ability to critically observe and analyse details in an image, visual art-based experiment was conducted to ascertain whether the treatment group deferred significantly from the control group in their ability to critically observe and identify details in visual images. Thus, Table 4.20 indicates that the Treatment group scored a mean and standard deviation of 18.56±8.42 representing a total mean percentage of 21.84 as against the Control group which scored a mean and standard deviation of 11.81±6.70 representing a total mean percentage of 13.89, and the test statistics pvalue = 0.0001 is less than the significant alpha (0.01) set. On responding to evaluation questions on whether it was easy for them to critically observe and identify details in images, the Cronbach's alpha coefficient in

Table 4.21 showed a very high Alpa, α= .983. This high response from the students can be attributed to the visual art-based intervention on critical thinking and observation conducted.

H_o1: There is no difference between medical students who are guided with visual thinking strategies and medical students who are not guided in their ability to observe and analyse visual images.

The test statistics of $p = 0.0001$ on the experiment is highly significant and provides strong evidence against the null hypothesis. We therefore go for the alternate hypothesis and conclude that there is a difference in the students' ability to observe and analyse visual images when visual artbased interventions are given.

H_o2: Medical students' background knowledge in visual art does not influence their ability to observe and analyse visual images. The test statistics of $p = 0.197$ is not significant and provided evidence in favour of the null hypothesis. We therefore fail to reject the null hypothesis and conclude that the student's ability to observe and analyse visual images is not dependent on their background knowledge in visual art. This implies that even if the medical students have background knowledge in visual arts, their skills to critically observe and analyse details of visual images may not be adequate.

H_o3: Medical students will not find it easy to observe and analyse visual images

The Cronbach's reliability coefficient alpha, α= .983 indicates that the Visual Thinking Strategies used in combination with the four Visual images were reliable and appropriate for the experiment.

H_o4: Visual art-based critical thinking and observational skills training will not improve medical students' ability to observe and analyse visual images more critically.

The test statistics of p = 0.0001 is highly significant and provides strong evidence against the null hypothesis that Visual art-based critical thinking and observational skills training will not improve medical students' ability to observe and analyse visual images more critically. We therefore reject the null hypothesis and go for the alternate hypothesis that the visual artbased critical thinking and observational skills training improved medical students' critical thinking and observational skills.

Feedback from Students after Participating in the Critical Thinking and Observational Skills Experiment

Apart from soliciting the views of the students on whether they found it easy in identifying and analyzing the visual details as shown in Table 4.22, this study also found out from the students how the exercise helped to improve their skills. Some of the students expressed their views positively that:

"It has thought me to pay critical attention to details in images as a fundamental principle of reading images in the field of medicine".

Also, another asserted "It has prompted me to always look carefully at images in order to know the exact information the images are showing".

Again, a third student postulated "This exercise has enabled me pay close attention to images to help see critical aspects of the basic stuff to see for more information and detail" whiles another declared *"It has taught me how important observing images critically is. A lot of details can be seen when I critically observe images".*

"I realised that I very much missed important details on images that I looked at previously and so I have learnt to be more observant", mentioned by one of the students.

Additionally, *students confessed, "It was easy to identify all the images, except Image Four. I had to critically think for quite some time and this has definitely improved my thinking ability".*

Moreover, others proclaimed *"It has taught me to look beyond the obvious when trying to understand visual media, observations must be critically done and appropriately accordingly", "I will now look at images with keen interest than just scanning through a picture because there's more to everything than what the eye sees in a split second", "It makes you observe a picture carefully, thinking there are more for you to identify.*
And you look at it critically so you identify it correctly".

4.8.1 Summary of the Testing of Hypotheses

Based on the testing of the four hypotheses, the following key issues were noted:

The test statistics of $p = 0.0001$ implies that the students have to be given additional training on how to effectively observe, describe and analyse physical features of anatomical objects including the human body.

Even though the test statistics of $p = 0.197$ was not considered significant, it should not be taken for granted that students' background knowledge in visual art per se is enough to enable them identify and analyse visual details.

Since the skills to be developed will be applied on diagnosing human health, it is important that students are given proper training to develop their visual literacy skills in general and critical thinking and observational skills in particular for practice.

Feedback obtained from the students on the difficulty level they encountered on identifying and analysing each of the four images resulted in Cronbach's reliability coefficient alpha, $\alpha = .983$. This indicates that Visual Thinking Strategies applied in this study was effective in enabling the students to observe critically. This buttresses the fact that even medical students with background knowledge in visual art have to be re-trained to develop a critical eye for looking and looking well to see details.

The test statistics of $p = 0.0001$ is an indication of the positive effect of the experiment on developing the students' critical thinking and observational skills. That is, the developed framework (Figure 4.10) proposed by this study, when adopted by the medical school, will make a significant impact in augmenting the lecturers efforts in training to develop the students' critical thinking and observational skills for learning of Anatomy as well as for practice.

4.9. Summary of Analysis on the Effects of Visual Media on Teaching and Learning of Anatomy

Based on the findings, although application of visual media at the medical school have positive effects on students' learning of Anatomy, integration of visual media in the pedagogy of the medical school leaves much to be desired. This is because effective integration of visual media with the medical school's pedagogy has relevance for both teaching and learning of Anatomy and clinical practice as well. It was also established from the findings that the availability of some visual media in the school increased the interest of majority of the students. However, in situations where physical anatomical structures, virtual media (videos, audiovisuals and animations) including overhead projectors were not fully utilized during tutorials had negative effects on the students' efforts to construct their own learning as the constructivist philosophy propagates. This is contrary to SMHS claim that it uses problem-based learning since over dependence on lecture method without incorporating visual media in a PBL learning environment suggests that the needs of visual and kinesthetic learners were not adequately met. Standford (2017) claims experiential learning through Visual art-based interventions enables learners to effectively utilize their five sense organs to carry out physical examination of disease conditions, and provide treatment for patients.

Again, the lack of sufficient roomspace for the medical school to benefit from medical facilities like school mortuary, medical museum and an art centre limit opportunities for lecturers and students to explore various visual media to enrich medical education. Azer and Azer (2016) assert that effective use of three-dimensional visual media requires spacious classroom environment for effective learning to occur. This situation, if not checked, will not only thwart the lecturers' efforts in training students, but it will also limit students exposure with visual media to enable them perform in practice. As noted by Orr (1996), the services of medical students who are not adequately prepared can be 'dangerous' to humanity.

4.10 Negative effects from the Questionnaire, Focus Group Discussion, Interview and Critical Thinking and Observational Skills Based on the findings and analyses of the results from the abovementioned instruments administered, some shortfalls were identified that impacted negatively on teaching and learning of Anatomy at the medical school. These negative effects are explained as follows:

These negative effects are explained as follows:

1. The views of the students in Figure 4.6 tells that 3-D virtual and physical media are less effective in sustaining their interest for learning of Anatomy. This shortfall implies that students do not employ appropriate visual thinking strategies to explore the full benefit of visual media to boost their interest for learning of Anatomy. Since learner interest is paramount in exploring visual media for learning of Anatomy, it is necessary to integrate other visual thinking strategies to address the challenge.
2. Another weakness in the training of the medical students was the lack of access to anatomical models to be used for learning during tutorials (Table 4.16) where the students are expected to explore visual media to facilitate understanding of concepts taught as well as improve their critical thinking and observational skills. An interview response from the skills Coordinator implied that application of

visual media during tutorials is possible only if it is integrated with the medical school's curriculum; the focus of this study.

3. Analysis of the students' responses as shown in Table 4.19 reveal that they are aware of the limitation they have in developing their critical thinking and observational skills to the fullest, due to the lack of visual art-based observational skills training interventions.

4.11 Activities Undertaken for Objective Three

Objective three was to develop a suitable framework to integrate Visual Media and Medicine to improve students' observational skills and understanding of topics in Anatomy at the School of Medicine and Health Sciences of UDS in Tamale.

- **The Conceptual Framework for the Interdisciplinary Approach**

The developed framework in Figure 4.10 for integration of visual art into medical studies has been developed based on the findings and analysis of objectives one and two. This developed framework was tested based on Barber's (2009) model on integrating learning (Figure 2.11). Levels 300 and 400 students were engaged in critically observing and analysing images of two-dimensionality to test their observational skills. Activities undertaken for testing the framework has been discussed in chapter three, page 22 to 35 of this thesis. The framework was tested on Levels 300 and 400 students because it is at these pre-clinical levels that students need to interact and manipulate with visual media more frequently to hone their critical observational skills to prepare them for post-clinical healthcare where they will be applying the skills acquired on patients. However, the framework has been developed to include Levels 100 and 200 students because the students indicated at the focus group discussion that visual artbased critical observation should be organized for all the year groups.

4.11.1 Developed Framework for the Interdisciplinary Approach (Integration of Visual Art and Medical Education) for the School

The framework for the interdisciplinary approach for integrating visual art and medicine has been shown graphically with explanation under Figure 4.10.

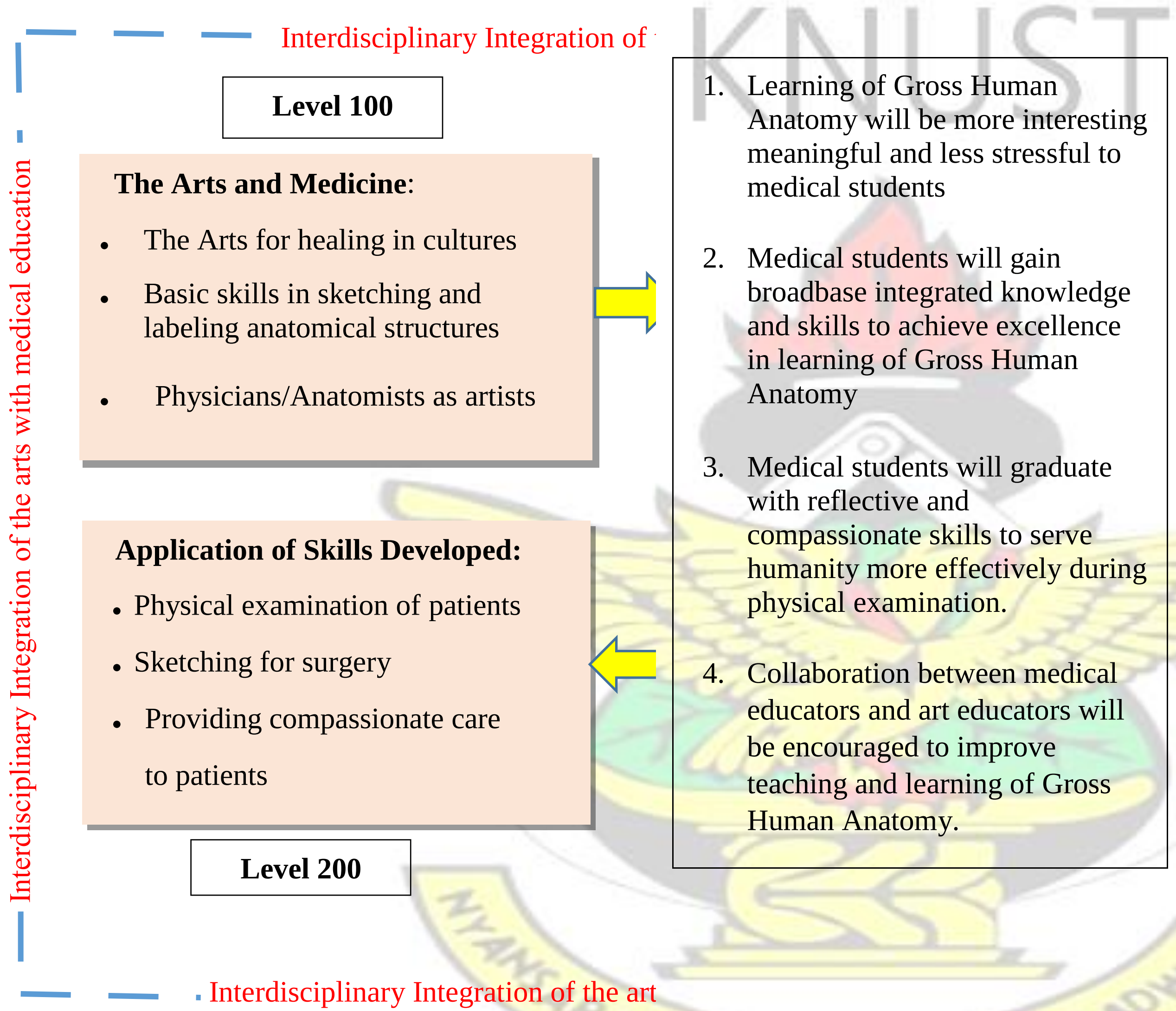


Figure 4. 10: Framework for the Interdisciplinary Approach to Integration of Visual Art and Medical Education. Adapted from Fogarty (1991); Hardens (2000). This framework is based on the constructivist theory of learning. *Source: Researcher's Construct.*

As observed by Fogarty (1991) under an integrated approach, interdisciplinary topics are arranged around overlapping concepts and emergent patterns. This process blends the disciplines by finding overlapping skills, concepts and attitudes found across the disciplines (Fogarty 1991 as cited in Atwa & Gouda 2014). Thus, this model will effectively integrate overlapping concepts between visual art and medicine with the pedagogy of the medical school to enrich teaching and learning of Anatomy.

- **Level 100: The Arts and Medicine**

At the beginning stage of medical education, there should be a corporation of the following topics of the integration of the two areas, that is, visual art and medical education. The topics that have to be integrated into the medical education curriculum are:

- ✓ Introduction to Application of the Arts for Healing in Society
- ✓ Historical Foundations of Scientist and Physicians as Artists
- ✓ Sketching Skills Development as Fundamental to the Practice of Science and Medicine
- ✓ Appreciation and perception of medical images

Since this thesis established that majority of students did not have background knowledge in visual arts (visual media), lessons should be presented to help medical students appreciate how the arts were applied in treating ailments in indigenous society. This will assist them to appreciate and explore how the arts can be applied in orthodox medicine. Lessons on Historical Foundation of

Scientist and Physicians as Artists should expose the medical students to appreciate that art preceded medicine. Through this lesson students will appreciate why good scientist and physicians in history and modern times have incorporated aspects of the arts relevant to their fields to enhance scientific or medical practice (Tapia 2017). Sketching and observation as skills were the bedrock of the success of famous Anatomist like Leonardo da Vinci and

Hippocrates who are referred to as the father of medicine (Zahir, 2016).

Therefore, basic skills acquired for sketching will develop students' skills for communicating disease conditions graphically and summarise their notes on key concepts taught under Anatomy (Delamerced 2018; Tapia 2017; Hajar 2011).

Thus, background knowledge of how successful physicians employed sketching skills in practice will motivate the students to pay particular attention to lessons taught on sketching skills development (Tapia 2017; Hajar 2011).

Level 200: Skills development for critical observation and sketching of anatomical structures

At this level, medical school should integrate critical observation and basic skills for sketching anatomical structures into its curriculum. This implies that Level 200 students should be taught how to apply visual thinking and observation strategies in critically observing and analyzing details of anatomical structures and other relevant medical images. Training sessions at this stage will also polish up their skills for basic sketching and shading three-dimensional anatomical structures to improve the students' spatial visualization skills for Surgery and other relevant areas of medicine where such skills can be applied in physical examination of the human body.

Contents of lessons to be taught under appreciation and perception of visual images will develop students' skills and sense organs of sight, feel, smell, touch and hearing for critical observation and analysis of radiological images, palpation, percussion and auscultation of disease conditions of the human body (Hajar 2016). That is, the use of the human senses for sight, touching, smelling, hearing, tasting and kinesthetic are fundamental to identifying normal and abnormal physical features in the practice of medicine and visual arts (Standford 2017). For example, the "eye" as a sense organ is used in both disciplines for inspection of physical features of an object.

In visual art as it is in medicine, inspection consists of visual examination of the body to identify the shapes, texture, colour, masses as well as softness or hardness of objects. Standford (2017) has also noted that the human sense are useful for diagnosing skin abnormalities, abdominal masses, and the movement of the abdominal wall with respiration. That is, in medicine palpation is the examination of the abdomen for crepitus of the abdominal wall, for any abdominal tenderness, or for abdominal masses. Similarly, in the visual arts artists use their hands to press for softness and tenderness of objects to appreciate variations in masses, texture or softness or hardness of objects. With skills in touching and pressing or in "palpation" both medical doctors and artists are able to differentiate normal physical qualities from abnormal qualities of an object. Furthermore, auscultation of the abdomen to detect altered bowel sounds or vascular bruits are fundamental to the practice of medicine and visual arts. In art, artists often perceive sounds from different sources in order to determine normal sound and abnormal sound (Standford 2017).

 Level 300: Expressive Art

At this level, the medical school should incorporate an introduction to compassionate care through the arts to enable students develop visual literacy skills for identifying and analysing facial features, emotions, and general bodily presentations, including contextual features such as clothing, hair, and body art, since most patients visit hospitals already disturbed emotionally before they see the doctor (Bramstedt 2016). It is for this reason that Tapia (2017) said humans need a mix of physical and emotional care. Therefore, lessons taught through expressive arts such as drama in relation to medical scenarios should prepare students to exhibit skills of emotional care in attending to their clients (Standford 2017). Additionally, intriguing fine art images relating to health conditions such as fatigue, stress and others may trigger useful discussions among students during sessions on compassionate care, and this will help medical students retain empathy and deepen understanding of the human condition (Hajar 2016). Hence, educational trips to art museums with these students will engage them in observing and discussing meaningfully images that relate to their course of study.

 Level 400: Application of skills acquired in clinical practice

This is the level where students will begin to apply critical observational skills and skills in compassionate care when conducting physical examination of patients.

That is, students during residency will be required to produce sketches of the location of certain diseases they have examined in real-life clinical situations for discussion by their peers. Additionally, students will be required to share with their peers how they have applied skills in compassionate care on patients who are emotionally disturbed due to their state of health. At this level, collaboration is needed between experts in Medical education and Art education (medical Illustrators and art therapists) to provide expert assistance to the medical students during residency.

4.11.2 Benefits of the Developed Framework on the Integration of Visual Art and Medical Education

The developed framework will be of benefit to lecturers, students and patients in the following areas:

- **Benefits to Lecturers**

The framework will make the teaching experience on teaching Anatomy more concrete and effective (Lecture Notes 2019), because lecturers will be able to explain Anatomy concepts more easily (Nadeem 2015).

1. Since the easiest means of comprehending scientific information is through visual media and observation (Gazzaniga 1998), integration of the developed framework will blend with the pedagogy of the medical school to make teaching of Anatomy more interesting, as it will inform lecturers’ decision to structure their teaching in a manner that will provide students with opportunities to

visually explore and engage in learning activities that will help them understand scientific concepts (Gazzaniga 1998).

2. Since illustrations play an essential role in medical education, the sketches or illustrations that are produced as a result of the developed framework may be used by lecturers to teach complex concepts in Anatomy for easy comprehension by students. That is, visual images to be employed under the developed framework will be beneficial because the use of visuals can teach medical students so much about anatomy (Delamerced 2018), and promote understanding of facts and ideas as well as help the learner to imagine real situations and reflect on past experiences (Rankin, Starlings & London 2005).

 Benefits to Students

1. Students will gain skills in discovery learning through interaction with variety of visual media to boost their higher-order thinking for learning of Anatomy (Gullat 2008; Gelineau 2011; Alberts 2010 & Inan 2009 as cited in Dhanapal, Mastan & Ehsan 2014).
2. Students will secure competencies key to being effective physicians, and will apply skills and knowledge acquired in clinical practice in physical examination of patients as well as provide compassionate care to meet emotional needs of patients (Standford 2017).
3. The framework will sustain students' interest in Anatomy because exposure to effective interaction with visual media using visual thinking strategies will help them learn Anatomy with ease (Nadeem 2015).

4. The students as future doctors will develop critical eyes to see visual details that they otherwise would not notice without critical thinking and observational skills training (Ge 2013).
5. The framework will expose the students to acquire a sense of how the body of anatomical science knowledge and visual art integrate to make a unified body of knowledge in medicine (Orr 1996), because medicine is an art and applied science that combines scientific knowledge, discovery and application with its practices (Tapia 2017).
6. Since visuals speak louder than words, training for skills in sketching will minimize students' use of complex and sometimes confusing medical terminologies in communicating disease conditions to patients (Delamerced 2018).

 Benefits to Patients

Patients will derive some benefits from the students when they are trained to acquire skills in compassionate care through visual art-based interventions as proposed by this study.

Fernando, Arroll and Consedine (2016), Jain (2011) and Langer and Rosen (2019) have outlined the following as benefits patients will derive from the students when they become medical doctors:

1. Patients will feel comfortable when students learn how to communicate words of encouragement and hope to patients.

2. Patients will be touched gently by the students to motivate and make them have a feeling that they care.

3. Patients will be comforted as students learn how to touch, talk and listen to them to show that they care.

From the literature reviewed, talking, listening, gently touching and care-giving are skills that are fundamental to the practice of medicine and art. Therefore, the developed framework will enable students acquire basic skills in empathizing and providing compassionate care beyond giving conventional treatement as explained by Fernando, Arroll and Consedine (2016), Jain (2011) and Langer and Rosen (2019).

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0 Overview

This chapter is the summary, conclusions and recommendations

5. 1 Summary of Findings

The study aimed at achieving the following objectives:

1. To find out the kinds of Visual Media used for teaching and learning of some topics in Anatomy at the School of Medicine and Health Sciences of UDS in Tamale.
2. To analyze the effectiveness of Visual Media on teaching and learning of some topics in Anatomy at the School of Medicine and Health Sciences of UDS in Tamale.
3. To develop a suitable framework to integrate Visual Media and Medicine to improve students' observational skills and understanding of topics in Anatomy at the School of Medicine and Health Sciences of UDS in Tamale.

Objective one was tackled based on the data collected from field on the types of visual media employed for teaching and learning of some topics in Anatomy. This facilitated analysis of the effectiveness of the visual media identified for the teaching and learning of some topics in Anatomy to satisfy objective two of the study. The outcome of objectives one and two formed the basis for developing the visual art-based intervention framework. Four hypotheses were formulated for testing the framework on Level 300 and 400 students who were categorized into

Treatment and Control groups. This enabled the study to evaluate the effectiveness of the framework for integration with medicine on its positive effects on students' critical thinking and observational skills. Thus, the testing of the developed framework for implementation satisfied objective three of the study. Below were the key findings derived from the study:

5.1.1 Major Findings on the Role of Visual Media in Teaching and Learning of Anatomy at the School of Medicine and Health Sciences, Tamale.

The major findings of this study are:

1. The medical school has enough physical visual media, particularly physical anatomical structures and models for teaching and learning at the skills laboratory and during lectures.
2. There was no evidence of e-library with Anatomy software containing virtual media specifically for teaching and learning of Anatomy at the medical school.
3. The medical school did not have a mortuary and medical museum facility located at the medical school purposely for teaching and learning of Anatomy.
4. Students had access to manipulating and interacting with the visual media mostly during skills training at the skills laboratory than during lectures.
5. Even though, the medical school had enough models and other anatomical structures, the students did not utilize them during tutorials where they are

expected to explore visual media to enhance understanding of concepts or topics taught.

6. The medical school did not have enough projectors to be used by the students to project virtual images of their own at tutorial meetings.
7. In terms of effectiveness of the visual media identified, responses from the students showed that physical visual media of two-dimensionality and three-dimensionality were effective in helping students achieve their objectives of learning of Anatomy.
8. In terms of teaching approach, the study found out that the lecturers employed mostly lecture method, whereas the students preferred lecturedemonstration method during lectures.
9. Students' participation in physical examination activities, mainly undertaken at the skills training laboratory were the means by which the students developed critical thinking and observational skills.
10. Impact of the Visual Art-Based critical observational skills experiment conducted and interpreted in terms of p values and Cronbach's reliability coefficient, showed that the Visual Art-Based critical thinking and observational skills training is effective in improving students' critical observational skills.
11. Although the students participated in the experiment with keen interest and appealed that Visual Art-Based experiment should be implemented at the medical school, they felt that sessions on Visual Art-Based lessons should not be examinable.

5.2 Conclusions

1. This study concludes that the medical school has enough physical visual media for teaching and learning of Anatomy from medicine viewpoint. These visual media at the skills laboratory can also be utilized in context of visual art to help students explore the visual details of the visual media to improve their critical thinking and observational skills.
2. Although the students indicated virtual media facilitate learning of Anatomy, the lack of e-library with Anatomy software containing virtual media impeded teaching and learning of Anatomy at the medical school. It may be assumed that the students can have access to virtual media online but the students clearly indicated that they would wish the medical school established an e-library with recommended Anatomy software.
3. The lack of mortuary and medical museum facility at the medical school negatively affected effectiveness of teaching and learning of Anatomy. These are facilities that house important visual media of threedimensionality. This compels the lecturers to take the students outside the medical school environment to have access to cadavers at the teaching hospital. The time spent could have been saved for other equally important learning activities if the medical school had its own morgue and medical museum.
4. The practice of medicine requires skills, and so availability and accessibility of visual media for teaching and learning particularly at the skills laboratory

is appropriate. But the types of visual media easily visible to the students were those placed on tables or hanged on walls.

5. The situation where models and other anatomical structures were not utilized during tutorial meetings limited the students' chances of exploring visual media to enrich understanding of challenging concepts taught during teaching sessions on Anatomy.
6. In situations where students brought their own virtual media in the form of Anatomy videos and animations for discussion at tutorial meetings, the lack of projectors for use during tutorials impeded their efforts in perceiving and appreciating virtual images collectively. This, to some extent, rendered group discussions ineffective.
7. The analysis concluded that both physical and virtual media of threedimensionality were effective in enabling the students achieve their objectives for learning Anatomy. Although, illustrated images were rated as the most utilized visual media during teaching sessions and these were done by the lecturers. The students were not encouraged to practice sketching to produce their own illustrated images as reflected in their responses.
8. The lecturers' approach to teaching Anatomy through the lecture method could be attributed to the volume of medical information to be delivered to the students. The gap was that lecturers did not impact fully because the students' responses indicated they preferred demonstration teaching approach where they could see, touch and manipulate anatomical objects.

9. It is worth noting that activities such as palpation, inspection, auscultation and percussion undertaken at the skills laboratory was useful in developing the students' observational skills for physical examination of patients. But more would have been achieved if the medical school were to implement Visual Art-Based critical observational skills training sessions to augment efforts made by the skills training coordinators.
10. The Visual Art-Based critical thinking and observational skills experiment conducted has proven that similar scientific interventions will be suitable alternative approaches for training to develop critical thinking and observational skills of medical students.
11. Since the goal is to train the medical students to acquire basic critical thinking and observational skills through visual art interventions, it is reasonable to agree with the students that their participation should not be examinable for grading. Other forms of assessment can be introduced to create competition and make the students attach importance to observational skills training sessions.

5.3 Recommendations

In view of the findings and conclusions made, the following recommendations were made for consideration:

1. First and foremost, the medical school should procure additional models and medical diagrams to be made available for use at the tutorial meetings by the students.

2. Secondly, the lecturers should employ a combination of lecturedemonstration approach in teaching of Anatomy to cater for all the students including auditory, visual and kinesthetic learners in the lecture hall.
3. Moreover, the medical school should consider implementing the developed framework proposed in this study for integration of Visual ArtBased interventions with medical education. This will go a long way in boosting critical observational skills training at the medical school.
4. Again, emphasis should be placed on assessment for learning rather than of learning. Assessment for learning provides students the opportunity to do peer assessment of Visual Art-Based learning activities they will undertake.
5. Also, students should be encouraged to build portfolios of medical images and sketches relevant for discussion and reflection to sharpen their critical thinking and observational skills.
6. There should be collaboration between art educators and the medical school to ensure the successful implementation of the proposed Visual Art-Based framework.
7. Last but not the least, a session should be given as proposed by the students for implementation of the Visual Art-Based critical thinking and observational skills training.

5.5 Suggestions for Further Research

In pursuing the agenda of integrating visual media with medical education, further research is needed on how the Visual Art-based Framework proposed by this study can be used to improve teaching and learning of Gross Human Anatomy at the School of Medicine and Health Sciences, as well as teach medical students compassionate care to enable them handle emotions of patients during physical examination.

Secondly, further research is needed to investigate how collaboration can be encouraged between medical educators and art educators for exchange of ideas from both disciplines to enrich medical education in Ghana for the benefit of humanity.

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Appendix A:

A Letter of Introduction for the Researcher to Seek Access into the Medical School to Conduct the Study.

DEPARTMENT OF GENERAL ART STUDIES

FACULTY OF ART, COLLEGE OF ART & SOCIAL SCIENCES
KWAME NKRUMAH UNIVERSITY OF SCIENCE & TECHNOLOGY

Tel: (233) 03220-62261

University Post Office
Kumasi – Ghana
West Africa
E-mail: generalart.cass@knust..edu.gh;
headgeneralart.cass@knust.edu.gh

Ref: GAS/S/3

Date: 15th July, 2016

The Registrar
University of Development Studies
P.O. Box TL 1350
UDS - Tamale

Dear Sir,

RESEARCH FOR PhD THESIS

Mr. Enoch Mani is a PhD Student in the Department of General Art Studies, Faculty of Art, College of Art & Built Environment, KNUST, Kumasi. His student number is PG 3636915.

He is conduction research on ***"An Interdisciplinary Approach to Medical Education: The Role of Visual Arts in Medicine at the Tertiary Institutions of Ghana".***

As part of his study, he would like to use your school as basis for the study. He would thus conduct interviews, observe teaching and learning or studies as well as some facilities available to the Visual Arts Department.

I would be grateful if you would grant him permission to collect his data.

Yours faithfully,

HEAD
DEPARTMENT OF GENERAL ART STUDIES
FACULTY OF ART
COLLEGE OF ART & BUILT ENVIRONMENT
KWAME NKRUMAH UNIVERSITY OF SCIENCE & TECHNOLOGY
KNUST - KUMASI

Dr. Steve Kquofi
HEAD OF DEPARTMENT

EX789
15/8/2016

Approval from the Medical School for the Researcher to Conduct the Study.

DEPARTMENT OF GENERAL ART STUDIES

FACULTY OF ART, COLLEGE OF ART & SOCIAL SCIENCES
KWAME NKRUMAH UNIVERSITY OF SCIENCE & TECHNOLOGY

Tel: (233) 03220-62261

University Post Office
Kumasi – Ghana
West Africa
E-mail: generalart.cass@knust..edu.gh;
headgeneralart.cass@knust.edu.gh

Ref: GAS/S/3

Date: 15th July, 2016

The Registrar
University of Development Studies
P.O. Box TL 1350
UDS - Tamale

Dear Sir,

RESEARCH FOR PhD THESIS

Mr. Enoch Mani is a PhD Student in the Department of General Art Studies, Faculty of Art, College of Art & Built Environment, KNUST, Kumasi. His student number is PG 3636915.

He is conduction research on *"An Interdisciplinary Approach to Medical Education: The Role of Visual Arts in Medicine at the Tertiary Institutions of Ghana"*.

As part of his study, he would like to use your school as basis for the study. He would thus conduct interviews, observe teaching and learning or studies as well as some facilities available to the Visual Arts Department.

I would be grateful if you would grant him permission to collect his data.

Yours faithfully,

Dr. Steve Kquofi
HEAD OF DEPARTMENT

HEAD
DEPARTMENT OF GENERAL ART STUDIES
FACULTY OF ART
COLLEGE OF ART & BUILT ENVIRONMENT
KWAME NKRUMAH UNIVERSITY OF SCIENCE
& TECHNOLOGY
KNUST - KUMASI

(2) SAR (SMHS)
Ple. kindly assist Enoch Mani
to collect data on the above mention
topic
for Registrar
5/09/16

Appendix B:

An Informed Consent to Solicit the Opinion of Medical Students to Voluntarily Participate in the study on:

"An Interdisciplinary Approach To Medical Education: The Role Of Visual Media In Teaching And Learning Of "Anatomy" At The University For Development Studies, Tamale, Ghana"

CONSENT FOR PARTICIPATION IN RESEARCH

I volunteer to participate in a research conducted by Mr. Mani Enoch from the Kwame Nkrumah University of Science and Technology (Department of Educational Innovations in Science and Technology). I understand that the research is designed to gather information about academic work of UDS SMHS on campus. I will be one of approximately 349 students being interviewed or issued a questionnaire to complete for this research.

1. My participation in this research is voluntary. I understand that I will not be paid for my participation. I may withdraw and discontinue participation at any time without penalty. If I decline to participate or withdraw from the study, no one on my campus will be told.

2. I understand that most interviewees will find the discussion interesting and thought-provoking. If, however, I feel uncomfortable in any way during the interview session, I have the right to decline to answer any question or to end the interview.

3. Participation involves being interviewed by researchers from KNUST,

Kumasi. The interview and, or completion will last approximately 30-45 minutes. Notes will be written during the interview. An audio tape of the interview and subsequent dialogue will be made. If I do not want to be taped, the researcher would avoid taking audio records of my responses.

4. I understand that the researcher will not identify me by name in any reports using information obtained from this interview or questionnaire, and that my confidentiality as a participant in this study will remain secure. Subsequent uses of records and data will be subject to standard data use policies which protect the anonymity of individuals and institutions.

5. Faculty and administrators from my University will neither be present at the interview nor have access to raw notes or transcripts. This precaution will prevent my individual comments from having any negative repercussions. I understand the UDS and the Medical School have given approval for the study to be conducted as an academic exercise for enriching teaching and learning at the medical school. I have read and understood the explanations provided above, and I voluntarily agree to participate in this study.

2) Informed Consent Form Signed by the Medical Students as a Sign of Consenting to Voluntarily Participate in the Study.

LEVEL 300

~~Signature~~ Name of Participants:	Signature of Participants:
Samira Zangwio	
Hafizu Muntala	
Mumuni Sahadatu	
M'BAKWU ERNESTINA	
Mahamadu Abraham	
Kyebambo Ireneus	
Hayford-Mensah Joseph	
Haruna Kamaldeen	
BOUARE DJENEBA	
DIDONGO MARTIN	
Mark Alhassan Yakubu	
Alhassan Faiza	
Agyeikwa Aparfong Connie	
Kennedy Adjei Fosu	
Achinkok Dominic	
Abubakari Abdul-Wahid.	
Abu Rashid Kanawa	
ZIBLIM ANDREW	
Zakariah Hazlina	
Yussif Sakinah	
Yussif Osman Bibi	

For further information, please contact me on:[2042 550 424 / 0500119670]

Informed Consent Form Signed by the Medical Students as a Sign of Consenting to V

3) oluntarily Participate in the Study.

Informed Consent Form Signed by the Medical Students as a Sign of Consenting to V

LEVEL 300

Name ~~Signature~~ of Participants:	Signature of Participants:
AHORDZU KWASI ELIM	
Ahiadu Ruth-Esther A	
Agyemang Eric Brobbey	
Agyeglwe Silas Teewe	
Agugoe Edem Daniel	
Afriyie Esther Godliness	
Adjei Emmanuella Senyah	
Adam Abrasey	
Angela Adeah	
Abugbilla Gideon Adel	
Annan- Noonoo Godfrey	
ABDULAI MARIAM NNABIYA	
Abdul Samad Abdul Basit	
Abdallah Mohammed	
Abanga A. Emmanuel	
AIBI MILLICENT	
AFEPORO SHADRACH	
JOHN OPOKU WARE	
SIIBU IBRAHIM ANTHONY	
Abubakar Ali	

For further information, please contact me on:[2042 550 424 / 0500119670]

4) oluntarily Participate in the Study.

Informed Consent Form Signed by the Medical Students as a Sign of Consenting to V

LEVEL 400

Name of Participants:	Signature of Participants:
Ausali Samuel Paa Kwesi	
ADUAH VICTOR ABUGAH	
Ibrahim Mohammed Faisal	
BOABU SHARON BOSOMPEM	
Lambongang Jabing Siknon	
Afful Obeng Dominic	
Richard Tongbor	
Abrefa Busia Bismark	
Konadu Augustine	
Oladele Jennifer Mary	
Abukari Abdul-Latif	
Adam Hilda Wunintira	
Gladys Kunbelersuur	
Anane Mavis Ama	
Sherika .S. Abdurahim	
Appiah Agyemang Fedna	
Faustina Abena Oti-Boateng	
Mussel Dibbils	
John Mbugeba	
Mohammed Hussein Amidu	
Damiları Ebenezer	
Modesta Bagina	
Anthui Douglas	
Sotchway Smile	
Adade Elvis	
Tuba Rubab	

For further information, please contact me on:[2042 550 424 / 0500119670]

5) oluntarily Participate in the Study.

Informed Consent Form Signed by the Medical Students as a Sign of Consenting to V

LEVEL 400

Name of Participants:	Signature of Participants:
NHYIRA YAW ADJEI-BANUAH	
OBED Amesika-Forei	
Wosu Sarimah Adaure	
SOMABIB BARBARA ZEWOBA	
GYAMFI DANIEL	
Hadi Salawudini	
Zipporah Awinbon	
Anne-Vanessa Vanderpuije	
Benson Girly U.	
ANTWI-YEBOAH PROSPER	
Iddrisu Muhammed Lawdeen	
JOSHUA ANSAH HENAKU	
NIMOH-BREMA NANA ABA MARFOAA	
Deborah Mensah-Onumah	
Adunah Nancy Atinadaga	
Akorfa Mortoti-Amugu	
ABDUL-LATIF SALIA	
MACCARTHY THOMAS C.	
OTUO SEREBOUR ERNEST	
ASHIGBI JOSHUA EDEM	
Seidu Adama	
Abdulai Hayat	
Shahad Bawa Zaa-idatu	
Bortegraye B Eunice	
Ataawinh Kyo Regina	
Hanna Saeed	
Yenzuo Baaquee Issahaku	
Bayel Charles Lwanga	
Naabu Joshua Njula	
FRANK KILL NYAME	
Bertha Emmah Kllsah	

For further information, please contact me on:[2042 550 424 / 0500119670]

Appendix C:

1) Questionnaire to Solicit the Opinion of Medical Students of University for Development Studies School of Medicine and Health Sciences (SMHS), Tamale on:

"An Interdisciplinary Approach To Medical Education: The Role Of Visual Media In Teaching And Learning Of "Anatomy" At The University For Development Studies, Tamale, Ghana"

This questionnaire was designed to collect data from the medical students on the above topic to facilitate data analysis and interpretation on the types of Visual Media used in medical education and how the visual media identified impact on teaching and learning of Anatomy at the University's SMHS. Please, kindly provide responses to the questionnaire items provided below. The information you provide will be handled confidentially. Your responses and that of others will help inform decision making on improving teaching and learning of Anatomy at the Medical School in future.

(Please mark only one oval)

1. Sex

   - Female
   - Male

2. Year of study

   - PBL 2
   - PBL 3

3. Age (to the nearest whole number)

4. Do you have background knowledge in Visual Art?

- ○ Yes ○ No

5. If yes to Question 4, how does this background knowledge in Visual Art help you on learning Anatomy?
6. Do you know what Visual Media is?

Mark only one oval.

- ○ Yes ○ No
- ○ Partially

If your answer to Question 6 is **No,** please skip to Question 7.

Check all that apply.

7. If your answer is Yes or Partially to Question 6, then what is Visual Media?
8. What teaching method(s) do your lecturers use most for teaching Anatomy?

- ○ Lecture ○ Demonstration ○ Discussion ○ Tutorials ○ Educational trips to Museums

9. Which of the following teaching method(s) with visual media is most effective in facilitating your understanding of concepts taught under Anatomy?

Mark only one oval. ○

Lecture

○ Demonstration ○ Discussion ○ Tutorials ○ Educational trips to Museums

10. Which of the following learning styles do you prefer during learning of Anatomy?
    ○ Visual (eg. reading of textbooks, lecture notes, images, power point)
    ○ Auditory (eg. watching video, listening to lecture presentations)
    ○ Kinesthetic (eg. touching and manipulating anatomical structures)

11. Which of the following visual media do your lecturers incorporate the most during teaching of Anatomy?
    ○ Anatomy atlases ○ Cadaver dissection and observation ○ Models ○ skeleton ○ Animations ○ Simulations ○ Illustrated images ○ Audio-visuals ○ Other:

12. What topics under Anatomy are taught with the visual media chosen in Question 7?

13. Do your lecturers use the visual media mentioned in Question 6 separately or in combination during lessons taught?
    - They are used separately
    - They are used in combination

14. As a medical student, which of the following visual media do you prefer when learning Anatomy?

    - Anatomy atlases
    - Physical (3D) models
    - Cadaver observation and dissection
    - Animations
    - Simulations
    - Illustrated images
    - Audio-visuals

15. Do your lecturers train you to do critical thinking and observation using visual images to enhance your observational skills?

    - Yes
    - No
    - Sometimes

16. Does the medical school take you out on educational trips to Medical Museums to enhance your critical thinking and observational skills?

    - Yes
    - No

17. Does the medical school take you out on educational trips to Art Museums to enhance your critical thinking and observational skills?

- Yes ○ No

18. Which of the following modes of learning with visual media makes you appreciate learning Anatomy the most? * ○ Manipulating real (3D) Anatomy models to explain medical concepts

- Use of Anatomy textbooks and atlases ○ Use of Anatomy Museum to reinforce learning of medical concepts
- Use of (3D) Virtual Media for explaining medical concepts ○ Use of Art Museums with artifacts for observational skills training

19. Which of the following resource centres would you suggest that the UDS establishes for the medical school?

- Art museum ○ Medical museum

20. Do you have access to move the physical Anatomy models into different positions/planes to view the spatial inter-relationships between the parts?

- Yes ○ No ○ Sometimes

21. Do your lecturers discuss the physical features (eg. colour, texture, size, form, shape etc) of anatomical objects and relate these features to the human body?

   ○ Yes ○ No ○ Sometimes

22. Do your lecturers ask you to draw or illustrate any of the anatomical structures (eg. Models, skeletal etc.) in your sketch pad or any other surface?

   ○ Yes ○ No ○ Sometimes

23. Do your lecturers guide you on how to critically observe the physical characteristics (eg. colour, texture, form, shape, size lines etc) of the anatomical objects and relate it to the human body?

   ○ Yes ○ No ○ Sometimes

24. Is the current classroom sitting arrangement of your class suitable for learning Anatomy with models and other anatomical structures during Anatomy lessons?

   ○ Yes ○ No ○ Sometimes

25. Do you participate with keen interest when lessons are taught using various visual media?

   ○ Yes ○ No ○ Sometimes

26. Do you still participate with keen interest even when lessons are taught without visual media?

- Yes
- No
- Sometimes

27. How effective are Virtual (3D) (eg. Animations, simulations in enabling you achieve your objectives for learning Anatomy?

- Makes me to remember facts
- Better understand topic
- Provides no effect
- Sustains my interest
- Bores me

28. How effective are Physical (3D) anatomical structures (eg. Models, skeleton) enabling you achieve your objectives for learning Anatomy?

- Makes me to remember facts
- Better understand topic
- Provides no effect
- Sustains my interest
- Bores me

29. How effective are Physical (2D) anatomical structures (pictures, photographs, illustrated images) enabling you achieve your objectives for learning Anatomy?

- Makes me remember facts
- Better understands topic
- Provides no

effect ○ Sustains

my interest ○ Bores me

30. How effective are Anatomy atlases enabling you achieve your objectives for learning Anatomy?

○ Makes me remember facts ○ Better understands topic ○ Provides no effect ○ Sustains my interest

31. How effective are Cadaver dissections and observations enabling you achieve your objectives for learning Anatomy?

○ Make me remember facts ○ Better understands topic ○ Provides no effect ○ Sustains my interest ○ Bores me ○ Have no access yet

32. How frequently do you have direct access to manipulating with the medical school's anatomical structures (eg. Models and skeletal) on lessons taught in the various learning settings during lectures

○ Once a week ○ Once a month ○ Not necessary ○

Once a trimester

- Have no access

33. How frequently do you have direct access to manipulating with the medical school's anatomical structures (eg. Models and skeletal) on lessons taught in the various learning settings during tutorials ○ Once a week

- Once a month ○ Not necessary
- One a trimester
- Have no access

34. How frequently do you have direct access to manipulating with the medical school's anatomical structures (eg. Models and skeletal) on lessons taught in the various learning settings during skills session

- Once a week ○ Once a month
- Not necessary
- Once a trimester ○ Have no access

35. Which topic(s) under Anatomy is/are difficult to learn even with visual media? List them

Key to Likert scale: Please tick (√)

Variable	**1** Strongly agree	**2** Agree	**3** Neutral	**4** Disagree	**5** Strongly disagree
36. Having background knowledge in appreciation of visual images is necessary for medical students' learning of Anatomy.					
37. Visual images enable medical students to understand concepts taught on Anatomy better.					
38. Technology will replace medical students'/doctors' interpretation of visual images relevant to medical education/or medical practice?					

39. Radiological images (such as X rays, Ultra scans, CT scans, MRI scans, etc) require critical thinking and observational skills to analyse and interpret the images. Mark only one oval.					
40.Computer technology interpretation of radiological images will replace medical					
students/medics reading and interpretation of radiological images for diagnosis.					
41. Visual images are essential for medical students' critical thinking and observational skills training.					
42. Your lecturers make conscious efforts in using visual art forms in training you to develop critical thinking and observational skills.					
43. Your lecturers allow you to visualize Anatomy structures and manipulate its parts from different anatomical planes to improve your understanding of concepts taught on Anatomy.					

44. It will be helpful if the medical school introduces a programme for educational trips to Anatomy and Art Museums to improve your observational skills?					
45. A framework to integrate Visual art-based intervention with medical education at the School of Medicine and Health Sciences of UDS in Tamale will help improve students' observational skills development which would					
enable them to diagnose better through physical examination of physical features of disease conditions and also during surgery.					

46. Please, provide recommendations (if you any) that you believe will improve teaching and learning of Anatomy with visual media.

……………………………………………………………………………………… 2)

Questionnaire to solicit the opinion of Medical Students of University for Development Studies School of Medicine and Health Sciences (SMHS), Tamale on:

"An Interdisciplinary Approach To Medical Education: The Role Of Visual Media In Teaching And Learning Of "Anatomy" At The University For Development Studies, Tamale, Ghana"

Questionnaire on Visual Art-based experiment administered to Treatment group for Strategic critical thinking and observational skills

This questionnaire focused on collecting data on the ability of the treatment group to critically identify and analyse visual details embedded in selected images presented to them. The questionnaire sought responses by means of evaluation on the impact of the experiment in improving their critical thinking and observational skills. Please, kindly be part of the study by providing responses to the questionnaire items provided below. The information you provide will be handled confidentially. Your responses and that of others will help in improving the provision and use of visual media at the medical school in future.

(Please mark only one oval

1. Year of study

    - PBL 2 ○ PBL 3

2. Sex

    - Male
    - Female

3. Age (to the nearest whole number)
4. Religion *

    - Christianity ○ Islam
    - African Traditional Religion
    - Others

5. Where did you mainly grow up between ages 6 and 15 years

- Village
- District capital
- Town
- Regional capital ○ City (Accra, Sekondi/Takoradi, Tamale, Kumasi)

6. Mother's occupation
7. Father's occupation
8. Your birth position for your mother

- First ○ Second ○ Option 8 ○ Third
- Fourth ○ Fifth ○ Sixth ○ Others

9. Your birth position for your father

- First ○ Secon
d ○ Third
- Fourth
- Fifth
- Others

10. Which of your hands do you use mostly for your daily activities?

- Right
- Left

11. Which form of accommodation did you live in with your parents/guardians when you were growing up?
   - Compound house
   - Self-contained apartment

12. Which of these do you enjoy doing most?
   - Painting/Drawing
   - Sculpture/Working with clay
   - Playing computer games
   - Playing musical instruments
   - Weaving/leather work
   - Photography
   - Other:

13. Do you have background knowledge in visual art?
   - Yes
   - No

14. Look at image one carefully and write down the kind of image(s) you see. What activity is going on there? What is the posture or position of the images you see? Ask yourself this question "what else have I not seen?" Be curious to look carefully to identify the hidden details that cannot easily be seen by the

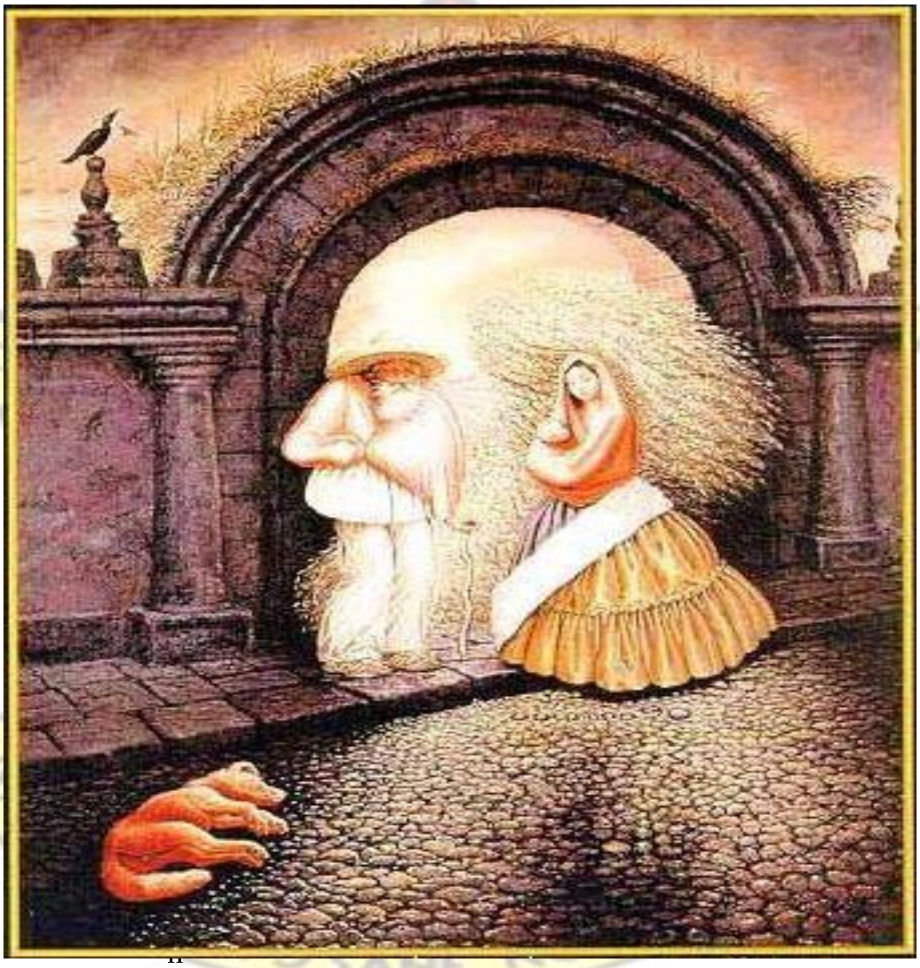
'untrained' eye. Example: What are their sexes, Does the background design between the two people look like an image to you? What is it like?)

Appendix C, Image 1:

Source: Aubrylia 2018
aubrylia.centerblog.net/rub-original-amusant-nouveau-.html

15. Look at image two carefully and write down the kind of image(s) you see. What are their sexes? What activities do you see going? What is the posture of the

images? Ask yourself this question “what else have I not seen?” Be curious to look carefully to identify the hidden details that cannot easily be seen by the ‘untrained’ eye. Example: The background shows additional human images. What are they like? How many are they? What formed the nose of the human image you are looking at? What other detail can you see?



dix C, Image 2: Painting of old man’s head with other heads embedded in the background.

Source: (Pinterest 2018, https://www.pinterest.ru/pin/480055641524277925/

16. Look at image three carefully and write down the kind of image(s) you see. What are their sexes? What activities do you see going on there? What is the posture of the images? Ask yourself this question “what else have I not seen?” Be curious to look carefully to identify the hidden details that cannot easily be seen by the ‘untrained’ eye. Example: What are the components that form the image that you see. What else can you identify?

Appendix C, Image 3: Design of elephant made of human figures Source: Golda Meir Mount Carmel International Training Center (MASHAV 2011).

17. Look at image four carefully and write down the kind of image(s) you see. What are their sexes? What activities do you see going on there? Ask yourself this

question “what else have I not seen?” Be curious to look carefully to identify minute or hidden details that cannot easily be seen by the ‘untrained’ eye.

Example: Can you see heads, animals, humans, etc. What else can you see?

Appendix C, Image 4: A painting of human face embedded in tree branches, rock and waterfall.

Source: *Elliman, C 2018, https://www.facebook.com/.../this.../1015079578581133/*

Key to Likert scale: Please tick (√)

Variable	**1** Strongly agree	**2** Agree	**3** Neutral	**4** Disagree	**5** Strongly disagree
18. It was easy to identify the objects, activities, events, developments in the image 1					
19. It was easy to identify the objects, activities, events, developments in the image 2					

20. It was easy to identify the objects, activities, events, developments in the image 3					
21. It was easy to identify the objects, activities, events, developments in the image 4					

22. Has this observation exercise improved your ability to observe images more critically than before?

○ Yes ○ No

23. If Yes, how has this exercise been helpful to you?

3) Questionnaire to solicit the opinion of Medical Students of University for Development Studies School of Medicine and Health Sciences (SMHS), Tamale on:

"An Interdisciplinary Approach To Medical Education: The Role Of Visual Media In Teaching And Learning Of "Anatomy" At The University For Development Studies, Tamale, Ghana"

Questionnaire on Visual Art-based experiment administered to Control group for Strategic critical thinking and observational skills

This questionnaire focused on collecting data on the ability of the control group to critically identify and analyse visual details embedded in selected images presented to them. The questionnaire sought responses by means of evaluation on the impact of the experiment in improving their critical thinking and observational skills. Please, kindly be part of the study by providing responses to the questionnaire items provided below. The information you provide will be handled confidentially. Your responses and that of others will help in improving the provision and use of visual media at the medical school in future

1. Year of study

Mark only one oval.

- PBL 2
- PBL 3

2. Sex

Mark only one oval.

- Male
- Female

3. Age (to the nearest whole number)
4. Religion

Mark only one oval.

- Christianity
- Islam
- African Traditional Religion
- Others

5. Where did you mainly grow up between ages 6 and 15 years Mark only one oval.

- ○ Village ○ District capital
- ○ Town
- ○ Regional capital ○ City (Acrra, Sekondi/Tadi, Tamale, Kumasi)

6. Mother's occupation
7. Father's occupation
8. Your birth position for your mother Mark only one oval.

- ○ First
- ○ Second
- ○ Third
- ○ Fourth
- ○ Fifth
- ○ Sixth
- ○ Others

9. Your birth position for your father Mark only one oval.

- First
- Second
- Third
- Fourth
- Fifth
- Others

10. Which of your hands do you use mostly for your daily activities?

Mark only one oval.

- Right
- Left

11. Which form of accommodation did you live in with your parents/guardians when you were growing up?

Mark only one oval.

- Compound house
- Self-contained apartment

12. Which of these do you enjoy doing most?

Mark only one oval.

- Painting/Drawing
- Sculpture/

Working with clay ○ Playing computer games ○ Playing musical instruments ○ Weaving/leather work ○ Photography ○ Other:

13. Do you have background knowledge in visual art?

Mark only one oval.

○ Yes ○ No

14. Please observe the image 1 carefully and identify the activities going on there.

Image 1: Aubrylia 2018

Source:
aubrylia.centerblog.net/rub-original-amusant-nouveau-.html

15. Please observe the image 2 carefully and identify the activities and objects there.

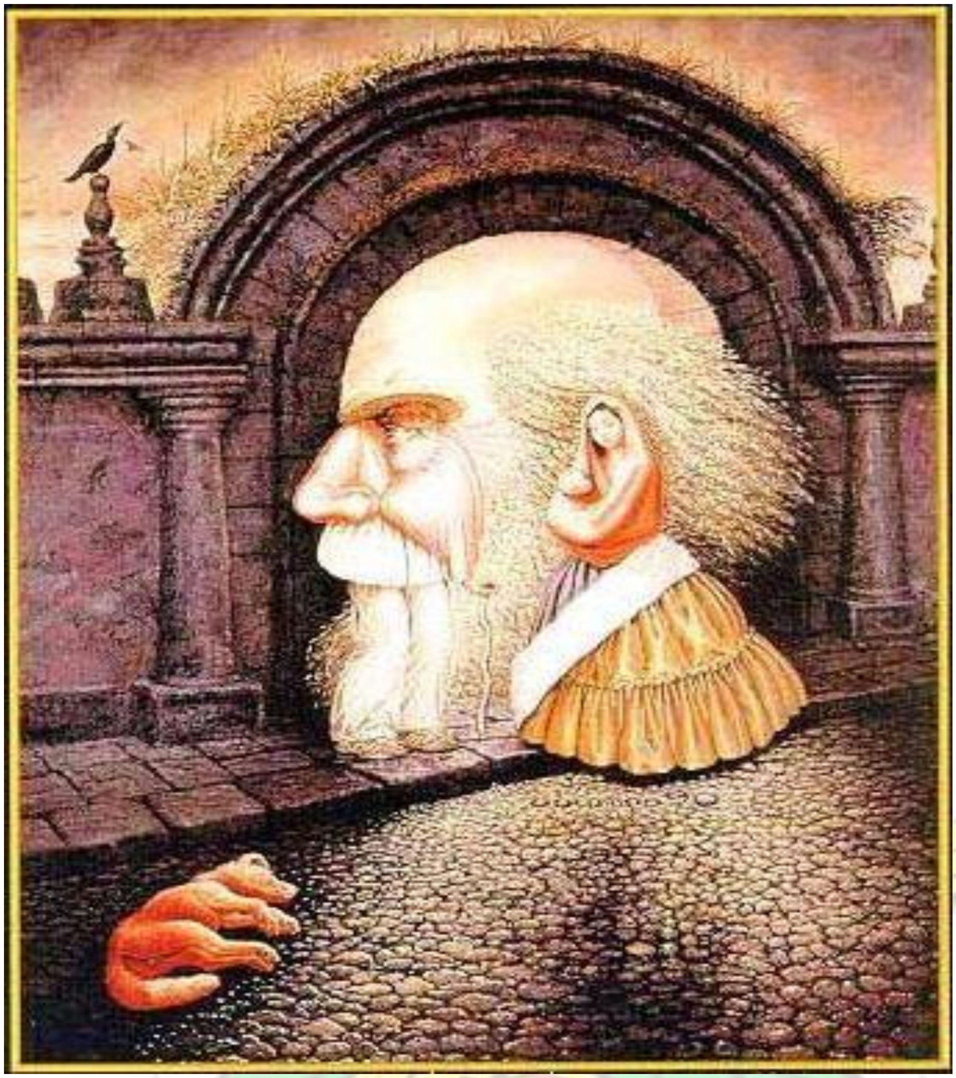


Image 2. (Pinterest 2018)

Source: https://www.pinterest.ru/pin/480055641524277925/

16. Please observe the image 3 carefully and identify the activities and objects there.

Image 3: MASHAV 2011
Source: Golda Meir Mount Carmel International Training Center

17. Please observe the image 4 carefully and identify the activities and objects there.

Image 4. *Elliman, C 2018,*
Source: *https://www.facebook.com/.../this.../1015079578581133/*

18. It was easy to identify the objects, activities, events, developments in the image 1

Mark only one oval.

- Strongly agree
- Agree
- Not sure or neutral
- Disagree
- Strongly disagree

19. It was easy to identify the objects, activities, events, developments in the image 2

Mark only one oval. ○

Strongly agree

○ Agree ○

Not sure or Neutral ○

Disagree

○ Strongly disagree

20. It was easy to identify the objects, activities, events, developments in the image 3

Mark only one oval.

○ Strongly agree ○

Agree ○

Not sure ○

Disagree

○ Strongly disagree

21. It was easy to identify the objects, activities, events, developments in the image 4

Mark only one oval.

- Strongly agree
- Agree
- Not sure or neutral
- Disagree
- Strongly disagree

22. Has this observation exercise improved your ability to observe images more critically than before?

Mark only one oval.

- Yes
- No

23. If Yes, how has this exercise been helpful to you?

Appendix D:

Marking Scheme for Visual Art-Based Critical Thinking and Observation Experiment

Image 1	Score
An old man	1
An old woman	1
A man playing a guitar	1
A man with legs crossed /A man sitting	1
A man wearing a hat	1
Woman carrying a hat/something	1
Woman with legs crossed/ Woman sitting	1
*Elbow forming the nose	1
*Elbow forming the nose of the old woman	1

*Elbow forming the nose of the old man	1
*Two heads of old people	1
*hat forming eye brow of the old woman	1
hat forming eye brow of the old man	1
Eye wrinkles for the neckless of a woman	1
*Mouth is formed by the waist	1
	Total = 14
Image 2	

An old man	1
Woman by the head	1
A woman holding something/baby	1
A man standing in the face	1
A man wearing a hat	1
Man holding a walking stick	1
A bird separating the two heads	1
An old man standing in front of a face	1
Entrance/ gate	1
Hat forming eye brow	1
A dog lying on the floor	2
One face looking direct towards viewer	2
One face far right	2
Two small faces far left	4
*Elbow formed the nose	1
*Head of woman formed the ear of the man	1
	Total = 20
Image 3	

An elephant made of women	2
Hair of woman as the tail	2
Two hands of woman as the trunk	2
Leg of woman forming the tusk	2
Legs of women forming the legs of elephant	2
Woman lying supine	2
Women formed the tie	2
Woman holding the hair of the other lady	2
Woman stretching to form abdomen	1
Woman sitting with legs open /hand on jaw	1
Some women climbing each other	1
Legs,	1
Bracelet on arm, wrist and ankle	1
Arrangement/composition of humans in different postures	1
hair,	1
Breast	1
Women lying down	1
Women bending	1
Eight women	8
	Total = 32
IMAGE 4	
An elephant	1
Waterfall	1
A bird	1
Animal standing above elephant	1
Trees	1

Stream of water	1
A house	1
A woman by a store	1
A lion on the tree	2
Lips	1
Eyes	1
Nose	1
A duck in water	2
A duck	1
A person running	1
A man running with fire burning on the body	2
A man behind elephant with a gun	2
Peacock	2
Human face with eyes closed	2
Human eyes formed by tree branch	2
	Total = 27

Appendix E:

An Interview Guide to Solicit the opinion of Medical Students of University for Development Studies School of Medicine and Health Sciences (SMHS), Tamale on:

"An Interdisciplinary Approach To Medical Education: The Role Of Visual Media In Teaching And Learning Of "Anatomy" At The University For Development Studies, Tamale, Ghana"

The purpose of this interview guide was to enable the researcher seek explanations from the participants in the study on some of their responses collected through the questionnaire. Please, kindly be part of the study by providing responses to the questionnaire items provided below. The information you provide will be handled confidentially. Your responses and that of others will help in improving the provision and use of visual media at the medical school in future.

Introduction

This focus group discussion is a follow up on the questionnaire administered to you. So, this discussion will help you better understand some of the issues. This will further inform you decision on the implementation of the ideas shared by the respondents.

Follow up questions on Questionnaire 1:

Question 1: How would you want lecturers to use visual media to teach Anatomy?

- What topics in Anatomy require the use of visual media during lectures?
- What kind of visual media do you suggest should be incorporated in teaching these topics mentioned?

Question 2: How does a medical student's ability to identify colour, texture, shape, lines help in his or her practice in medicine?

Question 3: Do you need to acquire skills in sketching accurately?

- How will skills acquired in sketching accurately help you in the practice of medicine?
- Which specific area of medicine will this skill be useful?

Question 4: How does the current sitting arrangement in rows affect your learning of Anatomy in lessons taught with models and other anatomical structures?

- What type of sitting arrangement would you have recommended for teaching Anatomy with models or anatomical structures?

Question 5: How will visual media enhance learning during tutorials?

- What type of visual media will be useful for learning at tutorials?
- What accounts for students not having access to the visual media during lectures?

Question 6: 13.5% of the students said they had no access to visual media during skills training.

- What account for some students not having access to visual media during skills training?

Question 7: If you were a lecturer, what approach would you adopt to make these difficult topics less difficult to learn by students?

Question 8: At what level or stage of your training do you think critical thinking and observational skills training is necessary?

How would these skills be applied when practicing medicine?

Question 9: How can art museums be used in medical education for teaching Anatomy concepts?

Question10: As level 300 students, what accounted for your ability to identify details embedded in the images?

Exit Question: Is there anything else you would like to say about use of art-based interventions in medical education?

1) An interview Guide to solicit the opinion of Lecturers of University for Development Studies School of Medicine and Health Sciences (SMHS), Tamale on:

"An Interdisciplinary Approach To Medical Education: The Role Of Visual Media In Teaching And Learning Of "Anatomy" At The University For Development Studies, Tamale, Ghana"

This interview guide aimed at collecting data from the lecturers at Department of Anatomy on how visual media identified impact on teaching and learning of Anatomy at the University's SMHS. Please, kindly be part of the study by providing responses to the questionnaire items provided below. The information you provide will be handled confidentially. Your responses and that of others will help in improving the provision and use of visual media at the medical school in future.

PART I: BACKGROUND INFORMATION

Department:……………………………………………

Date:……………………….

Position: Dean [ ] Senior Lecturer [ ] Lecturer [ ] Assistant Lecturer [ ]

i) Gender: (1) Male [ ] (2) Female [ ]

ii) Age: ………………………………………………………………………..

iii) Educational Qualification: (a) PhD [ ] (b) Masters degree [ ] iv) Years of teaching experience at the UDS SMHS:

PART II: Please answer the questions below.

1. Students complain they have difficulty learning and understanding musculoskeletal system and nervous system.

- What do you think are causing this difficulty?

  ……………………………………………………………………………………

- What teaching approach do you suggest can help solve this problem to make the learning of musculoskeletal and nervous system less difficult?

  ……………………………………………………………………………………

2. The students are suggesting that videos, models and other visual media be used with projectors to facilitate learning during tutorials.

 What are your views about this?

……………………………………………………………………………………

3. Students are suggesting that they should be trained on visual thinking strategies using visual images to improve their critical thinking abilities.

- What is your opinion on this?

  ……………………………………………………………………………………

- How would the acquisition of skills in visual thinking help the students in learning Anatomy?..

4. The students are suggesting that the lecturers could help them with websites to good videos on specific topics so that they can view the videos prior to lectures or after lectures.

 What is your opinion on this?

……………………………………………………………………………………

What are the reasons why the medical school does not have an E-library with relevant videos for the medical students to learn with?

5. The students complained that group members for cadaver dissection sessions should be reduced to about 10 in a group because some of them are not able to see and appreciate how dissections are done.

 What is your view about this?

…………………………………………………………………………………….

6. The students are suggesting that the medical school should introduce educational trips to Anatomy museums and art museums where they could observe various artifacts or visual media to enhance their observational skills.

- What are the reasons for the absence of educational trips to medical museums or art museums with the students?

……………………………………………………………………………………

- Is it within the medical school's curriculum to introduce educational trips? 7. Generally, the students believe that Visual art-based intervention when introduced on the medical school's curriculum would enhance their learning of Anatomy.
- Would you recommend for the implementation of Visual art-based intervention?
- In what ways do you think Visual art-based intervention will help improve teaching and learning of Anatomy

……………………………………………………………………………………

1. As a lecturer, how are the visual media available effective in helping you achieve your objectives for teaching Anatomy?

....

9. What recommendation would you make (if you have any) to improve the effectiveness of visual media used for the training of the medical students

……………………………………………………………………………………………

2. The students think the current sitting arrangement in rows does not help when learning Anatomy with anatomical objects.

 What is your views about this?

Thank you