Formative Research on Component Display Theory

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This dissertation titled
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by

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Abstract

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Formative Research on Component Display Theory

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In recent years, efforts are being made at all levels of education to prescribe instructional actions that would optimize desired instructional outcomes. Component display theory (CDT), a micro level instructional design theory proposed by Merrill (1983), offers guidelines and prescriptions to present components of instruction to teach facts, concepts, procedures, and principles.

In this study, CDT prescriptions were used to design two instructional modules on (copyright and fair use concepts) for undergraduate students at a large public university in the United States. Formative research methods and restricted quantitative methods were employed to explore the instances by using debriefing (semi-structured) interviews, observation, document analysis, and achievement test items as data.

Despite the evidence that supports CDT, most of the empirical studies were conducted in the early development of the theory. Based on available literature, there are no empirical studies that have investigated strengths, weaknesses, or possible improvement of CDT using a formative research approach. Hence, the purpose of this study is to evaluate CDT prescriptions by answering the following questions: 1) What are the strengths and challenges of utilizing CDT in computer-based instruction? 2) What improvements or modifications can be made to CDT to increase its relevance to
computer-based instruction? And, 3) Are all CDT presentation forms necessary for designing quality computer-based instruction?

The findings of the study suggest that the presentational sequence of CDT’s primary presentation form (i.e., generality + instance + practice) could engage the learner in concept knowledge acquisition. Learner perception on content presentation was positive. In general, it was evident that the secondary presentation forms offered substantial support to the learner and it is recommended that they are treated as a requirement instead of an option. However, design priority should still be placed on primary presentation forms because it is the main vehicle of instruction. The analytical nature of CDT stands out to be the most prominent challenge when applying the theory to design instruction.
Dedication

This work is dedicated to my parents.
Acknowledgments

First, I thank God Almighty for His grace and mercies throughout my academic journey. I would like to express my deepest gratitude to my advisor, Dr. David Richard Moore, for his excellent guidance and constructive feedback throughout this dissertation journey. I also thank my dissertation committee members Dr. Krisanna Matchmes, Dr. Greg Kessler, and Dr. Edna Wangui for their valuable guidance in the research process. My sincere thanks to Dr. Teresa Franklin, without her support my Ph.D. dream might have been impossible.

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Chapter 1: Introduction

Background of the Study

This study focuses on the use of rigorous formative research methods to improve an existing instructional design theory, component display theory (CDT). Over the last two decades, many instructional design theories and models have been developed with the aim of understanding, improving, and solving instructional problems (Merrill, 2013; Morrison, Ross & Kemp, 2010; Reigeluth, 1999; Reigeluth & Carr-Chellman, 2009). The goal of the instructional designer is to make learning more effective and efficient by prescribing instructional actions that would optimize the desired instructional outcomes (Merrill, 2013). Another aim of the instructional designer is to bring desired changes in the learners’ knowledge and skills through sound instructional procedures. As Gropper (1983) pointed out, a well-designed instruction saves time, money, and eases the learning process. Yagodzinski (2012) explained, “each instructional design theory is based on a unique set of goals, values, instructional methods, and situations in which the methods work best” (p. 1).

Instructional design has been criticized for its cumbersomeness, lack of efficiency, and lack of contextualization (Mckenney & Reeves, 201); however, these problems can be solved by employing rigorous formative research approaches to identify the strengths, challenges, and potential improvements for the existing instructional design theories and models (Reigeluth & Frick, 1999). The lack of design research studies can be attributed to the complexities and difficulties associated with the application of the existing instructional design theories and models (Mckenney & Reeves, 2012). Applying
instructional design theories and models to design effective and efficient lessons to solve real-world problems can be time-consuming and costly.

In the past few decades, there has been a strong movement towards the integration of information and communication technology (ICT) to design effective, efficient, engaging, and appealing instructions to achieve the desired learning goals (Merrill, 2013). Researchers are making efforts to research the best practices that can guide instructional design for quality instruction (Collis & Margaryan, 2005; Gardner, 2011; Glazatov, 2012; Merrill, 2013; Stein, 1982; Van Hurst, 1984). As an attempt to solve instructional problems, researchers have also conducted experimental studies that focus on comparing instructional design theories and models to determine which one is superior, effective, and efficient in specific learning environments (Archibald, 2010; Özmen & Ünal, 2008; Sasayama, 1985). There is a large body of experimental research that validates the effectiveness of the various components of CDT across different grade levels (Callahan, 1979; Merrill, 1994; Merrill, Olsen, & Coldewey, 1976; von Hurst, 1984).

The potential uses of computer-based instruction in the 21st-century educational system provide a chance to examine instructional design and development process (McKenney & Reeve, 2012; Wichadee, 2015). CDT is a micro instructional design theory developed by M. David Merrill in the 1980s. CDT specifies instruction on two dimensions: content (facts, concepts, procedures, and principles) and performance (remember, use, and find) (Merrill, 1983). Merrill (1983) explains that each content area requires a unique combination of presentation forms to help the learner achieve the desired learning outcome optimally. Again, Merrill (1983) specifies three presentation
forms: primary presentation forms, secondary presentation forms, and interdisplay relationship. Primary presentation forms include rules (expository presentation of a generality), instance (expository presentation of examples), recall (inquisitory generality), and practice (inquisitory instance) (Merrill, 1983). Secondary presentation forms consist of: mnemonics, helps, prerequisite knowledge, alternative representation, and feedback (Merrill, 1983). Interdisplay relationships are techniques that help the learner to work in the learning environment. Interdisplay relationships are independent of primary and secondary presentation forms (Merrill, 1983).

These three presentation forms cover the entire taxonomy of CDT. Primary presentation forms classify how content is presented to the student systematically and logically. Secondary presentation forms are elaborations, techniques, and methods added to the primary presentation forms to facilitate learning. The interdisplay relationship is a component of instruction that is designed to facilitate how the student works in the learning environment. It is important to note that each presentational component is independent of each other.

One area that has seen insufficient research is employing rigorous design methods to conduct formative research with existing instructional design theories (Reigeluth & Frick, 1999). Reigeluth and Frick (1999) define formative research as “a kind of developmental research or action research that is intended to improve design theory for designing instructional practices or processes” (p.634). According to Reigeluth and Frick, one of the best ways to improve existing instructional design theories and models is to
conduct formative research to find out areas where they work best and areas that would need improvement.

Additionally, other researchers have expressed the need to conduct formative research to solve real-world problems (Carr, 1993; Gravemeijer & Cobb, 2013; Greeno, Collins, & Resnick, 1996; Kelly, 2013; Merrill, 2013; McKenney & Reeves, 2012; Nieveen & Folmer, 2013; Plomp, 2013; Reeves, Herrington & Oliver, 2005; Tessmer, 1993; van den Akker, 2013).

To expand the design and development knowledge base of the theory (CDT), the researcher considered it appropriate to employ formative research methods to refine the theory to cater for current instructional design needs.

McKenney and Reeves (2012) explain that there is the need to conduct design research in an authentic learning environment with the aim of solving real-world problems. Plomp (2013) noted that “educational design research is appropriate to develop research-based solutions to complex problems in educational practice or to develop or validate theories about learning processes, learning environment and the like” (p. 11). From an educational technology perspective, Reeves (2006) argues that there is “a legacy of ill-conceived and poorly conducted research that results in no significant differences or, at best, in modest effect sizes” (p. 57), and thus, an approach such as design research is appropriate for furthering the field.

Another concern in the field of instructional technology is that researchers have applied quantitative research methodologies as an effort to solve instructional problems (Özmen & Ünal, 2008; Reeves, 2006; Sasayama, 1984). However, these studies
employed quantitative research techniques by comparing two instructional design theories and models to find out which one is superior to the other (Reeves, 2006). Reeves (2006) argued that it would be better for educational technologists to focus more on “design research aimed at developing an optimal solution” (p. 12) for solving real-world problems than just comparing theories. Therefore, to address such problems, it is necessary to conduct formative research that employs rigorous qualitative data collection strategies to solve problems in a more naturalistic environment (Kelly, 2013; McKenney & Reeves, 2012).

It is argued that media alone does not teach rather, it facilitates the process of how learners access learning materials (Shon, 1996). Therefore, more emphasis should be placed on how to apply sound instructional design principles to design effective and efficient instruction which is rarely addressed in media comparative studies. Effective and efficient instructional interventions require a systematic and analytical application of an instructional design theory or model.

**Statement of the Problem**

There are many instructional design theories and models. However, most have not undergone formal review to support the needs of current instructional problems (Reigeluth & Frick, 1999). Reigeluth and Frick pointed out that even though it is important to develop new instructional design theories and models to support emerging technologies, it is equally important to acknowledge the existing theories to find out how they can be improved to meet current instructional goals. Even though CDT was
developed in the 1980s, it still has a potential for designing effective, efficient, and appealing instructions (Merrill, 2013).

The literature shows that researchers have studied CDT in two major ways: comparing it to traditional approaches to designing instruction at the micro level and examining individual components within CDT (Chao, 1983; Sasayama, 1985; Von Hurst, 1984). Despite evidence that supports the effectiveness of CDT (Chao, 1983; Keller, 1986; Keller & Reigeluth, 1982; Robinson, 1984; Sasayama, 1985; Stein, 1982; von Hurst, 1984), there are only a few that have employed formative research methods to investigate the strengths, challenges, or possible improvements of CDT.

The power of the internet and computers have affected how students search for information and how they learn (Parsad & Jones, 2005). Computer-based learning technologies are being accepted in most colleges in the United States (U. S. Department of Education, 2014). According to Shon (1996) “technology alone does not cause learning. Rather, learning is influenced more by instructional interventions” (p. 3). This situation has created the need for educators to understand theories that promote sound instruction in the 21st century. Hence, this study combines theory and practice to understand better instructional strategies that could help in solving instructional problems in this computer age.

Purpose of the Study

The purpose of this study is to employ formative research methodologies to investigate an instructional design theory (CDT), by designing modules for teaching undergraduates. This study aims at identifying strengths and challenges of applying CDT
in designing computer-based instruction. Finally, this study will hypothesize possible improvements to CDT. Adobe Articulate was chosen as the design and delivery platform for this study because it is a potential instructional presentation tool, with functions and features that make it possible for designing computer-based instruction. Also, it creates an autonomous learning experience that presents learning material without the interference, consistency, and influence of an instructor. Hence, the researcher saw the need to apply CDT in such a learning environment to identify improvements that may be needed to the underlying theory. Also, the instructional objectives can be created for a wide variety of elements in the CDT taxonomy.

**Research Questions**

The main research questions guiding this study include the following:

1. What are the strengths and challenges of utilizing CDT in computer-based instruction?

2. What improvements or modifications can be made to CDT to increase its relevance to computer-based instruction?

3. Are all CDT presentation form types necessary for designing quality computer-based instruction?

**Significance of the Study**

Results from this study will extend the knowledge base of CDT to computer-based instruction. Specifically, this study will help determine which knowledge domains can utilize CDT and to what degree are the recommended presentation forms essential.
This study will contribute to filling the gap in the literature as there is currently scanty formative research on CDT.

**Limitations of the Study**

- The study was limited to college students at a large public university in Southeastern Ohio in the United States of America. CDT is only concerned with the micro level of designing instruction for a single idea or concept. CDT is described as a micro level instructional design theory because it has little focus on other instructional components such as motivation and group learning. Additionally, CDT offers some flexibility in its implementation, many of the design decisions may be idiosyncratic and are described in detail for the reader to understand the context in which the design was created.

- This study focused on two implementations of CDT and conducting formative research on the designed instances. Though the researcher collected both qualitative and quantitative data on students’ engagement and learning, the study cannot make absolute claims as to the effect of the instance on students learning with the topic because, quantitatively speaking, the sample size was not large enough to make such claims.

- Conclusions drawn from this study cannot be generalized to other content beyond copyright and fair use in a digital learning environment which was used in this study.

- This study employed formative research method which is a qualitative and focused on the in-depth understanding of a single topic. It may be helpful to
employ quantitative research approach to describe CDT prescriptions regarding their effectiveness, appeal, and efficiency (Reigeluth & Frick, 1999).

- Students’ prior knowledge of the targeted content, copyright and fair use, may have played a role in students’ learning, but was not investigated in this study.

**Delimitations of the Study**

The research setting, participants, and the lesson developed from this study may affect the generalizability of the results. Participants in this study were college students and may not represent other populations of adult learners or students. Technology availability and time constraints may influence the instructional strategies and tools for developing lessons on Adobe Articulate platform. This study focused on a single application of an instructional design theory.

**Definition of Terms**

To set boundaries for this study certain terms need to be defined.

*Adobe Articulate:* Is an authoring tool developed by Adobe (Shank & Bircher, 2009). It has four authoring tools: Presenter, Quizmaker, Engage, Storyline, and Replay. These tools can be used together or separately to design computer-based instruction. Instructional products designed with Adobe Articulate can be delivered in a virtual environment as well as on mobile devices (Shank & Bircher, 2009). The primary output from Adobe Articulate is Flash content. Flash content is a portable format that can be distributed online, therefore; the Flash player must be installed before one can play instruction designed with Adobe Articulate (Articulate.com).
**Component**: A component is the individual parts in instruction (Merrill, 1983). For example, the definition of a concept, examples, and practice can be described as individual components of the instruction.

**Component Display Theory**: An instructional design theory that focuses on micro level of designing instruction by providing instructional strategies for teaching a single idea or concept (Merrill, 1983).

**Computer-based Instruction**: “Computer-based instruction is an instructional paradigm, which uses computer technology to deliver training or educational materials to users” (Marquis, 2008, p. 395).

**Concepts**: “Group of objects, events, or symbols that all share some common characteristics and that are identified by the same name” (Merrill, 1983, p. 287). In statistics, Central Limit Theorem is an example of a statistical concept.

**Design Research**: A systematic but flexible methodology aimed to improve educational practices through iterative analysis, design, development, and implementation, based on collaboration among researchers and practitioners in real-world settings, and leading to contextually-sensitive design principles and theories (Wang & Hannafin, 2005, p. 6).

**Expository generality (EG)**: An expository generality is a form of primary presentation form where content information is presented to the student based on rules (Merrill, 1983). For example, presenting the concept of copyright to a student by telling or providing an illustration.
**Expository Instance (Eeg):** An expository instance is a form of primary presentation form where examples are presented to students (Merrill, 1983).

**Facts:** “Arbitrarily associated pieces of information such as a proper name, a date or an event, the name of a place or the symbol used to name a particular objects or events” (Merrill, 1983, p. 287).

**Formative Research:** It is a kind of qualitative research methodology used in “developmental research or action research that is intended to improve design theory for designing instructional practices or processes” (Reigelugh & Frick, 1999).

**Generality:** Generality is a “general statements of definition, procedure, and principle” (Merrill, 1983).

**Inquisitory Generality:** An inquisitory generality is a form of primary presentation form where content is presented in the form of a question (Merrill, 1983). An example is asking the student to apply generality to a specific case by responding to a question.

**Inquisitory Instance:** An inquisitory instance is a form of primary presentation form where students are required to practice (Merrill, 1983). An example is asking a student to paraphrase the definition of copyright in writing.

**Instance:** An instance is a prototype or a product design with CDT in Adobe Articulate learning management system. It is the instructional products used in this study (Reigeluth & Frick, 1999).

**Instructional Design Theory:** “An instructional design theory is a theory that offers explicit guidance on how to better help people to learn and develop” (Reigeluth, 1999, p. 5).
Interdisplay Relationship: Interdisplay relationship is concerned with directions given to the learner on how to consciously process the learning material and how to operate in the learning environment (Merrill, 1983).

Learning Management System: “Learning management system is a software application for the administration, documentation, tracking, and reporting of training programs, classroom and online events, e-learning programs, and training content” (Rahimi, 2015, p. 425).

Primary Presentation Form: Primary presentation form is a discrete presentation of instructional materials (Merrill, 1983). It is the main vehicle of the instruction (Merrill, 1983). Primary presentation form consists of generality, instance, and practice. The generality can be presented to the learner either expository or inquisitor form.

Principle: A principle is an explanation of why things happen in the world (Merrill, 1983). For example, Gross Domestic Product can be described as a principle to explain national income.

Procedure: “Ordered sequence of steps necessary to accomplish some goal, solve a particular class of problems, to produce some product” (Merrill, 1983, p. 287). For example, steps required to operate a microscope can be described as a procedure.

Secondary Presentation Form: Secondary presentation forms are additional information/elaborations added to the primary presentation forms to facilitate information processing (Merrill, 1983).

Theory: “An organized body of concepts and principles intended to explain a particular phenomenon” (Leedy & Ormrod (2005, p. 5).
Tools: Instruments used for collecting data from participants to answer the research questions in this study (Mile & Huberman, 1994).

Organization of the Study

This study is divided into five chapters. Chapter one included an introduction, statement of the problem, the significance of the study, the research questions, the limitations and delimitations of the study, and the definition of terms. Chapter two provides a theoretical review of literature of the study. Chapter three outlines the methods used for data collection for answering the research questions for the study. The methods include procedures used for developing the instructional material, population sampling, data collection and analysis procedures, and the role of the researcher. Chapter four reports the results of the data collected. Finally, chapter five contains the discussion of the findings of the study, implications, and recommendations for future research.
Chapter 2: Literature Review

Chapter Overview

This chapter is divided into five sections. The first section is the context of the study which addresses formative research design. The second section focuses on the conceptual framework which includes the instructional design framework and component display theory (CDT). The third section discusses light on previous studies that have employed formative research methods as an attempt for improving an existing instructional design theory or model. The fourth section presents chronologically empirical studies on CDT. The final section addresses the research gap for the present study. Figure 1 represents the V-map of the literature review in this chapter.

Figure 1. The V-Map of the Literature Review
Formative Research Methodology

The history of educational design research can be traced back to the early 1990s (Brown, 1992; Collins, 1992). There are many terms used to describe research of this type. Some of the most common names are formative research (Newman, 1990; Reigeluth & Frick, 1999), design-based research (Kelly, 2003; Teras & Herrington, 2014), development research (van den Akker, 1999), educational design research (van den Akker, Gravemeijer, McKenney, & Nieveen, 2006; McKenney & Reeves, 2012), design experiments (Brown, 1992; Collins, 1992).

The nuance difference between formative research and design-based research is that design-based research is iterative which leads to refinement of design and theory (van den Aller, 1999). Another subtle difference is that design-based research tends to adopt formative research techniques as one of the major methods for data collection. Again, the goal of the formative research is to improve design process, and that of the design-based research is theory generation (van den Akker, 1999).

Wang and Hannafin (2005) defined design-based research as “a systematic but flexible methodology aimed at improving educational practices through iterative analysis, design, development, and implementation, based on collaboration among researchers and practitioners in real-world settings, and leading to contextually-sensitive design principles and theories” (p. 7).

Plomp (2013) defined design research based on developmental and validation purposes. Plomb (2013) defined developmental design research as:
the systematic analysis, design and evaluation of educational interventions with
the dual aim of generating research-based solutions for complex problems in
educational practice, and advancing our knowledge about the characteristics of
these interventions and the processes of designing and developing them (p. 17).

Even though many educational researchers are enthused with experimental
research, however, it is not the most appropriate path for developing instructional
technology (Reeves, Herrington & Oliver, 2005). Hence formative research approach is
crucial to the development of instructional technology. Formative research methodology
is similar to experimental design-based research, but the former focus on finding possible
improvements to an instructional design theory (Reigeluth & Frich, 1999). However,
experimental research is useful to evaluate the existing theory.

According to Walker (2006), the focus of design research is not to test theories;
rather it is more concerned about refinement and improvement of an existing theories or
systems. Design research focuses on discovering effective and efficient ways to improve
educational practices. In the same vein, van den Akker (1999) mentions that the aim of
conducting design research “is not to test whether the theory, when applied to practice, is
a good predictor of events” (p. 9). Design research aims at testing and refining learning
environments as well as defining new design principles to solve complex problems real
context (van den Akker, 1999).

Reeves, Herrington, and Oliver (2005) suggested that researchers interested in
design research in higher education need to focus on “complex and difficult problems
that cut across multiple disciplines” (p. 104). Copyright and fair use concepts are not an
exception regarding solving a complex and relevant phenomenon in the higher educational system.

According to van den Akker (1999), characteristic of design research includes:

- A focus on broad-based, complex problems critical to higher education
- The integration of known and hypothetical design principles with technological affordances to render plausible solutions to these complex problems
- Rigorous and reflective inquiry to test and refine innovative learning environments as well as to reveal new design principles
- Long-term engagement involving continual refinement of protocols and questions
- Intensive collaboration among researchers and practitioners, and
- A commitment to theory construction and explanation while solving real-world problems (p. 5).

**Importance of educational design research.** McKenney and Reeves (2012) outlined the importance of conducting design research as follows:

- Educational design research provides direct link between research and practice.
- It requires researchers and practitioners to collaborate to identify and solve teaching and learning problems in education.
- Existing design principles and theories can be used to develop a prototype solution to complex problems.
- Formative research is mostly conducted in naturalistic contexts which resemble how real-world situations or problems occur (p. 23).

Similarly, Edelson (2002) addresses that design research:
• Offers opportunities to learn unique lessons.
• Yields practical lessons that can be directly applied.
• Engages researchers in the direct improvement of educational practice (p. 105).

Conceptual Framework

Component display is a micro level theory developed by David Merrill in the late 1970s (Merrill, 1983). The three main presentation forms of CDT are primary presentation form, secondary presentation form, and interdisplay relationship (Merrill, 1983). The theory postulates that there is a unique combination of presentation forms that can produce effective learning experience. The unique combination of CDT taxonomy is based on the content of the topic and its correspondent level of performance. Merrill (1983) theorized that instruction is effective if it contains all the necessary primary and secondary presentation forms. Merrill specifically mentioned that CDT is a micro level theory for designing instructions to achieve cognitive domain objectives. The theory also categorizes learning objective into two dimensions: the type of content (facts, concepts, principles, and procedures); and the level of performance with that content (remember, use, and find) (Merrill, 1983, p. 281).

Merrill (1983) linked associative and algorithmic memory structures to “remember” and “use” respectively. The associative memory represents a hierarchical structure whereas algorithmic memory represents rules or schema. At the "use" level performance in algorithmic memory, the student uses the existing schema to process the learning material whereas in the "find" performance the student creates a new schema by reorganizing the existing rules (Merrill, 1983).
Instructional Design Framework

According to Reigeluth and Carr-Chellman (2009), “instruction is anything that is done purposefully to facilitate learning” (p. 6). This includes constructivist methods and self-instruction, and other traditional methods such as lecture and direct instruction (Reigeluth & Carr-Chellman, 2009).

Even though learning theories are important in providing explanatory frameworks on how learning takes place, they do not inform the specific activities and method to facilitate learning (Reigeluth & Carr-Chellman, 2009,) it is the instructional theory that provides specific activities, methods, and context to facilitate learning. Instructional theory focuses on how to design instructions to achieve maximum learning outcomes. Instructional theory takes into consideration the learners’ characteristics, context, and the nature of the content material, and design instruction that will benefit such individuals.

Brunner (1966) proposed that instructional theory is prescriptive in nature in that it has a set of rules that can be employed to achieve the desired learning outcomes. CDT provides sets of prescriptions that can be used to design instruction at the micro level (Merrill, 1983). On the other hand, Morrison, Ross, and Kemp (2010) describe learning theory as descriptive because it explains how learning takes place. Brunner’s prescriptive proposition on instructional design theory is in accordance with that of Merrill’s CDT.

Reigeluth and Carr-Chellman (2009) describe instructional design theory as a set of design theories that constitute multiple components of instruction. Figure 2 represents the instructional theory phases proposed by Reigeluth and Carr-Chellman (2009). They
proposed six instructional theory phases that must be considered when designing instruction. These include:

- What the instruction should be like – Instructional Event
- What the process of gathering information for making decisions about instruction should be like – Instructional Analysis
- What the process of creating the instructional plans should be like – Instructional Planning
- What the process of creating the instructional resources should be like – Instructional Building
- What the process of preparing for implementation of the instruction should be like – Instructional Implementation; and
- What the process of evaluating the instruction should be like – Instructional Evaluation (p. 9).

Figure 2. Six Aspects of Instructional Design-Theory (Reigeluth & Carr-Chellman, 2009, p. 9). Used with permission. See Appendix Q.
Reigeluth (1999) pointed out that instructional design theory consists of at least two important components. They are the methods that can be applied to increase learning and the indications of when to apply a specific method, which he refers to as *situations*. Situations consist of outcome and conditions. Outcomes involve the effectiveness of the instruction based on the desired learning goal, efficiency of the instruction, and the appeal of the instruction (Reigeluth, 1999). Conditions aspect of instruction considers the characteristics of the learner, the learning process, learning environment, and instructional development constraints (Reigeluth, 1999). Figure 3 is the Reigeluth’s components of instructional design theories.

![Figure 3. The Components of Instructional-Design Theories (Reigeluth, 1999, p. 9)](Used with permission. See Appendix Q.)

In fact, the seminal work of Robert Gagné in 1965 on the conditions of learning marks the beginning of instructional design (ID) (Banathy, 1987). Many instructional design models are based on the core of the Analyze Design Development Implement
Evaluation (ADDIE) model (Gustafson & Branch, 2002). While some models such as ones developed by Dick, Carey, and Carey (2005); Morrison, Ross, and Kemp (2010); Smith and Ragan (2005) were more process-based, some models such as those of Gagné, Briggs, and Wager (1988); Merrill (1983) were more theory-based (Gagné, Briggs, & Wager, 1988). The latter has dominated the field of instructional design for over 25 years (Willis, 1998). The common features among all these models are that they provide linear, systematic, descriptive approach to instructional design (Kenny, Zhang, Scwier, Campbell & Campbell, 2005).

**Component Display Theory**

This section will provide a detailed explanation of CDT. In the late 1970s, David Merrill developed his “component display theory” which postulated that there is a unique combination of presentation forms that can produce an effective learning experience. Merrill (1983) specifically mentioned that CDT addresses issues at the micro level of instruction. He also stated that CDT specifies how to design instruction to achieve any cognitive domain objective (Merrill, 1983). Merrill (1983) linked associative and algorithmic memory structures to “remember” and “use” respectively. According to Merrill (1983), associative memory represents a hierarchical structure whereas algorithmic memory represents rules or schema. At the "use" level performance in algorithmic memory, the student uses the existing schema to process the leaning material whereas in the "find" performance the student creates a new schema by reorganizing the existing rules (Merrill, 1983).
One of the important components of CDT is what Merrill referred to as learner control. Instruction designed with CDT provides students with high degree of individualization (Merrill, 1983). Students control their learning pace and also can adapt to the learning environment to meet their preferences (Merrill, 1983). Merrill (1983) theorized that instruction is effective if it contains all the necessary primary and secondary presentation forms.

The framework of CDT stems from three major categories of instructional variables. Reigeluth and Merrill (1978) identified these as organizational strategies, delivery strategies, and management strategies.

Organizational strategies. Organizational strategies are strategies that are concerned with the design processes, selection of topic, sequencing, assessment, and feedback (Merrill, 1983). Organizational strategies are sub-divided into two subcategories: micro and macro strategies. Micro strategies addressed individual display which includes “their characteristic, interrelationships, and sequencing that are to be presented to the student” (Merrill, 1983, p. 283) whiles macro strategies mainly deals with the “selection, sequence, organization of the subject-matter to be presented” (Merrill, 1983, p. 283). According to Merrill (1983), CDT is complete at the micro level of designing instruction. This study is concerned about micro strategies of instructional design.

Delivery strategies. Delivery strategies are concerned with the decision that affects the way information is presented to the student (Merrill, 1983). Delivery strategies affect instructional media selection and how it will be used to present and carry learning
activities to the learner (Merrill, 1983). Examples may include lecture, online learning platforms, and video, just to mention a few (Merrill, 1983).

**Management strategies.** Management strategies are concerned with the decisions affecting the way the individual student will be helped to interact with the learning activities (Merrill, 1983). Management strategies involve motivational techniques, individualization schemes, scheduling, resource allocation, and other implementation activities (Merrill, 1983, p. 284).

It appears that the combination of the three strategies could be used to create effective instruction, but Merrill (1983) claims that CDT is exclusively concerned with organizational micro strategies and independent of macro, delivery, and management strategies (p. 284). CDT can be used with many delivery systems to present instructions despite it focuses solely at the micro level of designing instruction (Merrill, 1983).

Merrill (1983) assumes the most useful way to classify learning capabilities is in two dimensions: the performance and the content type. Figure 4 represents performance – content matrix of CDT. Merrill (1983) claims that the for “each performance – content category there is a combination of primary and secondary presentation forms that will result in more effective, efficient, and appealing acquisition than will other combination of displays” (p. 285).
The performance – content matrix offers guidelines to both designers and instructors on how to approach content materials (Merrill, 1983). For example, if the content material is about teaching facts, according to the matrix, students are required to search their memory to reproduce the information (Merrill, 1983).

To illustrate the combination of the two-dimensional classification, students are expected to remember facts if the content is made up of facts (remember – fact); remember – concept; use – concept; find – concept; remember – procedure; use – procedure; remember – principle; use – principle; and find – principle (Merrill). From Figure 4, facts have no general or abstraction representation (Merrill, 1983). From the performance level, use requires students to apply some abstraction to specific cases, and find requires the student to invent new abstraction (Merrill, 1983). CDT further explains presentation mode involved in presenting content material. The primary presentation form specifies the combination of content and its presentation mode. Figure 5 is Merrill’s (1983) primary presentation forms.
According to Merrill (1983), learning can be achieved by combining four primary presentation forms (expository presentation of a generality, expository presentation of instance, inquisitor generalities, and inquisitor instance). The expository presentation of generality provides the student with rules, definitions, and general overview of a topic (Merrill, 1983). Expository presentation of an instance deals with using examples and nonexamples, and specifics of a topic to present information to the student (Merrill, 1983). Inquisitory generalities deal with asking students question about the topic, and finally, inquisitory instances require students to practice or apply what they have been taught (Merrill, 1983). A generality or instance can be presented in either expository or inquisitory manner (Merrill, 1983).

Moreover, Merrill (1983) designated another presentation form called secondary presentation form. Secondary presentation forms are elaborations or additional information added to the primary information to help students to process the learning material (Merrill, 1983). Some of the secondary presentation forms include prerequisite

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<td>Rule or Generality</td>
<td>G- Practice</td>
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information, mnemonics, attention focusing (help), alternative representation, and feedback among others (Merrill, 1983).

Component display theory was not initially intended to act as a prescriptive guide to instructional design, but rather a descriptive and predictive theoretical construct which examines and explains components of an instructional presentation (Merrill, 1983). But in recent years the nature and form of CDT has taken on a much more prescriptive tone (Merrill & Twitchell, 1994). CDT is described as prescriptive in nature because it outlines specific combination of content and performance level with fixed presentation forms and objectives to obtain the desired learning outcomes.

The descriptive theory of CDT is an extension of Gagne’s theory (Merrill, 1983). Merrill classified learning objectives along two dimensions: learner performance level (remember, use, find) and content type (facts, concepts, principles, and procedures) (Merrill, 1983, p. 286). The basis for this classification was based on some assumptions about the nature of subject matter (Merrill, 1983). The descriptive CDT clearly displays the mechanisms of the instructional process (Merrill & Twitchell, 1994). The descriptive component of CDT identifies and summarizes learners’ performance and content to be taught (Merrill, 1983). The content can be presented in the form of facts, concepts, procedures, and principles (Merrill, 1983).

**Generality.** A generality is a statement of the relationship that characterizes the concept (Merrill, 1983). *Generality* can be in the mode of text, verbal, or visual presentation. For example, by using visual presentation to teach the concept “greenhouse effect,” the instructor can use a diagram showing the relationship between sun radiation
and atmospheric gases as a form of presentation. Selecting an appropriate form of presentation is integral to instructional design (Merrill, 1983). An instructional designer can select a single mode of presentation to achieve the instructional goal; sometimes multiple modes of presentation is required for designing efficient and effective instruction (Merrill, 2013).

**Example.** In CDT, Merrill referred to example as an instance. It is a specific case, event or object that shows the relationship among concept class (Merrill, 1983). Examples can be presented to students as a demonstration or as an exploration. Presenting examples as a form of demonstration may not require active student participation. However, examples that are presented as an exploration will require students to manipulate and understand what will occur (Merrill, 1983). Reigeluth and Schwartz (1989) pointed out that examples are used to lead the student to achieve the main learning objective. According to Reigeluth and Schwartz (1989), “the nature of this type of learner participation is different from that required for application of the generality, in that the learner’s behavior is not the one specified by the objective” (p.3).

**Practice.** The practice provides students with the opportunity to apply generalities to different unencountered situations (Merrill, 1983). To effectively help the student to understand the concept, practice items should be different from what was presented as examples (Merrill, 1983). The practice must be designed in such a way that students will be required to apply generalities in a similar but unencountered situation.
Regarding other parts of the content-performance matrix such as facts, principles, and procedures, the practice component of the instruction has to offer the student an opportunity to apply the newly acquired knowledge to solve new problems.

**Feedback.** Feedback is one of the integral elaboration elements of CDT at the secondary presentation level (Merrill, 1983). Feedback is generally considered to be an important component of instruction that seeks to improve knowledge and skill acquisition (Azevedo & Bernard, 1995; Bangert-Drowns, Kulik, Kulik, & Morgan, 1991; Corbett & Anderson, 1989; Moreno, 2004; Pridemore & Klein, 1995).

It is important to note that in CDT, feedback varies from one level to another (Merrill, 1983). At every performance level, there should be a feedback; Merrill (1983) described this as an adequacy rule. Thus, to ensure that the lesson is balanced regarding components that would come together to the instructional needs of the student.

At the remember level, Merrill (1983) suggests that the student should be given a correct answer feedback that offers the student second presentation of what should have been provided as correct answer. Merrill (1983) again prescribed that feedback at remember level can be paraphrased to help the student to correspond the alternative statement of the generality.

At the use level, the student should be given both correct and incorrect feedback that would help to identify why an instance is an example of a concept, procedure, or principle (Merrill, 1983). At the find level, Merrill (1983) suggests that, for example, a concept definition invented by a student can be given to a peer student to find out if the
peer student can use it to classify instances. If the peer student can use it, then it is considered as correct feedback to the student who invented the definition.

At the procedure level, the learner should be engaged in a new task to find out if the desired result would be obtained (Merrill, 1983). If the desired result is correct, that serves as correct feedback to the student (Merrill, 1983). Finally, at the principle level, predictions are applied in a new situation, if the prediction is verified, it serves as correct feedback to the student.

Even though feedback is recommended for all the practice, certain precautions must be noted (Merrill, 1983), because when students get to know that for example, by clicking a button, they will receive an immediate feedback before answering questions they may think they know how to work through the problem. This behavior can lead to self-deception and less adequate learning on the part students and consequently lead to poor test performance (Merrill, 1983).

Cohen (1985) opines that “feedback is one of the more instructionally powerful and least understood features in instructional design” (p. 33). Feedback provides students with an opportunity to confirm correct or wrong information regarding their response (Cohen 1985).

Hattie and Gan (2011) described feedback as one of the best means to increase student learning. Hattie and Timperley (2007) defined feedback as “information provided by an agent (e.g., teacher, peer, book, parent, self, experience) regarding aspects of one’s performance or understanding” (p. 8). It appears that there is no ideal model of how feedback influences learning. Some researchers have investigated the impact of feedback
on student learning, and they rest on the notion that providing instant feedback to students can alter their knowledge or skill acquisition (Hattie & Gan, 2011; Merrill, 1983; van der Kleij, Feskens & Eggen, 2015; Winne & Butler, 1994). Winne and Butler (1994) stated that “feedback is information with which a learner can confirm, add to, overwrite, tune, or restructure information in memory, whether that information is domain knowledge, meta-cognitive knowledge, beliefs about self and tasks, or cognitive tactics and strategies” (p. 574).

In 1991, Banger-Drowns, Kulik, Kulik, and Morgan proposed a model for learning from feedback. The model outlined five-stage cycle of providing feedback. In the first stage, the student is considered as being motivated or having prior knowledge of the learning material. In the second stage, the student uses stage one to activate cognitive processes to search for the answer and respond in stage three. At stage four the student uses feedback provided to evaluate the response. Finally, in stage five the student adjusts strategies, knowledge, and beliefs, among others (Banger-Drowns, Kulik, & Kulik, 1991). The model emphasized that instructors must take precautions in providing feedback to students because if feedback is given wrongly, it will not affect the initial state of the student (Banger-Drowns, Kulik, & Kulik, 1991). van der Kleij, Feskens, and Eggen (2015) describe that “feedback can help students identify and correct errors and misconceptions, develop more effective and efficient problem-solving strategies, and improve their self-regulation” (p. 477).

Hattie and Timperley (2007) identified four levels of feedback; feedback aimed at the self, task, process, and regulation level. To distinguish these four levels of feedback
Hattie and Timperley (2007) employed a model developed by Kluger and DeNisi in 1996. Feedback aimed at self relates to the characteristics of the student but, not necessarily relate to the task. The main function of feedback at the task level is to correct students. Feedback at the process level involves the process that students use to complete the task. Finally, regulation level feedback relates to student self-assessment and eagerness to take feedback.

Similarly, van der Kleij, Feskens, and Eggen (2015) proposed three distinct types of feedback which were based on the earlier work of Shute (2008). These include: “knowledge of results, knowledge of correct response, and elaborated feedback” (p. 477). Knowledge of results is related to telling the student whether the answer is correct or wrong without providing additional information. Knowledge of results is in consistent with behaviorist view of learning because it reinforces correct recall of facts (Hattie & Gan, 2011). An example of knowledge of result feedback is that the instructor will show the student the location of the error but will not provide correct answer or further information. Knowledge of correct response feedback originated from cognitivism (van der Kleij, Feskens, and Eggen, 2015). While knowledge of results feedback does not provide correct response knowledge of correct response, revise student’s incorrect responses, and provide correct answer (van der Kleij, Feskens & Eggen, 2015). However, with elaborated feedback “the process itself takes on the forms of new instruction, rather than informing the student solely about correctness” (Kulhavy, 1977, p. 212). According to van der Kleij, Feskens and Eggen (2015) elaborated feedback can take many forms
such as “hints, additional information, extra study material, and an explanation of the correct answer (p. 478).

Even though many researchers have investigated feedback in regard to timing, Shute (2008) pointed out that results from these studies are conflicting. In respect to feedback timing, van der Kleij, Feskens and Eggen (2015) classified it as immediate and delayed feedback. The interpretation and difference between immediate and delayed feedback can be ambiguous. Immediate feedback is usually delivered after a student has responded to an item; this kind of feedback is common in formative assessment instances (Shute, 2008). A unique distinction between immediate and delayed feedback is that students receive immediate feedback in the process of taking a task, but this is not the case with delayed feedback (Shute, 2008). Merrill (1983) suggests that feedback should be delayed until the student completes the task as opposes to Skinner (1968), one of the stern advocates of immediate feedback.

It seems that the nature of computer makes it possible to deliver immediate feedback to students taking computer-based instruction on their response. Hence, the power of immediate feedback in the computer-based environment cannot be underestimated.

Miller (2009) found out that students prefer immediate feedback to delayed feedback. In a similar study, van de Kleij, Eggen, Timmers, and Veldkamp (2012) confirmed that students spent a significant amount of time reading immediate feedback than delayed feedback. The results of the study indicate that feedback timing is important
factor that instructors and instructional designers should take into consideration when designing instruction. Researchers also need to consider feedback timing when investigating how feedback affects learning (van der Kleij, Eggen, Timmers, & Veldkamp, 2012).

Traditionally, one-to-one tutoring strategy has been considered as the most effective form of instruction (Bloom, 1984). By employing the one-to-one tutoring strategy, the instructor can provide immediate feedback to student in case there is misunderstanding. In this case, the instructor can adjust the instruction to meet the needs of the student. In today’s educational system, such instruction is unimaginable. However, modern educational technologies “offer promising solutions to this problem” (van der Kleij, Eggen, Timmers, & Veldkamp, 2012).

In a computer-based learning environment, an instructor can provide student with standardized feedback based on the student’s response to an item. This means that students can receive timely feedback on task. van der Kleij, Eggen, Timmers, & Veldkamp (2015) believe that feedback in most computer-based learning environment can “resolve the gap between students’ current status in the leaning process and the intended learning outcomes” (p. 479).

Even though researchers have identified that there are many methods of providing feedback to students, however not all of them are effective in improving learning (Hattie & Timperley, 2007; Shute, 2008).

**Help.** Help are directions and assistance given to students for them to process the learning material (Merrill, 1983). In CDT, helps are added to the primary presentation
form to reduce the difficulty of the content so that the student can understand the learning process (Merrill, 1983). Help can be in the form of direct attention, example, and encoding (Reigeluth & Schwarzt (1989). Help in the form of direct attention can be using colors, bold, label, and arrows to help the student to identify important information in the learning material (Merrill, 1983). An instructor can give students examples or practice by providing commentary to help them understand the generality. Finally, an instruction can help students by providing an alternative representation of the learning material. For example, graphs can be used along with a definition. Such presentations appear to help students gain understanding of the learning material and enhance their retention (Reigeluth & Schwartz, 1989).

Hattie’s (2015) meta-analysis study on how the student, home, curriculum, teacher, and teaching and learning approaches influence students’ achievement revealed that making teaching and learning visible was the key difference. According to Hattie visible learning means “an enhanced role for teachers as they become evaluators of their own teaching” (p. 22). Hattie described that visible teaching and learning happens when teachers see learning through the eyes of students and help them become their own teachers.

Providing students with constructive feedback can be important. For example, Hattie (2015) conducted a meta-analysis that showed that students whole receive feedback to correct errors and misconceptions increased learning dramatically compared to their counterparts who did not receive such feedback. In 2011, a similar meta-analysis
study on visual learning by Hattie revealed that the effects size for feedback was higher (N=150, 0.8) compared to learner control (N=150, 0.5).

One of the important components of CDT is what Merrill referred to as learner control. Instruction designed with CDT provides students with a high degree of individualization (Merrill, 1983). Students control their learning pace and can adapt to the learning to meet their preferences (Merrill, 1983).

**Learner control.** One of the important variables that Merrill (1983) considered when developing CDT is learner control. According to Merrill and Twitchell (1994), learner control refers to a situation where learners exert certain degree of control over the instructional events. Williams (1996), defines learner control as “instructional designs where learners make their own decisions regarding some aspect of the ‘path,’ ‘flow,’ or ‘events’ of instruction” (p. 957). In that situation, students have some level of freedom to make their own decisions regarding pace, strategies, and sequence to suit their preferences and styles (Merrill, 1983). Students also have opportunity to select curriculum, objectives, lessons, and segment or module (Merrill, 1983, p. 328).

Merrill (1983) describes that CDT is designed to encourage learners to become autonomous in their learning process. If all CDT prescriptions are implemented in a lesson, the instructional materials will be suitable for learners to achieve high levels in exercising learning control component in the lesson (Merrill, 1983). In CDT, Merrill (1983) proposed that when students have higher level of learner control and the course is designed based on all the four presentation forms; students are likely to have higher learning achievement.
Component display theory is similar to Reigeluth’s elaboration theory of instruction in that both have prescriptions to follow if the content is primarily concepts or principles (Reigeluth & English, 1996). It appears that the conceptual CDT is derived primarily from Ausubel’s (1982) advance organizers (English & Reigeluth, 1996). It provides guidance and prescriptions as to how to design instructions from a particular content area to achieve the target learning outcomes.

Researchers have applied CDT across a range of content, age groups, and learning environments, to examine its effectiveness in comparison with the existing traditional approaches to instructional design (Keller & Reigeluth, 1982; Stein, 1982; Sasayama, 1985; Von Hurst, 1984). Keller and Reigeluth (1982) conducted a study by comparing conventional mathematics instruction in both expository and discovery formats with CDT prescriptions. The results of the study revealed no significant effects on concept acquisition. Keller and Reigeluth (1982) concluded that the most important factor is to present generality in a more explicit manner. The study revealed that examples could be presented prior to following presentation of generality. The results of Stein (1982) study with eighth graders in concept learning were in contrast to what Keller and Reigeluth (1982) found. Stein (1982) found CDT to be superior in concept learning in comparing four treatments: expository prose, expository prose plus adjunct questions, CDT with only primary presentation forms, and CDT with both primary and secondary presentation forms. Stein (1982) concluded that both CDT forms were significantly effective in helping students to recognize previously learned instances of the concepts.
**Concept Teaching**

Merrill, Tennyson, and Posey (1992) defined concept “as a set of specific objects, symbols, or events which are grouped together on the basis of shared characteristic and which can be referenced by a particular name or symbol” (p. 6). Teaching a particular topic requires words that can refer to that particular instance. In any learning material, concepts are used to breakdown the content material so that it becomes teachable and learnable. The instructor’s ability to name appropriate concepts from a given learning material could help student understanding (Merrill, Tennyson & Posey, 1992).

The traditional method of teaching concepts has centered on the presentation of definition, examples, and non-examples, followed by practice in classifying examples and non-examples (Tennyson & Cochiarella, 1986). Other traditional strategies for teaching concepts include attribute isolation and mnemonics (Reigeluth, Merrill & Bunderson, 1978).

However, current research, particularly in cognitive science, has a different conception of concept acquisition, and how to measure them (Tessmer, Wilson & Driscoll, 1990). Brown, Collins, and Duguid (1989) are of the view that conceptual knowledge is not a collection of definitions, but they are tools used for different contextual purposes. Klausmeier (1980) explained that acquisition of concepts goes beyond classification of examples and non-examples. Certainly, conceptual knowledge goes beyond example classification.

Tessmer, Wilson, and Driscoll (1990) identified two components of concepts – declarative and procedural components. Each component requires different instructional
strategies to reach both declarative and procedural outcomes (Tessmer, Wilson & Driscoll, 1990). Declarative component involves strategies that will make the concept personally meaningful to the learner while procedural component seeks to employ strategies such as practice and feedback to help the learner to perform accurate concept classification (Tessmer, Wilson & Driscoll, 1990). This suggests that for learners to use concepts effectively, they must acquire both declarative and procedural knowledge for specific settings. When a concept is acquired learners make connections to know more about it through its defining attributes, examples, and non-examples, and clarification (Lehrer & Koedinger, 1988). Howard (1987) described concept as a schema because in concept acquisition information is normally organized around a single theme.

Teaching concepts of copyright and fair use can be challenging because it requires careful presentation of both examples and non-examples to adequately teach the individual concepts. Concept teaching requires presentation of diverse examples to demonstrate relevant and irrelevant attributes of the concept.

Presentation of examples and nonexamples are very important when teaching and learning concepts of a subject area. A study conducted by Akbuluttas and Coskun (2012) confirms that examples that are different from each other in terms of their irrelevance increase students understanding of the concepts. Akbuluttas and Coskun recommended that content types and expected learning levels should be presented together in an “accurate behavioral objective example” (p. 580). Also, in content types, examples should be precise (Akbuluttas & Coskun, 2012). It appears that presentation of diverse
examples is considered important in teaching concepts; instructor should not confuse students with ambiguous examples.

One of the important considerations in concept teaching is the organization of the content elements (Ausubel, 1964; Bruner, 1962; Gagné, 1962; Mayer & Greeno, 1972; Merrill, 1983; Scandura, 1973). It requires adequate information on prescriptions for describing the organization process at each stage of the instruction (Merrill, Tennyson & Posey, 1992; Tennyson & Park, 1980). Instructional designers should consider the instructional material from optimal learning pedagogies as well as from the structure of the subject matter (Merrill, 1983). Tennyson and Park (1980) pointed out that “content elements of instructional materials should be organized on empirically based design strategies, not according to conventional discipline structures” (p. 55).

Many researchers have developed instructional design strategies for organizing content elements for concept teaching (Houtz, Moore & Davis, 1973; Klausmeier & Feldman, 1975; Merrill & Tennyson, 1978; Merrill, Tennyson & Posey, 1992; Tennyson, Steve, & Boutwell, 1975). According to Tennyson and Park (1980) these design strategies include (a) the relationship between examples, (b) the relationship between examples and nonexamples, (c) the ordering of examples and instructional help, (d) developing a procedure for selecting an appropriate number of examples, and (e) the relationship between coordinate concepts (p. 56).

Instructional process for concept attainment involves the presentation of critical attributes of the concept, examples, and nonexamples (Merrill, Tennyson & Posey, 1992). Presentation strategies of concept attainment include, first presenting the critical
attributes of the concept, followed by examples and nonexamples (Carroll, 1964; Klausmeier, 1976; Merrill & Tennyson, 1978; Merrill, Tennyson & Posey, 1992). Klausmeier (1976) pointed out that providing concept definition in terms of its critical attributes facilitates the learners’ ability to identify the concept.

A study conducted by Johnson and Stratton (1966) demonstrated the effectiveness of a definition in concept learning. Johnson and Stratton (1966) employed multiple methods of concept teaching with two groups of college students. One group defined a concept in higher order classes characterized in a specific way. For example, an “altercation” was defined as a “social interaction characterized by heated exchange of opposing arguments” (p. 49). The results of the study revealed that students who were given definition performed significantly better in terms of concept classification of new examples, the definition of the concept, sentence completion, and selection of synonyms, than their counterparts who were not given a definition of the concept.

In a similar study, Anderson and Kulhavy (1977) found that college students who were given definition of unfamiliar concepts performed significantly better in answering multiple choices questions than students who had not seen the concept definition. The mean percentage between the two groups confirmed that students who were given concept definition performed better than that of students who were not given concept definitions.

In another study, Tennyson (1971) investigated the relative effectiveness of a concept definition, and examples and nonexamples. Two groups of college students were tasked to learn the concept “trochaic meter.” The results of the study indicate that
students who received combination of a definition, examples and nonexamples performed significantly better than students who received only examples and nonexample. Feldman (1972) also found the same results with sixth-graders. Students who received a combination of a definition, examples, and nonexamples outperformed students who received only examples, and nonexamples.

Additionally, Klausmeier and Feldman (1975) also conducted a study to understand the effectiveness of using concept definition and one rational set of examples and nonexamples. The rational set consisted of three examples and five nonexamples which present the critical attributes of the concept. The first group of students received a concept definition and one rational set, the second group received either definition alone or one rational set alone. The results of the study showed that the learning magnitude between the control group and the group that received a definition and one rational set was greater than the control group that received either a definition alone or rational set alone. Klausmeier and Feldman (1975) suggested that the combination of a concept definition with three rational sets can facilitate concept attainment.

A concept definition seems to be successful if it presents all the correct critical attributes of the concept (Carroll, 1964). A concept attainment can be facilitated if the definition contains proper attributes, values, and relationships to communicate the meaning of the concept to the learner (Carroll, 1964). The results of Markle and Tiemann (1969) study confirmed that concept attainment is facilitated if a concept definition reflects critical attributes of the concept. Feldman and Klausmeier (1974) pointed out that
concept definition must also be stated in appropriate terminology. This suggests that cognitive level of the learners has to be considered.

The strategy for concept attainment is not simply providing students with a concept definition. Tennyson and Park (1980) pointed out that:

If a definition alone is provided without the presentation of examples and nonexamples, the student may merely memorize a string of verbal associations. To ensure that students acquire a concept and not a string of words, they must, at minimum, also be presented with concept examples and nonexamples to classify (p. 58).

Research shows that one of the effective ways of presenting examples and nonexamples for concept attainment is that the critical attributes of the concept presented in both examples and nonexamples must differ at a time (Klausmeier, 1976; Klausmeier, Ghatala & Fayer, 1974; Markle & Tiemann, 1969; Merrill & Tennyson, 1992; Tennyson, Woolley & Merrill, 1972). Markle and Tiemann (1969) described that providing divergent examples and nonexamples help students to eliminate errors due to overgeneralization, undergeneralization, and misconception. Overgeneralization is a situation where students identify nonexamples as examples; undergeneralization is when students identify examples as nonexamples; and misconception is when students identify nonexamples as examples, examples as nonexamples (Markle & Tiemann, 1969). Markel and Tiemann referred to a “rational set” as a set of examples and nonexamples that reflect these characteristics.
Computer-Based Instruction

In recent years, schools have witnessed wide of computers for instructional purposes. Therefore, instructional designers and instructors should explore effective and efficient ways of using both software and hardware components to computers to facilitate teaching and learning. Computer-based instruction is a kind of instruction designed and delivered on computers (Alessi, & Trollip, 1985). In computer-based instruction, students have to interact with computers to accomplish the learning process.

Computer-based instruction has been branded with many names; some scholars refer to it as computer-assisted instruction (CAI), computer-based training (CBT), and computer-assisted learning (CAL) (Gibbons & Fairweather, 1998). It appears that when computers are mentioned in education, people first think of CBI because CBI is one of the oldest form computer applications in education (Alessi & Trollip, 1985). There are different kinds of CBI. They include simulation, instructional game, problem-solving, drill, tutorial, and among others (Gibbons & Fairweather, 1998).

Most of the CBI is based on cognitive learning theory (Mayer, 2009). However, presentation of instructional materials in computer-based learning environment remains a problem. Sometimes learning materials are presented in a linear and text-like form which is not different from the traditional textbook presentation (Evans, Gibbons, Shal, & Griffin, 2004). Modern computers are designed in such a way that it has capacity and functions to design more interactive and engaging computer-based instructions (Merrill, 2013). To improve computer-based instructions, instructional designers have to seek better cognitive instructional learning strategies.
According to Knowlton and Simms (2010), there are many ways to integrate computers into education at the higher education level. The integration of productivity software such as word processor to enhance students learning experiences can serve as one example. Another way is integrating computer functions such as emails, discussion boards, and blog into online courses to support online learning environment. Even though the above-mentioned strategies of integrating computers are used, Knowlton and Simms (2010) argue that these strategies are not substantive enough to increase adult learners experience in computer-based instructions. They suggested that computer-based instruction is a preferred way to integrate computers into higher education because CBI is designed to meet the needs of adult learners. CBI provides students with focused practiced and timely feedback on students’ performance (Knowlton & Simms, 2010).

Furthermore, a study conducted by Yaworski (2000) shows that CBI is useful for teaching developmental skills to adult learners.

**Advantages of computer-based instruction.** Some of the advantages of CBI are:

- It is interactive
- It provides immediate feedback to students
- It motives learners
- It provides consistency in instructional presentation
- The level of difficulty can be adjusted to meet the learner needs.
- It can present concepts in more dynamic way and use multiple forms of representation
- It can keep records of student performance and progress (Alessi & Trollip, 1985).
Guidelines for designing and implementing computer-based instruction.

Since the introduction of computers into education, researchers have provided many guidelines for designing computer-based instruction. For example, Alessi and Trollip (1985) offered eight-step model for developing computer-based instructions: “(a) define the purpose, (b) collect resource materials, (c) generate ideas for the lesson, (d) organize your ideas for the lesson, (e) produce lesson displays on paper, (f) flowchart the lesson, (g) program the lesson, and (h) evaluate the quality and effectiveness of the lesson” (p. 275).

Similarly, Gibbons and Fairweather (1998) provided multiple designs and development process for designing computer-based instruction: (a) select an appropriate strategy pattern, (b) subdivide the strategy into blocks, (c) divide strategy blocks into content-related blocks, (d) shuffle content block into instructional order, (e) create content tables, (f) design the creative overly, (g) diagram logic blocks using authoring tool logic such as; prompted practice, unprompted practice logic, and demonstration, (h) create content tables, (i) create message tables, (j) channelize messages, specify continuity blocks, design screen, (k) create production sheets, (l) review by subject-matter expect and designer, (m) test and debug, (n) pilot test with students, and (o) archive and begin configuration control (p. 423).

Cognitive learning strategies. Cognitivism is a major learning theory which deals “with the internal mental processes” (Alias, Lashri, Akasah & Kesot, 2014, p. 217). According to Alias, Akasa and Kesot (2014) the term ‘cognition’ refers to “the thinking pattern which includes processes of memorizing, forgetting, elaborating, transforming
and storing the information” (p. 217). Thus, cognitivism entails concept formation and information processing. Piaget’s classification of cognitive development is assimilation and accommodation (Piaget, 2001). Assimilation involves the process of integrating new knowledge into existing knowledge (Piaget, 2001). According to Piaget (2001), it is the basic underlying structure of any learning. Students use their prior knowledge to solve newly encountered problems. Accommodation, on the other hand, involves the process of altering existing cognitive structure (Piaget, 2001).

Cognitive learning strategies involve an application of a holistic approach and whole-brain for solving problems (Schunk, 2004). According to Schunk (2004), a cognitive learning strategy is one of the most effective pedagogies for helping college students to increase their standardized test scores. Schunk (2004), pointed out that for cognitive strategies to be effective, the learner must first be motivated. Schunk (2004) explained that the instructor should engage the learner to appreciate the need to learn a content material. Also, the learner must be shown the available resources to support their learning instead of leaving them to guess for correct answers (Schunk, 2004). For example, in a standardized examination, the instructor can provide learners with sample test questions for practice.

Cognitive strategies require students to think about the approach to problems by memorizing. In standardized test and multiple-choice questions, for example, students may not have enough time to discriminate between correct and wrong answers (Sousa, 2008). Sometimes students end up estimating for discriminating between correct and impossible answers. This can be problematic because students may have to apply
multiple approaches to solving problems. Students may be required to engage themselves with practice to solve newly encountered problems. Sousa (2008), reported that effective cognitive strategies for achieving high scores in exams include: linking newly acquired knowledge to existing schemas, repeating complex methods, employing heuristics by identifying patterns in problems and continues the practice.

Copyright Education at the College Level

The complexities surrounding copyright and fair use issues in academia indicate that copyright education at the college level cannot be undermined. There is a direct implication of copyright on undergraduate students, including those who take online classes and those who do not. While there is a greater chance for them to use copyrighted works, they also stand a chance of creating their work as well. Therefore, there is the need for undergraduate students to gain an in-depth understanding of copyright and fair use issues in their academic endeavor.

Usually, undergraduate students are required to take projects or activities such as attaching documents, forwarding document, downloading articles from databases, and writing papers for a course; all involve copyright consideration. The venue of the online learning environment especially entraps high risk for students to infringe on copyright laws. It is easy to scrutinize online course content to check for possible copyright violations. Zielinski (1999) is of the view mention that “in this environment of increasingly sophisticated tracking mechanisms and heightened sensitivity to copyright issues, it’s just common sense for people who use outside materials … to be aware of potential copyright violations and to take the necessary steps towards compliance” (para.
1). It is imperative for college students to have knowledge of copyright laws because “ignorance of the law is no excuse” (Alsaffar, 2006).

One of the vital goals of information literacy in the higher education is to equip students with skills that would help them locate, evaluate and use information in dynamic ways. It seems that college students have a misconception that everything on the Internet is free (Perrott, 2011). Piechocinski (2009) advocates that integrating copyright education learning opportunities into the classroom is one of the effective ways of helping students to use learning materials more ethically for their academic purposes.

To explore college students’ understanding of cyber copyright law Chou, Chan, and Wu (2007) developed a two-tier test with 10 two-level multiple-choice questions for 123 college students and 121 high school students in Taiwan. The first part of the questions consisted of scenarios and students were asked to justify whether the conduct was acceptable, and the second part required students to provide reasons to justify the conduct. The results of the study indicated that college students scored significantly higher than high school students in both tiers. The researchers found that the three main alternative conceptions that both students had concerning cyber copyright laws were “(1) the Internet content is entirely open for the public use; (2) the Internet is always free; and (3) all educational is fair use” (Chou, Chan, & Wu, 2007, p. 1072). The results of the study imply that although college students seem to have a better understanding of copyright issues than high school students, both need some instruction to help them construct new, correct conceptions of cyber copyright laws” (Chou, Chan, & Wu, 2007, p.108).
Currently, media literacy needs of college students have gained more discussion in the literature (Kapitzke, Dezuanni, & Iyer, 2011). In higher education, researchers are trying to research for the best pedagogical approach to address gaps in copyright education (Kapitzke, Dezuanni, & Iyer, 2011). In some higher education institutions such as Indiana State University, Georgia State University, Jacksonville State University, and Oakland University, an emerging trend for bridging such gaps is the development of credit-bearing course copyright for students (Rodriquez, Greer, & Shipman, 2014). For example, McGrail and McGrail (2010) developed a course Copyright with Web 2.0 Application, and this course is being taught at both Georgia State University and Jacksonville State University as an attempt to help college students to gain a better understanding of copyright laws. The goal of this course is to “prepare students for responsible and ethical citizenship and effective participation in the emerging global economy for the future” (McGrail & McGrail, 2010, p. 270).

**Formative Research Studies**

Advocates of design research such as Reigeluth and Frick (1999), McKeeney and Reeves (2013) suggest that one of the best ways to improve an existing instructional design theory or model is to evaluate them by employing rigorous formative research methods to identify areas that need to be improved. As such there have been some researchers that have focused on formative research by designing instances to evaluate some existing instructional design theories or models.

Watson (2007) employed formative research methods to evaluate Games for Activating Thematic Engagement (GATE) instructional design theory. Watson developed
an educational video game called *Lifecycle* with GATE to teach an “undergraduate course on system analysis and design” (p. 6). One key finding from the study indicated that students were not comfortable being graded on their performance in a game. However, the students did not complain about being graded on their reflection paper assignments (Watson, 2007). It seems students can develop a negative attitude towards educational video games if they are pressured to perform. Watson (2007) therefore recommended that designers should design games with GATE that are intrinsically rewarding.

Hsu (2009) also employed formative research methods with Goal-Based Scenarios Theory and designed an instance on statistical concepts and delivered it in the form of simulation for ten graduate students in large Midwestern University in the United States. Hsu (200) used think aloud interview, debrief and a focus group as the main data collection process. The researcher reported that the think aloud interview technique was not effective because students felt being distracted in the process taking the simulation lesson. The researcher recommended that GBS could be improved in these aspects:

(1) provide a worked example or instruction that demonstrates the behaviors of using GBS and seeking supports in order to increase the user’s lower sense of self-efficacy while pursuing mission or assuming the role, (2) employ approaches of a small group usage and open-ended question to promote learners’ engagement and interaction in scenario operations, (3) carefully integrate other components in GBS to support hands-on activity, (4) provide cues in negative feedback and recapitulate the concept in positive feedback (p. 4).
Again, in the year 2012 Yagodzinski conducted a study aimed at refining an instructional design theory called Creating Online Learning Communities for Adults (COLCA). This theory was in its early stage of development which aimed at guiding the development of online learning communities for adults (Yagodzinski). In this study, Yagodzinski designed an instance by applying COLCA for developing a professional development module for faculty development. This study employed formative research methods using course documents, observations, email messages, and participant interviews as the main source of data collection. The main aim of these data techniques was to help identify areas where COLCA worked best, and areas that need to be improved.

In a recent study, Schladen (2015) conducted a formative study on an existing instructional design theory; goal-based scenario GBS as an attempt to advance instructional design theory for virtual patients (VPs), online interactive cases. An existing two modules were tested with 10 medical trainees to determine which GBS methods were incorporated to find out which one worked and did not work. The analysis of participants’ responses revealed that VP (Matt Lane) incorporated all the methods of GBS. The researcher found that one significant method, Life Mode, which involves replicating high degree of fidelity, was not incorporated in GBS (Schladen, 2015). The researcher recommended that Life Model method should be incorporated into GBS methods to help students solve complex problems. Table 1 shows the list of studies that applied formative research methods as an attempt to refine the theory or model.
Table 1 reveals that most of the formative research studies were conducted in the United States. Also, all the studies employed qualitative research method, and formative methods in data collection process to gain insight about how to refine the theory. Again, all the studies were conducted in higher education level. This might be because of rapid emerging of new educational tools at the higher education and instructional designers are being challenged to know more about how existing instructional design theories can be optimally used with available learning tools to improve educational practices.
Research on Component Display Theory

The studies included in this review had used CDT in one of these ways: The study had employed one or more of primary presentation forms, the study had focused on the combination of various primary presentation forms. It also focused on the combination of primary presentation forms, secondary presentation forms, and interdisplay relationships.

In 1994, Merrill published meta-analysis studies on primary presentation forms. In all Merrill (1994b) found 27 studies of primary presentation forms. Some of the results were conflicting; however, the consensus was that the combination of rule + example + practice is superior to any combination of primary presentation forms (Merrill, 1994b).

Many studies have been conducted on various components in primary presentation forms. In Klausmeier and Feldman’s (1975) study on rule-alone and example-alone presentations, found that there was no significant difference between the two presentation forms. This finding is an indication that rule and examples are comparable in regarding their presentation. Contrary, Coleman (1979) reported that rule alone was superior to example alone. Reigeluth and Merrill (1977) also found that presenting example alone was effective than the combination of rule and example. Again, in that same study, Reigeluth and Merrill reported that there was little difference between rule only and practice only. However, the reports from these studies revealed that the permutation of two or more presentation forms was superior and effective than presenting the rule alone (Merrill, 1994).

Others have conducted studies that focused on how practice, another primary presentation form influences students’ learning. The findings from three studies (Freitag
and Sullivan, 1995; Hannafin and Sullivan, 1995; Schnackenberg, Sullivan, Leader, and Jones, 1998) indicate that students who had a greater amount of time to work on practice items achieved better than their counterparts who had less amount of time. Schnackenberg et al., (1998) found that students who achieved higher scores spent 2 hours and 23 minutes in practice and those who achieved lower scores spent 2 hours and 9 minutes in their practice items. Also, a study by Reigeluth and Merrill, (1977) reported that practice alone was superior to examples alone.

Portwood (1995) in his dissertation examined the effects of primary presentation forms among Malaysian students on learning concept-classification, procedure-using, and principle-using task. Results of the study revealed that the combination of rule + example + practice was superior to rule only, rule + example concerning procedure-using and principle using task (Portwood, 1995). There was no statistically significant difference on concept-using task. The results of the study support Merrill’s (1994b) claim that the combination of rule + example + practice is superior to the combination of only two primary presentation forms.

Similarly, a study by Shock (1991) study on Merrill’s three presentation forms with 252 six-graders supports Merrill’s (1994b) claim that the combination of generality + example + practice is superior. Shock applied this three primary presentation forms to facilitate students’ procedural knowledge acquisition on learning location and points on a graph.

Literature review on CDT revealed that the combination of three primary presentation forms supports students’ achievement. In addition, research support
Merrill’s (1994) claim that rule + example + practice is superior compared to the combination of two or only one. Likewise, a combination of two primary presentation forms is superior to only one (Merrill, 1994b). Finally, Litchfield, Driscol, and Dempsey (1990) reported that a good presentation of generality could reduce the number of examples presented to the student. They suggest that primary presentation forms are not isolated but contribute to designing an effective instructional package.

**Summary**

The review of literature has revealed that learning becomes effective when instructional materials are presented in a logical manner. This assertion supports Merrill’s (1994) claim that rule + example + practice is superior compared to combination of two or only one. To better understand CDT, a detailed review of its components and studies were provided. Finally, design research methods were reviewed to facilitate the design of sound instructional event.
Chapter 3: Methodology

Introduction

The purpose of this study is to employ formative research methodologies to investigate an instructional design theory (CDT) by designing computer-based instruction modules. Participants were undergraduate students with different majors from the College of Education at a large Midwestern University in the United States. These students enrolled in a course that focuses on integrating computer technology into teaching and learning in K-12. The focus of this study was to examine CDT at the conceptual domain level and provide insights and application in designing computer-based instruction. The study employed formative research methodologies to explore the strengths, challenges, and evaluate possible improvements to the theory. The research questions guiding this study were:

1. What are the strengths and challenges of utilizing CDT in computer-based instruction?
2. What possible improvements or modifications can be made to CDT to increase its relevance to computer-based instruction?
3. Are all CDT presentation form types necessary for designing quality computer-based instruction?

To answer these questions, Shon (1996), pointed out that it is appropriate to employ a qualitative research approach to answer questions which require profound insights into a phenomenon. Shon suggests that it could be challenging to apply quantitative research approach to answer such questions thoroughly. In the same vein,
Reigeluth and Frick (1999) indicated that “traditional quantitative research methods (e.g., experiments, surveys, correlational analyses) are not particularly useful for improving instructional-design theory, especially in the early stages of development” (p. 634). Hence, the researcher employed a formative research method, a type of qualitative data collection procedure, to answer the research questions for this study.

In design research, an instance is designed and developed based on a theory or a model. For clarity, instance and module will be used interchangeably. In experimental studies for example, an instance can be described as a treatment. The instance can be described as a treatment in experimental studies. The instances for this study were a computer-based instruction to facilitate the participants’ understanding. The researcher used Adobe Articulate Studio 13 to design the two modules. The Adobe Articulate Studio 13 offers instructional designers the ability to design engaging and interactive lessons. Participants’ understanding of the targeted knowledge, copyright and fair use concepts were assessed by using three achievement tests.

In this study, the researcher heavily relied on qualitative data instead of quantitative data to answer the above-mentioned research questions because the focus of this study was to improve CDT prescriptions by employing formative research methods.

**Research Design**

This study employed a case study design. A case study design helps in combining both qualitative and quantitative data sources to provide a thorough understanding of a research problem (Yin, 2014). It also reveals potential challenges that instructional
designers need to know when applying CDT in such learning environments to solve real-world problems.

The reasons for choosing a case study approach for this study are two-fold. First, a case study has unique characteristics that allow researchers to gain an in-depth understanding of the case in question (Yin, 2014). Second, a case study approach provides researchers with a unique lens to provide descriptive and exploratory evidence of a case (Yin, 2014). Moreover, (2014) indicated that a case study approach is appropriate for answering “how and why” questions in exploring contemporary phenomenon (p. 4). In this study, the researcher is interested in knowing how CDT can be applied in designing computer-based instruction in teaching undergraduate with computer-based instruction. The researcher wants to investigate which of the CDT prescriptions will work best when designing computer-based instruction and how it can be improved.

**Participants**

The participants for this study were undergraduate students enrolled in Teacher Education Programs of the College of Education at a large Midwestern University in the United States. The participants’ majors include Early Childhood Education, Middle Childhood Education, Special Education, Physical Education, Pre-Specialized Studies, and Outdoor Recreation and Education.

The grade range of these participants is sophomores to seniors. The researcher intentionally chose these students as participants for this study because they are future K-12 teachers, and the content of the modules will play an essential role in their profession.
After obtaining approval from Institutional Review Board (IRB), a total of 16 participants were recruited for this study. The researcher got permission from the instructor of the class (EDCT 2030) and joined them in one of their face-to-face meetings and discussed the nature of the study with the students. After the discussion, the researcher asked the students who were willing to volunteer to participate in the study to sign-up with their names, email address, and their availability. Seventeen students volunteered to participate in the study. The researcher made a follow-up to contact each student to confirm their availability to participate in the study.

In phase I, the researcher selected the first eight participants who signed-up for the study and assigned them to the *Standard CDT version* and called them Group A. In phase II, the researcher selected the remaining eight participants and assigned them to the *Limited CDT version* and called them Group B. All the participants were required to complete an adult consent form (Appendix H), demographic survey (Appendix A), computer-based instruction (Appendix M & N), debriefing interview questions (Appendix B), and end-of-lesson survey (Appendix C).

All the participants were enrolled in a college-level hybrid course designed for undergraduate students seeking licensure to teach K-12. The hybrid course was a required course for all education major students intending to teach K-12. The major objective of this course was to equip students with educational technology skills necessary in teaching and learning settings. This course aimed at helping these future teachers to effectively and efficiently integrate technology into teaching and learning to improve the
instructional processes. This course was designed to enhance students’ confidence and competency level in integrating computers into teaching and learning.

The main content of the course focused on applying various technologies for all kinds of projects such as microblogs, wikis, blogs, video, and audio editing among many others. Based on the curriculum, one area of concern was how students could observe intellectual property regulations. The weekly assignments required students to apply at least one technology to create their instructional artifact. In the process of completing their assignments, students may need to use copyrighted materials to complete their projects. Blackboard learning management system was used as a platform where students were required to submit their assignments and receive their grades.

In this hybrid course, students met three times face-to-face with their instructor throughout a 16-week semester, and the remaining coursework was completed online. Apart from the face-to-face sessions, each week the instructor posted relevant learning materials and tutorials that helped the students to learn the assigned topics and complete the required assignments. The online meeting was either synchronous or asynchronous. The synchronous meetings were hosted in Adobe Connect learning platform.

The Role of the Researcher and Ethical Considerations

In qualitative research, the role of the researcher is one of the important aspects to address. In a case study especially, the role of the researcher regarding data collection and analysis must be carefully taken into consideration (Patton, 2002), because the assumptions and beliefs of the researcher can influence how data are collected and
analyzed. Therefore, it is important for the researcher to address and acknowledge assumptions that could pose potential bias to the study (Miles & Huberman, 1994).

The researcher for this study is an international graduate student in the Instructional Technology Program at a large Midwestern public University in the United States. The researcher holds a Bachelor’s degree in Social Studies Education and Master’s degree in Education. His interest in teaching motivated him to learn more about how to design effective, efficient, and appealing instruction to improve teaching and learning. Prior to his Master’s degree, he was employed as a Social Studies instructor at a high school in Ghana. The instructional challenges he faced urged him to find solutions to instructional design processes.

In his role as a Social Studies teacher, he was required to prepare a weekly lesson plan for each topic. This process requires a thorough understanding of instructional design processes. Based on his knowledge and enthusiasm for instructional design, he chose to apply CDT to design instruction on copyright and fair use concepts to find out how it would help undergraduate students to learn better. Also, the researcher is interested in identifying the strengths, challenges and possible improvements of applying CDT prescriptions in designing computer-based instruction.

Regarding strengths, challenges, and improvements of CDT, the researcher assumes that the students self-report learning information may help to identify areas where the theory worked best and where it didn’t and come up with possible improvements. The researcher assumes that CDT was developed in the 1980s where most of the modern educational technologies such as Adobe Articulate Studio were not
available. Therefore, he sees the need to explore CDT with modern instructional design tools. The researcher expects to discover unanticipated challenges when applying CDT in such learning environment. Hence, the experience of the researcher in the process of applying the theory to design the two instructional modules was used as a source of data in this study.

**Formative Research Methodology**

As an attempt to expand the knowledge base of instructional design theories, several educational researchers have advocated for a formative research approach in conducting design research (Carr, 1993; McKenney & Reeves, 2012; Newman, 1990; Reigeluth & Frick, 1999; Romiszowski, 1998). Reigeluth and Frick (1999) proposed that formative research methodologies qualify as one of the best ways for evaluating an existing instructional design theory for improvements. The major aim of formative research focuses on explicitly applying or building a theory or a model to the research process (Richey & Klein, 2007). The core tenets of formative research according to Reigeluth and Frick (1999) is that “if you create an accurate application of an instructional-design theory or model, then any weaknesses in the theory and any improvements identified for the application may reflect ways to improve the theory” (p. 636). Similar studies that have employed formative research approach to improve instructional design theories include; English and Reigeluth, 1996; Hsu, 2009; Kim, 1994; Lee and Reigeluth, 2003; Schladen, 2015; Watson, 2007; Yagodzinski, 2012.

It is important to point out the differences between formative research on an instructional design theory and formative evaluation of an instructional product. In the
formative research the designer has to design an instance that truly represents the theory explicitly, but in the formative evaluation of an instructional product, the designer can simply collect data from learners or users of the instructional product (McKenney & Reeves, 2012). Hence, the validity of formative research becomes critical compared to that of formative evaluation of an instructional product (Kim & Reigeluth, 1996). It is, therefore, necessary for instructional designers to focus on applying rigorous formative research methods to design instance that truly represents the theory.

Kim (1994) pointed out some salient issues that need to be considered when conducting a formative research study to ensure proper validation of data collection. First, the designers’ understanding and ability to apply the theory under consideration is important, because the designer should develop an instance according to the theory. If the designer does not have an adequate understanding of the theory, then the validity of the data collected from the instance can be questionable and hence may not accurately represent the theory.

Second, even if the instance is representing the theory, it is recommended that a theory expert confirms the representation to lend further credence to its validity. Hence, construct validity becomes very important because the instance must measure what it is supposed to measure.

Third, to increase external validity, the learning environment has to be as natural as possible, and the characteristics of the learners must be realistic and representative of the instructional setting for generalizability (Kim, 1994; Reigeluth, 1989). Finally, data
collection in formative research on an instructional design theory can be challenging (Kim & Reigeluth, 1996).

Reigeluth (1983) also pointed out two important questions that design researchers need to ask when applying formative research methods during data collection. They are: what kind of data will be useful for improving the theory? And/or how are useful data collected? Hence, characteristics of the instructional theory such as “sequencing, selection, instructional strategies, and/or task analysis” (Kim & Reigeluth, 1996, p. 325) should be considered.

To improve methods for conducting formative studies in the field of instructional design, Reigeluth and Frick (1999) proposed six procedures for conducting formative research:

1. Select a design theory
2. Design an instance of the theory
3. Collect and analyze formative data on the instance
4. Revise the instance
5. Repeat the data collection and revision cycle
6. Offer tentative revisions for the theory

The next section of this dissertation explains how these steps were followed in this study.

Procedures in Formative Research Study Design

Select a design theory. Reigeluth and Frick (1999) proposed that the focus of formative research is to improve an existing instruction design theory or a model. In this
study, the researcher chose David Merrill’s component display theory as a design theory. According to Merrill (1983), CDT is complete at the micro level of designing instructional materials. Based on available literature, no study that has applied formative research methods with CDT prescriptions as an attempt to improve the theory. The goal of this study is to employ rigorous formative research methods with CDT prescriptions to design computer-based instruction to teach college students copyright and fair use concepts. The aim is to identify the strengths, challenges, and ways to improve the theory to meet current instructional needs.

**Design an instance of the theory.** An instance, in this case, is the computer-based instruction on copyright and fair use designed with Adobe Articulate Studio 13 using CDT prescriptions as a framework. The researcher employed CDT prescriptions as a major design framework for designing computer-based instruction to help college students understand how to comply with copyright laws in a digital learning environment. Reigeluth and Frick (1999) pointed out that “the design instance should be as pure an instance of the design model as possible” (p. 639). Reigeluth and Frick (1999) suggested that to improve an existing instructional design theory or model the researcher must design the instance that truly represents the components of the theory. It appears that formative researchers on instructional design theories and models have placed great emphasis on construct validity (McKenney & Reeves, 2012; Reigeluth & Frick, 1999). The terms instance, instruction, and lesson will be used interchangeably in this study.

**The modules development.** One of the important considerations in conducting formative research on instructional design theory is to work with subject-matter expert
(McKenney & Reeves, 2012; Merrill, Tennyson & Posey, 1992) because in the process of designing the instance the researcher obtained appropriate content materials to design the instance. In this study, the researcher collaborated with a Librarian who is an expert in copyright issues, to gain a thorough understanding of issues relating to copyright and fair use and validate the content materials. The Librarian recommended the following materials: http://www.copyright.gov and http://www.wipo.int/portal/en/index.html. Also, the researcher contacted Glazatov who has conducted similar studies on copyright and fair use for content materials and advice. How she applied CDT was similar to how it was applied in this study to design the instance. The researcher adopted Glazatov’s (2015) end-of-lesson survey to evaluate the effectiveness and efficiency of the instances.

The next step is to design the instance based on CDT prescriptions. According to Merrill (1983), the combination of the performance-content matrix provides ideal conditions, behavior, and criterion for achieving the desired learning outcomes.

Two instructional instances were designed based on CDT prescriptions. The first instructional module contained the entire presentation forms of CDT, thus primary and secondary presentation forms, and interdisplay relationship (Standard CDT Version). The second instructional module contained only primary presentation forms and the interdisplay relation of CDT (Limited CDT Version). To address construct validity of the learning materials, the researcher worked with the subject-matter expert in the entire design process. Both versions of CDT were developed concurrently. It took about seven months for designing both instances, May 2016 to November 2016.
The application of CDT is more analytical because it requires careful analysis of its components such as Performance-content matrix, a specification of objectives, and presentation forms.

Below is the description of how CDT taxonomy was applied in designing copyright aspect of the instructional module in the Standard CDT. In the design process of the copyright aspect of the lesson, the researcher had to refer to the performance-content matrix to specify the appropriate performance level expected from the student. In this case, the researcher selected Use-Concept, because the student was expected to use the concept of copyright to classify copyright materials from non-copyright materials.

The objective of that aspect of the lesson was to help the student to classify copyright materials from non-copyright materials. Examples of patent and trademarks materials were used as non-examples to help the student to use the concept of copyright by sorting answers from multiple choices. Based on CDT objective specification, the objective of the copyright aspect of the lesson was written as; given a description of examples of copyright materials the student will be able to classify by selecting from multiple choice with no error, one point for each correct answer.

Based on CDT prescriptions the appropriate primary presentation form for Use-Concept is written as EG + Eegs + Iegs.N + Ieg.N. This implied that an expository (EG) presentation consisting of generality was presented to the student followed by specific examples (Eegs) of copyright, trademark, and patent. In the last aspect of the primary presentation, the student was presented with a new set of examples and was asked to classify which ones are copyright, patent, or trademark materials.
The second presentation form elements used include alternative representation, prerequisite information, and feedback. A two-minute video which talks about copyright in an academic setting and other textual explanation was presented to the students as a form of alternative representation. Intellectual property was used as prerequisite information to help the student to relate to the concept of copyright. Finally, correct answers were given as feedback.

When the two modules were completely designed, five instructional designers with an understanding of the theory were invited to conduct a formative evaluation to review the instances (Appendix F & G). The feedback from the review revealed that some aspect of CDT such as mnemonic was not properly applied in the module. Also, the test items were not enough to help the students to learn the concepts. The feedback from this evaluation process was used to improve the instances. A pilot study was conducted with four undergraduate college students majoring in Communication Studies and Integrated Media, Psychology, and Sociology. Two Communication Studies and Integrated Media major students participated in Standard CDT Version while two Psychology and Sociology major students participated in Limited CDT Version.

Collect and analyze formative data on the instance. Employing multiple sources of data such as interviews, observation, and document analysis is one of the advantages of conducting qualitative research (Yin, 2009). Previous formative studies such as Clonts, 1983; Glazatov, 2012; Hsu, 2009; Kim, 1994, Lim, 1994; Schladen, 2015; Shon, 1996; Yagodzinski, 2012, relied heavily on the qualitative data collection approach. Gathering data from multiple sources in formative research improves the
quality of the data and facilitates the process of triangulation in qualitative research (Patton, 2002). Triangulation offers the researcher an opportunity to combine data from multiple sources to achieve the purpose of the study (Patton, 2002). One advantage of triangulation is that it ensures that the flaws of one method are compensated by the strengths of another (Patton, 2002). Mile and Huberman (1994) pointed out that data analysis is one of the most challenging tasks in conducting qualitative research.

Participant’s comments made during the debriefing sessions were categorized based on the emerging themes.

For instance, Participant 3 indicated on the end-of-lesson survey that she strongly agrees that the module had increased her understanding of the concepts of copyright and fair use. In this case, the researcher crossed-verified from the interview transcript to find out if she shared the same information when she was asked to share the new knowledge she had acquired after taken the module. To overcome these challenges, the researcher crossed-checked participants’ responses from the end-of-lesson survey and interviews for consistency.

**Instrumentation**

The researcher used a total of five tools for data collection in this study. These tools are a set of questions for debriefing sessions (Appendix B), observation, end-of-lesson survey (Appendix C), screen recording, and a time log. The debriefing questions are a set of open-ended questions used for collecting data about students’ reaction and experience after completion of the instance. Also, the debriefing session was used to help the students to self-report their learning experience. The debriefing session was in the
form of a face-to-face interview with participant’s right after they had completed the lesson. The purpose of the debriefing questions was to gather rich qualitative data to find out CDT prescriptions that worked best and those that did not work and to come up with possible improvements of the theory. The purpose of the observation technique was to take notes and make sure that any technical difficulties that would emerge would be solved in the process of the study. The purpose of the end-of-lesson survey was to find out the efficiency, effectiveness, and appeal of the lesson. The end-of-the lesson survey questions consisted of 11 Likert-scale type questions obtained from Glazatov (2015). Participants’ responses to the end-of-lesson survey served as a guide during the debriefing sessions to ensure that there is consistency in the participants’ responses.

Data Collection Procedures

The primary data sources used for this study were debriefing interviews, observations, and document from the screen recording. The secondary quantitative data were collected from end-of-lesson survey and time logs. It is important to mention that the researcher was another source of data. The researcher collected data on himself regarding the challenges that surfaced during the study, especially on how CDT was applied in designing both instances.

Observation. Patton (2002) pointed out that in qualitative research observation, techniques give the researcher the opportunity to observe the research setting, the participant, and activities in the research setting from a more natural environment. Observation provides researchers with better understanding and context of how participants interact with the research situation. Moreover, observation reduces the
likelihood of the researcher making pre-assumptions (Patton, 2002), which can negatively influence the outcomes of the study. Also, the combination of observation and interviewing techniques can provide the researcher with a more comprehensive understanding of the research setting.

In this study, observation technique was used to provide the researcher an opportunity to systematically take notes in the process of participants’ reaction to the instance. Also, the researcher would be familiar with unexpected situations and address them for future improvement (Glense, 2006).

**Debriefing.** Another source of data used in this study was the interview. Participants were asked to describe their experience after completing the lesson in the form of debriefing. Participants were requested to provide constructive responses based on their experience from the lesson because this was a way to improve an instructional material. Participants were encouraged to truthfully self-report their experience from the tutorial.

Patton (2002) suggested that interviewing participants is one of the direct ways to collect rich formative data. Patton (2002) further stated that the interview technique “allows us to enter into the person’s perspective” (p. 341). According to Patton (2002), the three ways of approaching qualitative interview data are: (a) the informal conversational interview, (b) the general interview guide approach, (c) the standardized open-ended interview (p. 342). In this study, the researcher adopted the interview guide approach where a series of predetermined questions were used to seek participants’ experience from the lesson.
Reigeluth and Frick (1999) also pointed out that interview questions in a formative study should focus on how to identify the flaws in the instance being used. The interview questions should help the researcher to identify the strengths, weaknesses, and the best ways to improve the instance. Reigeluth and Frick (1999) mentioned that the flaws that would surface in the early part of the interview process should be corrected so that they will not be repeated during the conduct of the study.

Each participant was interviewed after completing the instance. The researcher conducted the entire interview with each participant. Each interview lasted for about 20 minutes. All interviews were recorded, transcribed and kept in a locked cabinet in the researcher’s office. A code was assigned to each participant’s data file for confidentiality. The participants were informed that their participation was voluntary, and their responses would not affect their grades.

**Document analysis.** Another important qualitative technique used for data collection in this study was document analysis. According to Patton (2002), documents can be records, artifacts, and achieves. The documents used in this study were the screen recordings from the participants’ computer. All the screen activities of each participant were recorded and used as a guide during the debriefing section. The researcher analyzed the screen recording alongside with the interview recording and observational notes to check for consistency. The other document used as a data source was time log. This was the recording of how long it took each participant to complete the lesson. Time log data was important to check for the efficiency of the lesson.
End-of-lesson surveys. In this study, the researcher adopted a pre-existing end-of-lesson survey instrument. This instrument had been validated in Glazatov’s study in 2015. Glazatov (2015) applied CDT prescriptions to design a similar lesson used for this study. The researcher obtained written permission from Glazatov before using the end-of-lesson survey (See Appendix J). The purpose of adopting such survey instrument was to understand participants’ experience and perceptions about the learning materials based on the presentation forms. The survey aimed at asking participants to rate the quality of the instruction. The end-of-lesson survey was used to assess the appeal of the instruction and student’s attitude towards the instruction. Participants were asked to rate on a scale from 1 - 5 the degree to which they liked the instructional unit, the sequence of the instruction, and relevance of the instruction for their academic purposes. That was a way of checking for consistency by cross-checking qualitative statements the participants had already made.

Research Activity

The four main activities that participants performed were: signing a consent form, completing the instructional instance on copyright and fair use, completing the end-of-lesson survey, and the face-to-face debriefing session.

Each participant was assigned a different time slot to come to the research room. The researcher explained the purpose and procedures of the study to each participant. The researcher informed each participant that the study was testing instructional material to identify its strengths, challenges, and ways to improve it. Also, the researcher informed
participants that any problem the participants encountered might be associated with the weakness of the approach, rather than their deficiencies.

**Step one.** Each participant completed a hard copy of the adult consent form and a demographic survey. Participants had the opportunity to ask questions and have them answered before they choose to participate in the study.

**Step two.** After gaining their consent, participants were asked to complete a computer-based lesson on copyright and fair use concepts. The lesson was designed with Adobe Articulate Studio 13 and delivered on Microsoft Window 7 computer. The activity process on the computer monitor screen was visually recorded using Snagit 11, screen recording software. It was only the participant’s computer screen that was video recorded not the participants themselves. The purpose of the screen capture was to collect data about participants’ progress and reaction to each section in the lesson. After that, participants completed the end-of-lesson survey after the lesson. The researcher observed and took notes of the entire learning process. Typically, the lesson was designed to last for 40 minutes.

**Step three.** This step allowed participants to reflect on their learning experience after completing the instance. The debriefing session audio recorded with a portable audio recorder and locked in a cabinet at the researcher’s office. The debriefing session for each participant lasted for about 20 minutes. Figure 6 represents the flow chart of the research activities that participants followed.

As an attempt to find out the relevance of secondary presentation form elements in the lesson, group B participants were introduced to the Standard CDT lesson if they
can identify those elements without prompt, and how that could have helped them learn better.

**Observation.** Patton (2002) pointed out that in qualitative research observation, techniques give the researcher the opportunity to observe the research setting, the participant, and activities in the research setting from a more natural environment. Observation provides researchers with better understanding and context of how participants interact with the research situation. Moreover, observation reduces the likelihood of the researcher making pre-assumptions (Patton, 2002), which can negatively influence the outcomes of the study. Also, the combination of observation and interviewing techniques can provide the researcher with a more comprehensive understanding of the research setting.

In this study, observation technique was used to provide the researcher an opportunity to systematically take notes in the process of participants’ reaction to the instance. Also, the researcher would be familiar with unexpected situations and address them for future improvement (Glense, 2006). Finally, the researcher wanted to make sure the research environment is as natural as possible so that it would not have any negative influence on data that would be collected. Figure 6 represents a flow of research activities the researcher and the participants followed in the research process.
Revise the instance. According to Reigeluth and Frick (1999), the instance can be revised when the researcher feels confident about the value and use of it. Data collected at the pilot stage were transcribed and analyzed, and the results were used to improve the instance for the actual study.

Repeat data collection and revision cycle. A total of 16 undergraduate students were recruited from EDCT 2030 class to participate in this study. The first eight students...
who volunteered to participate in the study were assigned to complete the *Standard CDT Version* (Group A) while the remaining eight students completed the *Limited CDT Version* (Group B).

Reigeluth and Frick (1999) recommended that data collection, analysis, and revision should be repeated to enhance external validity. The process helps to confirm earlier findings and enhance the generalizability of the study to some extent. This was to ensure that saturation level is attained. Thus, the researcher is not getting any new data from the participants. The data collection procedure used in phase I was repeated in phase II, except that phase II participants were not allowed to verbalize their thoughts in the process. Also, participants in phase II took improved versions of the instructional instances. This approach was to enhance reliability and validity of the study. The researcher stopped collecting data when saturation level was reached. At the saturation point, the researcher kept on collecting the same data that were not distinct from the previously collected data.

In phase I, one of the participants pointed out that some of the test items were ambiguous and were difficult to understand. Another participant also revealed that the font size of the text was small, and she found it difficult to read from the computer screen. She also suggested that instead of two sets of quiz the researcher should add another set of quizzes at the end of the lesson to measure the overall understanding of the concepts. Also, one of the participants at phase I suggested that the researcher should add an introductory video of how to navigate on the learning platform, although there was a
text explanation of how to work on the module. She also recommended that more pictures be added to the lesson to make it more appealing.

In phase II, the researcher used the font size tool in Adobe Articulate Studio 13 to enlarge the text size for it to be eligible to read. Another set of quiz items were added at the end of the lesson. More pictures were also added to the lesson. Finally, ambiguous test items were revised. The researcher found that it was difficult to write conceptual test items based on CDT taxonomy.

**Offer tentative revisions for the theory.** Based on the findings from phase I and phase II, the researcher can propose an improved version of CDT prescriptions when applying it to design computer-based instruction. Future researchers should replicate the theory and revisions be made to validate any modifications (Reigeluth & Frick, 1999).

**Data Analysis Procedures**

**Qualitative data analysis.** In qualitative research, data analysis is one of the essential stages that researchers need to take into consideration (Miles & Huberman, 1994). Qualitative data analysis is all about how to draw valid meaning from the data collected. Miles and Huberman (1994) put it in a question form, “what methods of analysis can we use that are practical, communicable, and non-self-deluding – in short will get us knowledge that we and others can rely on?” (p. 1).

Qualitative researchers such as LeCompte (2000), and Rubin and Rubin (2012) have provided guidelines for conducting qualitative data analysis. LeCompte (2000) outlined a five-step data analysis approach which includes: (a) tying up, (b) finding items, (c) creating stable set of items, (d) creating patterns, and (e) assembling structures (p.
Similarly, Rubin and Rubin (2012) offered a five-stage data analysis model for analyzing qualitative interview data: (a) "recognizing and finding concepts, themes, events and topical markers, (b) clarifying what is meant by specific concepts and themes and putting together an overall narrative, (c) coding – figuring out a brief label to designate each and then mark it, (d) storing the data by grouping all the data units with the same label into a single file, and (e) final synthesis - combining concepts to suggest the relationships, evaluations and possible theories" (p. 189).

Data analysis in this study took the following form: to increase construct validity, all data sources, which included observations, notes, quiz scores, and interview transcripts, were compiled and put together in a Microsoft Word file. The audiotape from the debriefing session was transcribed. The completed transcripts were summarized and grouped based on the questions asked during the debriefing session. Then, the researcher made a close consultation to CDT prescriptions applied in this study to find out which prescriptions worked best for the participants and which ones did not work. For example, CDT prescribes how to use examples and non-examples to teach a concept. In this study, for example, the researcher used patent and trademark as nonexample to help learners to learn copyright concept. Finally, based on the available data the researcher made recommendations and suggested ways that can be adopted to improve CDT in the context of the study.

The researcher employed a deductive approach based on CDT prescriptions for data collection (Burnard, Gill, Stewart, Treasure & Chadwick, 2008). Figure 7 shows the deductive approach stages used in this study.
As an attempt to reduce the risk of collecting extraneous information during the debriefing session, the researcher relied on the propositions of CDT prescriptions during data analysis for this study. The debriefing session, observation, document analysis, and notes all focused on the CDT prescriptions. This approach was chosen because the researcher wanted to explore CDT propositions in a particular circumstance to find out its strengths and challenges, and identify possible improvements.

**Test scores data analysis.** The other data collected was participants’ test scores. In all, there were three quizzes. Quiz one and two consisted of five multiple-choice items, and quiz three had six multiple choice items. The quizzes were scored on percentages. Each quiz item was scored to measure the validity of individual quiz items. Frequency and average percentage score were computed to determine the performance between the two groups and establish differences in the individual participants’ performance.

As an attempt to check for retention of knowledge, participants were invited to retake the three quizzes. Three participants from group A and four participants from group B agreed to retake the quiz.
Enhancing Trustworthiness, Validity and Credibility of the Data

Concerns over trustworthiness, validity, and credibility of the data are raised in qualitative research where the researcher is the main instrument for data collection. Therefore, it is important in such situations for the researcher to acknowledge that there may be some biases and assumptions that can influence the research process. Employing multiple strategies is critical to ensuring the validity and credibility of the data (Creswell, 2014). In this case study, the researcher employed the following strategies to enhance trustworthiness, validity, and credibility of the study: triangulation, member check, peer examination.

**Triangulation.** Triangulation is a research data collection method where various data sources are used to find converging evidence on the responses (Creswell, 2014). In qualitative research, validity may be achieved if the researcher can establish common theme from converging different data sources. Patton (2002) suggested five ways of conducting triangulation of data in qualitative research, these are:

1. Comparing observations with interviews;
2. Comparing what people say in public with what they say in private;
3. Checking the consistency of what people say about the same thing over time;
4. Comparing the perspectives of people from different points of view. For example, during an evaluation, a researcher could triangulate staff views, client views, funder views, and views expressed by people outside the program; and
5. Checking interviews against program documents and other written evidence
that can corroborate what interview respondents report (p. 559).

In this study, data were collected from multiple data sources; observation, end-of-lesson survey, interviews, and document analysis. Each data collected was analyzed independently and later triangulated to confirm for meaning and consistency. The researcher used descriptive analysis, content analysis, as well as inductive and deductive analysis for analyzing information from different data sources.

**Member checks.** Member checks involve the process of soliciting feedback from the participants in an attempt to validate the data (Creswell, 2014). This process is sometimes referred to as respondent validation. It provides the researcher with an opportunity to polish the data before it is finally reported in the results. Maxwell (2009) opined that “the single most important way of ruling out the possibility of misinterpreting the meaning of what participants say and do and the perspective they have on what is going on, as well as being an important way of identifying your own biases and misunderstanding of what you observed” (p. 244). After all data were transcribed, participants were invited to read the transcript to ensure the accuracy of their responses. In the process of debriefing, participants were encouraged to report more constructive feedback based on their experience from the lesson than saying something just to please the researcher.

**Peer examination.** This is about involving a colleague who can provide objective and constructive criticism about the data. This is an attempt to produce a deep and sound understanding of the data (Creswell, 2014). This process helps other readers to understand the study apart from the researcher. In this study, a doctoral student and
graduate assistant in the Instructional Technology Program in the College of Education served as peer examiner.

**Specification of Pilot Study**

The pilot study was conducted to find out if the research protocol is realistic and workable. The purpose of the pilot study was to guide this study regarding of selecting appropriate instruments, refining the instance, and specific activities to implement. Also, the pilot study provided insights in examining the stability and quality of data record from screen capture software (Snagit), audio equipment, and Adobe Articulate Studio 13 functions. The audio and video equipment were stable and the data collected were of good quality.

In phase I of the study, two instructional instances were designed. The first instructional instance was designed with CDT prescriptions which incorporated all the three presentation forms of CDT (primary presentation forms, secondary presentation forms, and interdisplay relationship) and named it *Standard CDT Version*. The second instructional instance was designed with CDT prescriptions with only primary presentation forms and interdisplay relationships, and named it *Limited CDT Version*.

The researcher recruited four students to participate in the pilot study. Two students participated in each version of CDT. Two of the participants were undergraduate students majoring in Communication Studies and Integrated Media, and the other two were undergraduate students majoring in Psychology and Sociology. The pilot study for *Standard CDT Version* was conducted on September 5, 2016, while that of *Limited CDT Version* occurred on October 3, 2016. Two students majoring in Communication Studies
and Integrated Media completed *Standard CDT Version* while other two students majoring in Psychology and Sociology completed *Limited CDT Version*. Each participant was scheduled to an individual time slot to report at the venue of the research to participate. Results from the pilot study informed the researcher about the protocol of this study regarding of instrumentation and data analysis.

**Procedures.** During the pilot study, participants could verbalize their thoughts as they progressed in the lesson without any interruption from the researcher since interference could affect the learning activity. The researcher did not engage participants in any conversation. Rather, all concerns were noted in the field notebook. Sometimes the participant would ask the researcher questions regarding the quiz items. For example, when one participant was answering item 5 in the first quiz, she asked the researcher “I think a logo can be a copyright material, what do you think.” The researcher did not provide her the correct answer but encouraged her to focus on the lesson.

The major findings from the pilot studies are:

- Two participants, one from the *Standard CDT* version and the other from *Limited CDT* lesson suggested that the researcher should add an end-of-lesson quiz to the lesson. The rationale was that they wanted to test their understanding of all the concepts at the end of the module.

- Initially, the researcher planned to analyze the end-of-lesson survey, but the results from the pilot study indicated that it would be useful to use it to guide the debriefing questions to check for consistency in the participants’ comments during the debriefing session. The rationale was to use participants’ responses
from the end-of-lesson survey as evidence from other data source such as the interviews.

- Originally, the researcher decided to use deductive approach as a coding scheme to analyze the data to answer the research questions, but it was revealed from the pilot study that inductive approach based on CDT parameters would be effective for data collection. This reduced the tendency of collecting extraneous information that would not be useful to answer the research questions.

- All the participants found primary presentation forms to be effective and logical.

- All participants preferred contextual and relevant examples.

- Both instances were designed to last form 30 minutes, but three participants pointed out that they needed more time to complete the instances.

- A few typographical errors were also identified.

**Chapter Summary**

In this chapter, the researcher presented the procedures and formative research methods used during the data collection exercise aimed at improving the CDT prescriptions. The descriptions of all the procedures guided the researcher informed the data collection exercise to answer the research questions, analyze data, as well as to address bias and suppositions of the researcher in the research process.
Chapter 4: Findings

This chapter presents the results of the study through a narrative of the instructional design process that documents how component display theory (CDT) prescriptions were applied in developing an instance and how formative feedback from participants’ learning experience was used to analyze the theory. The learning experience in this context consisted of presentational strategies. Data were collected on the strategies that worked, strategies that did not work, and why. The participants’ learning experience was captured using a set of debriefing interview questions. Also, the researcher used the end-of-lesson survey as a guide to probe participants on their learning experience. The rationale was to triangulate different data from both qualitative and quantitative sources.

The research questions guiding this study were:

1. What are the strengths and challenges of utilizing CDT in computer-based instruction?

2. What possible improvements or modifications can be made to CDT to increase its relevance to computer-based instruction?

3. Are all CDT presentation form types necessary for designing quality computer-based instruction?

To evaluate CDT, the researcher developed two instructional instances based on CDT prescriptions. The first instance consisted of the original CDT prescriptions named Standard CDT. In Standard CDT, the researcher applied the primary presentation forms, secondary presentation forms, and interdisplay relationship elements in the CDT prescriptions. In the second instance, the researcher utilized only components in the
primary presentation forms and interdisplay relationship without adding any of the secondary presentation forms, named *Limited CDT*. This decision was an attempt to evaluate and verify Merrill’s (1983) claim that “the primary presentation forms are the main vehicle of instruction” (p. 308) and secondary presentation are methods just to help the student process the learning material. This study aimed at employing formative research methodology to explore how efficient both versions of CDT would be, based on formative feedback from participants.

Both instances were designed to teach undergraduate students the concepts of copyright and fair use. The quiz items were the same in both instances. The participants for this study were 16 undergraduate students from a large public university in Midwestern Ohio in the United States. Eight students participated in *Standard CDT* (Group A), and the other half participated in *Limited CDT* (Group B). Data were collected through interview techniques, debrief, document analysis, and observation. Participants were asked to critique the instances constructively because that would help to improve CDT prescriptions.

The findings from this study are grouped into three sections. The first section was organized into CDT components, which includes primary presentation forms, secondary presentation forms, and interdisplay relationship. The second section presents the analysis of codes and themes that emerged from the interview transcripts, and the last section presents the quantitative results for both groups to demonstrate their performances from the quiz items in the instance. The quantitative data also put the qualitative results into perspective by comparing the participants’ performance in both groups. The qualitative
data from both groups were analyzed based on CDT’s prescriptions. The themes that emerged from the analysis of the interview transcripts were coded based on CDT taxonomy. This process offered a systematic approach for analyzing the qualitative data to produce reliable findings.

Tables 2 and 3 represent demographic information for group A and B participants respectively. From Tables 2 and 3, students came from five different majors with age range, 18-22 years. Females were the majority in group A while males were the majority in group B. All the participants were traditional American students.

Table 2
Demographic Information of Group A Participants

<table>
<thead>
<tr>
<th>Participant</th>
<th>Gender</th>
<th>Major</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participant 1</td>
<td>Female</td>
<td>Early Childhood</td>
<td>Sophomore</td>
</tr>
<tr>
<td>Participant 2</td>
<td>Female</td>
<td>Early Childhood</td>
<td>Junior</td>
</tr>
<tr>
<td>Participant 3</td>
<td>Female</td>
<td>Middle Childhood</td>
<td>Junior</td>
</tr>
<tr>
<td>Participant 4</td>
<td>Female</td>
<td>Special Education</td>
<td>Sophomore</td>
</tr>
<tr>
<td>Participant 5</td>
<td>Female</td>
<td>Early Childhood</td>
<td>Sophomore</td>
</tr>
<tr>
<td>Participant 6</td>
<td>Male</td>
<td>Physical Education</td>
<td>Sophomore</td>
</tr>
<tr>
<td>Participant 7</td>
<td>Male</td>
<td>Recreation Management</td>
<td>Sophomore</td>
</tr>
<tr>
<td>Participant 8</td>
<td>Male</td>
<td>Physical Education</td>
<td>Junior</td>
</tr>
</tbody>
</table>
Table 3

Demographic Information of Group B Participants

<table>
<thead>
<tr>
<th>Participant</th>
<th>Gender</th>
<th>Major</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participant 1</td>
<td>Female</td>
<td>Early Childhood</td>
<td>Sophomore</td>
</tr>
<tr>
<td>Participant 2</td>
<td>Female</td>
<td>Early Childhood</td>
<td>Junior</td>
</tr>
<tr>
<td>Participant 3</td>
<td>Female</td>
<td>Middle Childhood</td>
<td>Junior</td>
</tr>
<tr>
<td>Participant 4</td>
<td>Female</td>
<td>Special Education</td>
<td>Sophomore</td>
</tr>
<tr>
<td>Participant 5</td>
<td>Female</td>
<td>Early Childhood</td>
<td>Sophomore</td>
</tr>
<tr>
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<td>Male</td>
<td>Physical Education</td>
<td>Sophomore</td>
</tr>
<tr>
<td>Participant 7</td>
<td>Male</td>
<td>Recreation Management</td>
<td>Sophomore</td>
</tr>
<tr>
<td>Participant 8</td>
<td>Male</td>
<td>Physical Education</td>
<td>Junior</td>
</tr>
</tbody>
</table>

Qualitative Data Analysis: Standard CDT version (Group A)

Based on CDT’s performance-content matrix, the objectives of the lesson can be classified as *Use-concept* and *Remember-procedure*. The learning objectives for both instances were; the learner will be able to:

- correctly classify previously unencountered examples of copyright, trademark, and patent work;
- correctly classify appropriate copyright limitations in a digital learning environment;
- correctly employ a general process of determining how to use copyrighted work in an academic setting.
**Primary presentation forms.** The CDT prescription for *Use-concept* is written as $\text{EG} + \text{Eegs} + \text{Iegs.N} + \text{Iegs.N}$. (Merril1994b). This means, first an *Expository* presentation consisting of *Generality*($\text{EG}$) (definition) is presented followed by *Expository Instance*($\text{Eegs}$)(examples) followed by different kinds of examples that will help the student to apply *Inquisitory Instance* ($\text{Iegs}$) (practice) the concept in a new or unencountered situation.

In this study, the researcher first defined the concepts: copyright, trademark, and patent, followed by series of examples. Then participants were asked to distinguish between these concepts in the form of examples and nonexamples and finally followed by another set of examples that were different from the first examples. Table 4 demonstrates the alignment of how CDT primary presentation form prescription was applied to achieve the first learning objective in the lesson.

<table>
<thead>
<tr>
<th>Table 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alignment of Primary Presentation Forms in Achieving the First Learning Objective</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step 1</th>
<th>Step 2</th>
<th>Step 3</th>
<th>Step 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Expository Generality (EG).</strong></td>
<td><strong>Expository Instance (Eegs)</strong></td>
<td><strong>Inquisitory Instance (Iegs.N)</strong></td>
<td><strong>Inquisitory Instance (Iegs.N)</strong></td>
</tr>
<tr>
<td>Definition of Copyright, Patent, and Trademark</td>
<td>Provide specific events or situations of Copyright, Patent, and Trademark</td>
<td>Provide examples of Copyright, Patent, and Trademark, and ask the learner to classify which ones are examples of copyright, Patent, or Trademark. All examples should illustrate the attribute value of the definition</td>
<td>Repeat step 3 by providing new set of examples and the learner to classify. Steps 3 and 4 and framed in a question form</td>
</tr>
</tbody>
</table>
The first component of primary presentation form for *Use-concept* is *Expository Generality* (definition). For clarity, the terms instance, module, and lesson will be used interchangeably in this chapter. Each participant from both groups completed the module on individually. After completing the lesson, each participant was asked to share their learning experience during the debriefing session. Below are qualitative reports participants shared regarding their learning experience during the lesson.

Researcher: Please tell me, what did you like about the lesson?

Participant 2 mentioned that, “I think the concepts were well-defined and I didn’t have a hard time to understand any of them. In fact, they were straightforward, and I liked the way the whole thing [the lesson] was structured.”

Although most participants were not familiar with the concepts of copyright and fair use, some participants articulated the need to know more about the content. For example, Participant 3 stated the following regarding copyright law:

I know something about copyright, but I have never taken any formal lesson like this one before. I think this is a great way to get students understand copyright laws better. The language was clear and easy to understand. I remember in my freshman year at college it was kind of difficult to work with copyright materials. I know I could be in trouble if I don’t use those materials appropriately. So, I think this lesson is very useful for me. It was not difficult to learn because it was straightforward.

Participants 1 and 8 also expressed that the concepts were relevant for academic purposes. For example, Participant 1 said:
This lesson teaches very important topic because sometimes in my class projects I struggle to figure out how to use copyrighted materials. I try to make sure I do the right thing because inappropriate use of copyright material can put me into trouble.

Participant 5 specifically mentioned that the presentation of the lesson was logical by stating that:

I liked the sequence of the lesson because after studying each concept I had a couple of examples to refer to get the clear meaning of each of them. I think that was a great way to present a lesson.

Similarly, Participant 7 said:

I liked the way the lesson was organized. I think it is better than just reading a book trying to learn these concepts. He further stated that: I think the lesson was more engaging too because I had questions to check for my understanding. I think that’s great.

Researcher: Can you tell me more about the organization of the lesson?

Participant 7 further explained that:

Each concept had concrete examples that helped me to understand. Sometimes I don’t get the understanding just from reading the definition, but after going through a few examples, I gained better understand. I think that can be considered as a strength for the lesson. From my experience, I think the lesson was well-organized.
Participants 4 and 6 also mentioned that the length of the lesson was appropriate. For example, Participant 4 stated that, “the length of the whole lesson was appropriate, you don’t have to spend too much time to finish.” Participant 6 also commented that, “I think this is good for one lesson period.”

Researcher: Tell me what you did not like about the lesson?

Participant 2, 3, 4, 5, 7 pointed out that some sections of the lesson were wordy. They preferred pictures, videos, and diagrams to demonstrate what is being taught. For example, Participant 2 indicated that:

I became bored when I had to spend more time reading some section in the lesson that had only words without a video, diagram, or picture. Some sections had pictures and videos that were easy to follow.

Similarly, Participant 3 mentioned that, “In fact, when I got to that section that was full of reading I was not motivated to read.” Participant 7 also expressed that, “The videos and pictures made the lesson more appealing than text only.” Participants 6 and 8 did not see anything wrong with the lesson. For example, Participant 8 mentioned that, “I think I like the lesson, it was appealing to me.”

The second component of primary presentation forms for Use-concept is the Expository Instance (Example). Participants were asked to share their learning experience with the examples that were presented to them in the lesson to help them understand the Generality.

Researcher: Could you please share with me what you think about the examples presented in the lesson?
Participants statements concerning their experience about the examples presented were positive. Participant 1 expressed that the examples were specific to each concept and were easy to follow. She thought that the examples were not too difficult to understand. Similarly, Participant 2 explained that:

The examples were helpful for me to understand the concepts; they were all familiar. Even though I didn’t know more about copyright laws, the examples you presented helped me to think about some situations I was dealing with copyright issues.

Participant 3 commented that:

I liked the examples because they were all school related. They were concrete examples, and I didn’t have a problem to figure them out.

Participant 5 also shared a similar thought by stating that, “That the examples were in the right context because I know copyright is a familiar concept I hear in academia most of the time.” Again, Participant 8 said that:

I liked the examples because you used real-world scenarios to present each case. I remember you used how copyright and fair use documents are used in the Blackboard. I would like to know more about how these materials are used in Blackboard by Professors and students.

Participants 4 and 6 shared similar views that the examples were not redundant, but diverse enough to help classify one concept from another.

The researcher wanted to find out participants’ experience concerning the number of examples presented to them.
Researcher: Why are you saying you liked all the examples? Were they too small or they were plenty?

All the participants were satisfied with the number of examples presented, though none of them talked about a specific number of examples they needed. For example, Participant 5 mentioned that, “At least I had more than one example for each concept to work with, so I think that was enough for me.” Similarly, Participant 3 pointed out that, “I wasn’t much concerned about the number of examples presented even if it’s only one and that can help me to understand the concept I think I’m fine with it.” In addition, Participant 8 indicated that, “I think the examples were not redundant and that helped me to look at each concept from a different angle.” Some participants expressed that they had enough and diverse examples that helped them understood the concepts (Participants 1, 2, 4, 6 & 7).

The third component of primary presentation forms for Use-concept is the Inquisitory Instance (Practice). When participants were asked about their learning experience on the worked examples and quiz items, their feedback was positive (Participants 1, 3, 4, 5, 6, 7 & 8). However, Participant 3 expressed that the quiz items were a bit difficult for her, stating that she was confused when she was asked to classify examples from nonexamples. Figure 8 represents the quiz item.
Participant 8 explained that: I liked the way the whole lesson was sequenced. After reading through each concept, there were examples followed by a quiz. I liked that because I don’t have to learn all the concepts and take one long quiz. I think that helped me to understand the whole lesson well.

Participant 1 indicated that: I think the quiz reflected what I read from the lesson. The quiz was not assessing a different thing than what was in the lesson. Majority of the participants agreed that the practice items were neither difficult nor easy, they were appropriate for assessing their understanding of the concepts.

Researcher: What do you think about the content materials? And why?

Participant 1 stated that, “I think they are more educative because at the college level everyone needs to get an idea of how copyright laws work.” The rest of the participants expressed that copyright and fair use are relevant topics to them because in some of their assignments they are required to use or be mindful of copyright materials. Therefore, it is necessary to gain a better understanding of how copyright laws operate in academic institutions and class projects.
Finally, CDT does not provide any specific sequence for the presentation of the content materials, so the researcher wanted to inquire about the usefulness of the presentational sequence used for this study (i.e., definition + example + practice).

Researcher: What did you find specifically useful about the presentational sequence of the lesson?

Participant 2 expressed that, “It was easy to follow and motivated me to complete the entire lesson.” Similarly, Participant 4 stated that, “I think it gave the lesson more meaning and motivated me to continue the lesson.” Participant 5 and 7 also thought that it is an efficient way to help students learn because everything was well sequenced and that can reduce frustration to some extent.

Participants 1, 3, 6, and 8 shared a similar experience that each concept was well-defined, followed by examples, and practice items. They pointed out that the presentational sequence motivated them to focus more on the lesson. For example, Participant 3 affirmed that:

I was kind of reluctant to learn something about copyright and fair use, but I think the way it [lesson] was presented motivated me to learn.

Secondary presentation forms. Secondary presentation forms are elaborations added to the primary presentation forms that provide additional context to the learner to facilitate learning. In Standard CDT, all the secondary presentation forms for the selected primary presentation forms of CDT prescriptions were applied to design the instance. They include alternative representation, prerequisite information, mnemonics, help, and feedback.
**Alternative representation.** It is another way of presenting the *Generality* to the student. This method can take a form of a diagram, chart, formula, video, or even another textual word. Alternative representation components used in the lesson were videos, diagrams, charts, and pictures. When participants were asked about how the videos helped them to understand the concepts, their overall responses were positive.

Researcher: Tell me what other way do you think this lesson could have been presented to help you learn better? And why?

Participant 1 narrated that:

I think the videos were perfect for the lesson because I’m an audio-visual learner, so that was very helpful for me to understand the concepts. I think the lesson will be great if you add more videos to it.

On a similar note, Participant 3 stated that:

The videos helped me a lot because it looked like I gained a little bit of each concept after watching the video. Sometimes I don’t have to spend more time in the text section.

Participant 4 indicated that:

Adding more pictures would be helpful in learning the concepts. The pictures you used to present concepts, copyright, trademark, and patent were good because they were familiar and concrete examples that are not had to figure out.

Figures 9, 10, and 11 displays examples of copyright, trademark, and patent presented in the lesson respectively.
Figure 9. Screenshot of Examples of Copyright Materials Presented in the Lesson

Examples of Copyright

- Text Copyright: Articles, website blogs, fiction, poetry
- Music Copyrights: original music composition (Written or recorded music)
- Visual Copyrights: original images, hand drawn art.

Image credit: creativecommons.com

Figure 10. Screenshot of Examples of Trademark Materials Presented in the Lesson

Trademark

- Trademark can be a symbol, words, or phrase that can be used to distinguish the source of a product among other parties. Companies can legally register their trademark to distinguish them from other companies. One of the main goals of trademark is to allow consumers to easily identify the producers of goods and services and avoid confusion.
- As mentioned in copyright law, registered trademarks have some degree of legal protection compared to unregistered trademark.

Ohio University Logo (Bobcat) is an example of a trademark. The Bobcat logo distinguishes Ohio University from other universities. It is also used in close association with the services the university provides.

CNN logo is a trademark that distinguishes it from other News agencies such as CBS or Fox News.

Nike is a footwear company recognized for durable and high quality shoes. The name Nike is a brand or trademark that identifies a product from other footwear companies.

Image Credit: creativecommons.com
Similarly, Participant 5 expressed that, “I wish you had more videos in the lesson because they were helpful for me to learn more about the concepts apart from the text presented in each slide.” Again, Participant 8 commented:

The narratives in the videos were very helpful because one, they served as an entry point and shed more light on all the concepts that I was going to learn, and two, it served as another way of learning the concepts apart from the reading materials provided.

Other participants responded that the alternative representation of the concepts gave them an opportunity to learn more about the concepts apart from the text presented (Participants 2, 4, 6 & 7).

*Mnemonics.* Mnemonic is a technique added to elaborate the *Generality* presented to the student. In other words, mnemonic devices are used to help the learner to
encode and recall relevant information in a lesson (Merrill, 1983). None of the participants recognized the mnemonics used in the lesson, but when they were asked to share their learning experience about how mnemonics helped them in their learning process, comments from the majority of the participants were positive.

Researcher: What did you like about mnemonics used in the lesson?

Six participants specifically mentioned that mnemonics technique helped them to learn about procedures for obtaining permission from a copyright owner (Participants 1, 2, 3, 5, 6 & 8). Again, Participants 1 and 3 mentioned that mnemonic technique was efficient when they were learning about factors that need to be considered in fair use standards. Figure 12 displays a screenshot of mnemonic technique applied in the lesson.

![Figure 12. Screenshot of Mnemonic Technique Used in the Lesson](image-url)
Participant 2 mentioned that, “that technique [mnemonic] was helpful when I was answering the practice items.” Participant 7 also indicated that:

Mnemonics saved me the amount of time I had to spend on that section of the lesson. I think it is a faster way to remember things. I’ve used mnemonics in most of my classes, and that helps me to remember most important points in my readings.

Conversely, Participant 4 pointed out that “I liked the mnemonics in the lesson, but I prefer to create my own. She explained that, in that case, I will have a greater chance of remembering it whenever I need to use it to remember that part of the lesson.”

Help. These are attention-focusing devices such as arrows, graphics, numbering, boldface type, and color designed to help the student to relate the important attribute of the Generality to a specific instance (Merrill, 1983). At this stage, each participant was directed to a section in the lesson where some of these attention-focusing devices were used. Figure 13 shows how attention-focusing devices such as arrows, boxes, and colors were applied to help participants learn steps to obtain permission from a copyrighted work.
Researcher: Look at this slide carefully and tell me what elements were useful when you got to this section of the lesson? And why?

Participant 2 stated that: I think it looks more appealing and I like the way you presented it. To me, I like how you presented each idea in a box with different colors and how the arrows connect each other.

Participant 3 expressed that “It’s easy to figure things out looking at the way it is presented. I can make connections with arrows and the colors.” Participant 4 also described that, “I think the way it is presented saved me time because it was not just in writing but after cleansing through I was able to make connections from each box.”

Participant 6 explained that, “That condensed the whole topic because I was able to make meaning from it by looking at the arrows and the boxes. It’s appealing too.”
Participant 4 pointed out that, the bold arrows were very helpful especially when I was learning steps to obtain permission from copyright owner. Similarly, Participants 7 and 8 gave a similar response that the arrows and colors helped them to pay attention important information in that section of the lesson. Contrarily, Participant 5 perceived that even though those attention-focusing devices made the lesson looked appealing, he could still learn without them.

**Prerequisite information.** These are information used as an entry point level for students to relate to the *Generality*. Sometimes it is referred to as student’s previous knowledge. This method can take a form of a story, video, or text. The researcher used *Intellectual property* concept as a way of introducing participants to the copyright concept. Students were asked to share their experience if the story about intellectual property helped them to remember something about copyright and fair use.

Researcher: Tell me what you know about the term *Intellectual Property*?

Responses from 5 participants revealed that they know little about intellectual property. (Participants 2, 3, 5, 6, & 8). For example, Participant 2 mentioned that, “I recall reading something about intellectual property from students’ handbook, but I don’t know the details.” Similarly, Participant 3 commented that, “I’ve heard about it before, but I don’t think I know more about how it operates. I know I cannot use any content from the Internet for my class project, but I don’t know the specifics about it.” Participant 1 recalled reading something about intellectual property at the library. She explained that:
I remember reading something at the library about copyright law, and when I was going through this lesson it clicked my mind about it, so I think that was a good startup for me.

In addition, Participant 5 mentioned that “I think it’s a way of protecting someone’s work in an academic environment.” Again, participants 6 and 8 expressed that intellectual property is a law protecting what others have created. Participants 1, 4, and 7 mentioned that they have no idea about intellectual property.

In another situation the Technology, Education, and Harmonization (TEACH Act) was used as an entry point to address the digital use of copyright materials in an online learning environment, interestingly only two participants knew about this Act (Participant 5 & 8). Participant 5 mentioned that, “I know it’s law on how to use copyright materials online.” Participant 8 responded that he knew there is a law like that but did not know more about it. The remaining 6 participants mentioned that they have not heard about that Act before (Participants 1, 2, 3, 4, 6, & 7). For example, Participant 1 said, “I know nothing about that [TEACH Act].”

**Feedback.** Feedback is another important secondary presentation form component of CDT prescriptions. Merrill (1983) recommended that feedback is for all practice items at the *Use* level. The feedback aimed at showing participants why an instance is an example of the concept class presented. The feedback was given by displaying the consequences of participants’ action in the lesson.

Researcher: Could you please tell me how the feedback was delivered? Was it helpful? And why?
Participant 1 explained: I felt good when I answered a question correct. I liked the instant feedback because I knew if I got the answer right or wrong.

Researcher: So, when you got a question wrong how did you feel?

Participant 1: Sometimes it encourages me to make sure that I get the next question right if not I may fail the test.

Participant 2 revealed that the instant feedback gave her confidence especially when she answered a question correct. She said, the instant feedback boosts my confidence for every question Similarly, Participant 5 mentioned that, “I liked the instant feedback because it was nice to receive reward instantly. I think it was good for me.” Participant 6 suggested that, “I think it would be nice to include sound so that if I answer a question correct, there will be something like a cheerleader to cheer me up. I think that’ll be interesting.” Participant 6 also agreed that the instant feedback motivated him to focus on the lesson because he could see his performance.

Contrarily, Participant 4 pointed out that: I didn’t benefit from the feedback because the feedback I received was only correct or wrong answer. I’ll suggest that you explain why I got a question wrong. I know most of the multiple-choice questions are like that, but to me, I don’t like it that way. Again, I wanted to know my score after finishing that quiz section than to see my score for individual items.

Similarly, Participant 3 commented that, “I didn’t like the instant feedback because I was demotivated to see that I was not doing well in the quiz. I wanted to see my score after completing the entire test.” On a similar note, Participant 7 said, “I would prefer to see
my score at the end of each quiz because I was kind of nervous when I got a question wrong. So, I think you have to take the instant feedback out from the lesson.”

**Interdisplay relationship.** The interdisplay relationship is another presentation form which is independent of primary and secondary presentation forms (Merrill, 1983). It consists of information presented to the student on how to process the learning material. It also includes directions given to the student on how to work in the learning environment. When participants were asked about the control they had on the lesson, their responses were positive.

Researcher: What did you find specifically about learner control? (i.e., Did you have control over the pace and speed in the learning environment?).

Participant 1: Yes, I had flexible control; I was not restricted in any way I could decide what to read and what not to read. I didn’t have any restrictions as to time or anything like that.

Participants 2, 5, 6, 7 and 8 reported that learner control was effective because they had their own pace going through the lesson, they could go back and read previous information that was not clear to them, and they could decide to read the whole text or not. For example, Participants 2 explained that sometimes I had to go back to the section of the lesson to make the right connection of new concepts. That was helpful.

Additionally, results showed that directions of how to work on the learning platform were helpful. All participants reported that they did not encounter any difficulties of how to work in the learning environment.
Participant 2 commented that, “The directions were clear, and I didn’t have any hard time to figure out what to do. Everything was straightforward.” On a similar note, Participant 5 said that, “the instructional video you provided in the instructional page was very helpful.” Again, Participant 7 expressed that, “the lesson was straightforward, and I don’t have to worry about what to do, I mean how to navigate around the lesson.”

**Qualitative Data Analysis: Limited CDT Version (Group B)**

This section presents the analysis of qualitative data collected from group B participants who took Limited CDT instance. The Limited CDT was designed with only primary presentation forms and the interdisplay relationship of CDT. The reason was to find out if it is necessary to include all the secondary presentation forms at the micro level of instructional development. The aim was to explore how secondary presentation forms could influence students’ learning experience. In the Limited CDT, the secondary presentation form applied in the Standard CDT were not included. These are mnemonics, help, alternative representation, prerequisite information, and feedback. Responses from Group B participants served as a confirmatory data for the responses from participants in group A concerning the need for secondary presentation forms. During the debriefing section for group B participants; some emphasis was placed on the secondary presentation forms elements to find out if adding them could make the lesson more effective as designed for group A participants. During the debriefing session participants in group B, were introduced to Standard CDT to find out if they could identify secondary presentation form elements and how those could have helped them learn the concepts better.
Primary presentation forms. Participants were asked to share their learning experience on how the lesson segment was presented. Majority of the participants expressed that the lesson was well presented regarding definition, examples, and practice section.

Researcher: Tell me what did you like about the lesson?

Participant 9 pointed out that I like the way you presented the whole lesson. After reading through each concept, I had a couple of examples and practice items to work with. I think that was a good way to present a lesson. Likewise, Participant 10 mentioned that: I learned something about how copyrighted materials can be used in Blackboard.

Researcher: Can you further explain that?

Participant 10: Yes, now I know that if a Professor posts something on Blackboard only students enrolled in that class can use it. That’s interesting.

Participant 12 commented that:

I think this lesson is very important because it seems if you’re a college student and you are not familiar with some of these things you can be in trouble since you need to be cautious about any material you use for your class project. I think this lesson is relevant for me.

Participant 13 agreed that the lesson was relevant, stating that:

I think at the college level I must know all these stuffs because I can be in trouble for violating any of the copyright laws for my class assignments and projects.
Participant 14 pointed out that the lesson was straightforward, and I didn’t have to spend too much time to complete. “I think that’s strength of the lesson because I thought it was going take me more time to complete the lesson.”

On the other hand, Participants 11 and 15 shared similar ideas concerning the organization of the lesson. Participant 11 said that:

I liked how you organized the lesson it was easy to follow, I didn’t have any problem struggling to find out what to do. I think that’s a better way to present a lesson.

Similarly, Participant 15 indicated that the concepts were well-defined stating that “I liked the way you defined each concept. The language was appropriate, and I didn’t have any difficulty understanding them.” Finally, Participant 16 revealed that, “I was kind of confused after reading the definitions of copyright, trademark, and patent.”

Researcher: Can you tell me why you were confused?

Participant 16 explained that: It seems to me they are similar concepts and, so I may need more time to figure out the difference well. Because of that, I was kind of struggling in the first quiz to classify one (concept) from each other.

Researcher: Tell me what you did not like about the lesson?

All Participants mentioned that they preferred images and videos in the lesson. Participant 9 indicated that, “I think if you add pictures to the lesson it will be better and easy to learn those (copyright and fair use) concepts better. Similarly, Participant 10 mentioned that, “I think you need to add pictures to this lesson to make it more appealing to learn.” In addition, Participant 11 expressed that, “I was kind of bored just reading
through the lesson without any video or pictures. Again, Participant 12 commented that, “this is a computer-based instruction unlike a textbook, even textbook have pictures, so I think you need to add videos and pictures if possible.”

Researcher: What difference do you think the incorporation of videos, picture, and diagrams could have made to this lesson?

Responses from all the participants were similar. Participant 9 for example, mentioned that, “I think this lesson will be more appealing and easy to follow if you include videos and pictures.” Similarly, Participant 10 expressed that “it would be easy to follow, and I think it could motivate students to focus on the lesson.” Participant 15 indicated that, “That will save time I think to go through this lesson.”

Researcher: Could you please share with me what you think about the examples in the lesson?

Concerning examples, responses from both groups were similar. Participant 9 mentioned that, “I think that’s one of the strengths of the lesson. The examples were clear and easy to relate to the concept.” Similarly, Participant 10 expressed that, “the examples were familiar and not abstract.” In addition, Participants 11, 12, and 16 indicated that the examples were contextual in the sense that they can relate it to their school-related projects. For example, participant 11 said that, “I like the way you used books and music as copyright examples.”

Again, as it was revealed in group A, no participant from group B indicated that they need a specific number of examples to be presented for them to learn any of the
concepts better. Participant 10 mentioned that, “If there is only one example and it helps me learn better I’m be good with it.”

Concerning quiz items Participants 10, 11, 15 and 16 expressed that they were appropriate while Participants 9, 12, 13, and 14 commented that the items were somehow difficult for them.

Researcher: Why are you saying the quiz questions were appropriate?

Participants 10 and 11 indicated that the quiz items were appropriate because they were not too easy or difficult. Participant 10 mentioned that, “I think the quiz item assessed what was in the lesson, so I think it’s a good reflection. Participant 11 also said, “it didn’t take me long to finish them which was great.”

Researcher: Why are you saying the quiz questions were difficult?

Participant 9 and 12 revealed that it was difficult to classify copyright examples from patent and trademark. For example, Participant 9 said that:

It was kind of hard for me to choose which is which [copyright, trademark & patent] I was kind of confused.

Participants 13 and 14 revealed that they didn’t read the instructions to the questions well instead of selecting multiple examples from nonexamples they thought they had to select only one option. Participant 13 said that:

In fact, I didn’t read the instructions to some of the questions well when I saw multiple choice sequence I thought I was supposed to select only one option. I think that’s why I got most of those types of questions wrong.
Researcher: What did you find specifically useful about the presentational sequence of the lesson?

Participant 9 explained that, “I liked the way each concept was presented and the examples. That made it easy to follow.” Participant 12 mentioned that, “It was straightforward just that there was too much reading I wanted more pictures or videos to reduce the reading aspect of it.” Participant 14 narrated, “To me, it was straightforward, and everything was kind of order and logic.” Some participants expressed that the lesson was logically presented (Participants 10, 13, 15) and the context was relevant for their academic purposes (Participants 11 & 16).

**Secondary presentation forms.** Each participant in group B was introduced to the Standard CDT to find out if they would be able to identify secondary presentation form elements without prompt. However, in some cases, participants were prompted to share their views of how these elements could have effective and efficient in the lesson.

Table 5 represents secondary presentation forms that were not included in the Limited CDT module. A check mark (✓) indicates that the participant identified that particular secondary presentation form element and brought it up while (X) indicates that the participant was not aware of that element.
Table 5

Participants Distribution of Secondary Presentation Forms Awareness

<table>
<thead>
<tr>
<th>Participant</th>
<th>Mnemonics</th>
<th>Help</th>
<th>Alternative Representation</th>
<th>Feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participant 9</td>
<td>X</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Participant 10</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Participant 11</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Participant 12</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Participant 13</td>
<td>X</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Participant 14</td>
<td>X</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Participant 15</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Participant 16</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

Note: ✓ = participant was aware of the element, and X = participant was not aware of the element.

**Mnemonics.** The researcher introduced a section in the *Standard CDT* where mnemonics technique had been applied, and participants were asked to carefully study the section of the lesson where mnemonic has been used. Majority of the participants were able to identify mnemonic technique and commented that if mnemonic were added to their lesson it could have helped them to gain a better understanding of those concepts presented in the lesson. A majority of the participants agreed that adding mnemonics to their lesson, could have made it more efficient.

Researcher: Please have a closer look at this section of the lesson (Figure 14) and tell what you think could have helped you learn better compared to the one you just took?
Some participants indicated their awareness of mnemonic technique (Participants 10, 11, 12, 15, 16). Participant 10 narrated that:

Why you didn’t include this [mnemonic technique] in the lesson. I think you should have given me this one [Standard CDT]. She further explained that I think that could have saved me time figure these steps [steps to obtain copyright permission] easily. Please, next time do it this way that will make it nice and easy to learn.

Participant 15 mentioned that:

Yes! This is better than the one [Limited CDT] you gave to me. With this, I think I can easily figure things out, and that could have same me time on that sections.
On the other hand, Participants 11 mentioned that:

I think you should have indicated it in the lesson [*Limited CDT*] that using mnemonic technique will make things easier, but all the same since it’s already provided I think that’s good.

Again, Participants 16 recalled that, “mnemonic technique was helpful in his freshman chemistry class.” Participant 12 also stated that, “I was looking for a short way of remembering some information on steps of seeking permission of a copyrighted work, and it was kind of hard for me. I think it [mnemonic] could have made a difference.”

Participants 9, 13, and 14 did not identify mnemonic technique in that section of the lesson; rather they focused more on the other section of the lesson. When Participant 9 was prompted, she explained that “I think that [mnemonic] would help if it was included in this lesson.” Participant 13 and 14 shared similar view that mnemonic technique is one of the easiest ways to memorize information.

*Help.* Participants were introduced to a section in *Standard CDT* lesson where arrows, colors, and boldface type had been used to help participants make a note of some important information in the lesson.

Researcher: Carefully look at this section of the lesson and tell me what you think is new from the lesson you just took, and share with me how it could have helped you learn the concepts better?

With less hesitation, each of them could identify those attention-focusing devices. For example, Participant 10 pointed out that:
It seems the arrows make things clear here because it presents the information in more logical and meaningful way, I can easily make connections about some information you presented.

Participant 12 commented, “this is so simple and easy to follow. The one I took was too raw it was only text. I think it would be a good idea to organize it this way next time.” Participant 13 also indicated that, “The arrows I think will give more directions over here than the one you gave to me.” Contrarily, Participant 11 mentioned that “even though those attention-focusing devices may be helpful, she could still understand the concepts with them.” None of the participants commented on attention-focusing devices, boldface, boxes, and colors used in the lesson.

*Alternative representation.* Participants were asked to mention other ways that could have made the lesson more efficient.

Researcher: Please share with me what I can do to make this lesson [Limited CDT] more efficient, effective, and engaging?

Participants (9, 10, 12, 13, 14 & 15) commented that the lesson could be efficient if videos and pictures were incorporated. Each participant was introduced to view a two-minute short video about copyright and fair use that was incorporated in the *Standard CDT* lesson. Participants 9, 10, 12, 13, 14 and 15 indicated that they learn best by listening than reading. Participant 10 said:

This video could have saved me a lot of time to learn this copyright thing. The narratives are straight to the point, and I think I would not even worry myself to read all the text part of the lesson.”
Similarly, Participant 12 expressed that, “this video could have been a great way to start the whole lesson; I think it would be helpful to add videos like this to the lesson.” Again, Participant 9 stated that “I was expecting to see some pictures showing examples of copyright and patent…or something like that, but I didn’t see anything like that.”

**Prerequisite information.** Participants were asked to share their learning experience concerning the previous knowledge they had about the concepts.

Researcher: Could you please share with me what you knew about copyright and fair use before you were introduced to this lesson?

Some participants explained that they didn’t know anything about copyright and fair use (Participants 9, 10, 14, 116). For example, Participant 10 mentioned that:

I’ve heard it [copyright] before, but I don’t know anything about it.

Other participants mentioned that they know little about copyright and fair use. Participant 11 indicated that, “I think I’ve read something about it [copyright] at the library.” Participants’ responses were positive concerning the incorporation of prerequisite information in the lesson. The researcher specifically asked participants to share their view of “intellectual property. Some participants expressed their view that it is how to protect someone’s idea (Participants 10, 11, 13, 14, 15 & 16). Participant 10 shared his view that I think intellectual property is about how colleges make sure that someone’s idea is used with permission.

Majority of the participants agreed that if the lesson had begun with a story around intellectual property that could have triggered what they know about copyright laws. Majority of the participants preferred information that could have triggered their
previous knowledge of the concepts presented. Two participants declined to comment on this question (Participants 9 & 12).

**Feedback.** All the participants wanted to know how they performed in each quiz.

Researcher: Please tell me if you were to receive feedback what kind of feedback you were expecting and why?

Five out of the eight participants commented that they were discouraged at a point when they could not see how well they were doing in the quiz (Participants 9, 10, 12, 13, 14, 15, & 16). For example, Participant 9 reported that “I was kind of discouraged because I was not seeing how I was scoring in the quiz. I was expecting to see my overall score at the end of each quiz, but it wasn’t like that”. They reported that they were not motivated because they did not know if they answered a question wrong or right.

**Interdisplay relationship.** The responses from participants in Group B supported what participants in Group A reported concerned the inter-display relationship components in the lesson. Majority of the participants in Group B reported that they did not have any difficulty working on the learning platform (Participants 9, 10, 11, 13, 14, 15 & 16). Participant 10 reported that “I like the way you presented the lesson because I could learn at my own pace, I could decide to read the examples first or the definitions and I could come back and read them again anytime I wanted.” Participant 15, on the other hand, reported that “the directions you provided in the lesson was clear enough for me, so I did not struggle to figure anything out or was confused on what to do.” Conversely, Participant 11 pointed out that the use of examples and nonexamples were helpful for identifying different concepts.
Observational Findings

The observational notes were coded based on what the researcher saw and perceived. The observational data were used to validate debriefing interview and screen recording data. Table 6 reports the narrative of the observational notes the researcher recorded.

Table 6

<table>
<thead>
<tr>
<th>Coding Scheme</th>
<th>Reports</th>
</tr>
</thead>
<tbody>
<tr>
<td>What the researcher saw</td>
<td>The researcher observed that each participant from both groups was focused on the lesson. There was only one instance that one of the participants (Participant) 6 drew my attention that one of the videos in the lesson was not playing properly.</td>
</tr>
<tr>
<td></td>
<td>Also, I observed that facial expression of some participants was moody (Participants 4, 7, 9, 12 and 13). The researcher did not interrupt rather recorded the exact time he observed that. During the debriefing section the researcher pulled out the screen recording documents to find out what participants were thinking at that time. Participant 4 reported “I was nervous when I got my first question wrong”. Participant 7 responded “I was sure that answer (Item 6 in quiz 3) was right but I got it wrong”. Participants 9, 12 and 13 narrated that they were demotivated because they didn’t know how they were performing in the quiz items.</td>
</tr>
<tr>
<td></td>
<td>In addition, the researcher saw that participants from both groups were relaxed in the learning process and felt that they were in a natural environment.</td>
</tr>
<tr>
<td></td>
<td>Further, the researcher observed that Participant 2 was smiling at some point. During the debriefing section the researcher asked her why she was smiling at that moment. She replied, “I was happy about my pass mark”. The screen recording document showed that she scored the entire quiz items correct. Participant 5 also reported similar account that “I was excited about my score”.</td>
</tr>
</tbody>
</table>
Table 6: Continued

| What the researcher perceived | • Again, no participant tried to ask the researcher questions in the learning process. They all focused on the lesson instead of asking the researcher to help them to answer quiz items.  
• The researcher perceived that participants who showed moody facial expression were not motivated about some section of the lesson, and those that smiled were motivated.  
• In addition, the researcher perceived that participants who were not motivated would not perform well in the quiz items. |

**Follow-up Interviews**

In two months after participants had completed the lesson, the researcher made a follow-up to find out what participants can share about the lesson and what they still remember. As an attempt to check for knowledge retention participants were asked to retake the entire three quizzes for the second time. Three participants from group A and four participants from group B volunteered to retake the quiz for the second time. It appears that each participant performed better in their first attempt than the second attempt and qualitative data responses from the follow-up interview were consistent with their performance. Table 7 shows quantitative results of participants quiz scores from their first and second attempts.
Table 7

Participants Scores on Their First and Second Attempt of the Quizzes

<table>
<thead>
<tr>
<th>Participants</th>
<th>Quiz 1 % Score</th>
<th>Quiz 2 % Score</th>
<th>Quiz 3 % Score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1st Attempt</td>
<td>2nd Attempt</td>
<td>1st Attempt</td>
</tr>
<tr>
<td>Group A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Participant 2</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Participant 4</td>
<td>60</td>
<td>80</td>
<td>100</td>
</tr>
<tr>
<td>Participant 6</td>
<td>80</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>Group B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Participant 9</td>
<td>40</td>
<td>60</td>
<td>40</td>
</tr>
<tr>
<td>Participant 10</td>
<td>100</td>
<td>100</td>
<td>80</td>
</tr>
<tr>
<td>Participant 14</td>
<td>60</td>
<td>80</td>
<td>40</td>
</tr>
<tr>
<td>Participant 16</td>
<td>80</td>
<td>80</td>
<td>100</td>
</tr>
</tbody>
</table>

On individual bases the researcher asked participants to share their experience and what they remember from the lesson. Two participants (Participant 2 & 4) from group A and four participants (Participant 9, 10, & 16) from group B agreed to share their experience.

Researcher: I know it has been a while you took a lesson on Copyright and Fair Use. Could you please share your experience on that with me?

Participant 2 narrated:

In fact, there were so many things I didn’t know about copyright. Before I took that lesson, I thought most of the images on the Internet are free to use. I remember in one of my class project it was a group project and I was kind of careful about the materials we were going to use for the project. Some of my group members brought in some images, and I told them we can’t use it because it
is against copyright law (infringement). I think your lesson is very important and I think most of the students are not aware of how copyright laws operate on campus.

Participant 4 too responded:

That lesson has made me aware of how to use materials properly for my class projects. Sometimes I get confused about the difference between plagiarism and copyright laws, so now I’m cautious about how to use someone’s work. I think that lesson was helpful.

Participant 9 said:

I remember that lesson was straightforward, and it always reminds me anytime I’ve to use someone’s work or material for my class project.

Participant 10 also responded:

That lesson was interesting, and I think I learned more about copyright issues which I didn’t know before. I thought Internet materials were free to use, but now I know that it is not like that. I could be in trouble if I don’t use any of those materials properly.

Participant 14 shared that:

The lesson was straightforward and easy to follow. It was educative because there are many things I didn’t know about copyright but now I’m aware of them. I didn’t know things like you can’t use images from the Internet and how materials are used on Blackboard. It was very relevant because I wasn’t aware of some of the things you presented in the lesson. One thing is that even if I know that I’ve to
use copyrighted material, I didn’t know how to go about it to get permission from
the owner. I remember you shared that information in the lesson. I think that was
helpful.

Participant 6 declined to comment.

Summary

This chapter presents the results of applying CDT prescriptions as an instructional
design framework for designing a lesson on copyright and fair use concepts. In all, 16
undergraduate students participated in this study. They were divided into group A and B
with eight students in a group. Group A participants participated in a lesson designed
with all the three presentation forms of CDT while Group B participants took another
version of the lesson that was designed with primary presentation forms and the inter-
display relation components.

Participants’ Test Score Results

Quantitative data (i.e., participants scores from quiz 1, 2, and 3) were numerically
coded and entered into a system file for analysis using Excel spreadsheet.

Table 7 displays how participants scored individual quiz items. The check symbol
✓ means that the participant answered the item correct and (X) means the participant
answered the item incorrectly. As shown in Table 7, all the participants in both groups
answered item 3 in quiz 3 correct. Conversely, it seems participants in group B had
difficulty with item 5 in quiz 1 compared to their counterparts in group A. Only two
participants in group B had item 5 in quiz 1 correct, and only one participant in group A
got that item incorrect. Again, item 4 in quiz 1 was another question that majority of
participants in group B could not answer it correctly. Similarly, half of the participants in group B answered item 4 in quiz 3 while none of the participants in group A missed it.

In quiz 1 item 4, participants were asked to classify trademark from copyright and patent materials, and item five required participants to classify copyright materials from trademark and patent materials. As shown in Table 8 majority of the group B participants answered that item incorrectly. Figures 15 and 16 represent quiz items four and five respectively.

Table 8

Participants Score of Individual Quiz Items

<table>
<thead>
<tr>
<th>Participants</th>
<th>Quiz 1</th>
<th>Quiz 2</th>
<th>Quiz 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Group A</strong></td>
<td>Item #</td>
<td>Item #</td>
<td>Item #</td>
</tr>
<tr>
<td>1</td>
<td>✓ ✓ ✓ X ✓</td>
<td>✓ ✓ ✓ ✓ ✓</td>
<td>✓ ✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>2</td>
<td>✓ ✓ ✓ ✓ ✓</td>
<td>✓ ✓ ✓ ✓ ✓</td>
<td>✓ ✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>3</td>
<td>✓ ✓ ✓ ✓ ✓</td>
<td>✓ X ✓ ✓ ✓</td>
<td>✓ ✓ ✓ ✓ X</td>
</tr>
<tr>
<td>4</td>
<td>X ✓ ✓ X ✓</td>
<td>✓ ✓ ✓ ✓ ✓</td>
<td>✓ ✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>5</td>
<td>✓ ✓ ✓ ✓ ✓</td>
<td>✓ ✓ ✓ ✓ X</td>
<td>X ✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>6</td>
<td>✓ ✓ ✓ ✓ X</td>
<td>✓ ✓ X ✓ ✓</td>
<td>✓ ✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>7</td>
<td>✓ ✓ ✓ ✓ ✓</td>
<td>✓ ✓ ✓ ✓ X</td>
<td>X ✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>8</td>
<td>✓ ✓ ✓ ✓ ✓</td>
<td>✓ ✓ ✓ ✓ ✓</td>
<td>✓ ✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td><strong>Group B</strong></td>
<td>Item #</td>
<td>Item #</td>
<td>Item #</td>
</tr>
<tr>
<td>9</td>
<td>X ✓ ✓ X X</td>
<td>X X ✓ ✓ X</td>
<td>✓ ✓ ✓ X ✓ ✓</td>
</tr>
<tr>
<td>10</td>
<td>✓ ✓ ✓ ✓ X</td>
<td>✓ ✓ X ✓ ✓</td>
<td>✓ ✓ ✓ X X</td>
</tr>
<tr>
<td>11</td>
<td>✓ ✓ ✓ ✓ X</td>
<td>✓ ✓ ✓ ✓ ✓</td>
<td>✓ ✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>12</td>
<td>X ✓ ✓ X X</td>
<td>✓ ✓ ✓ ✓ X</td>
<td>X ✓ ✓ ✓ X</td>
</tr>
<tr>
<td>13</td>
<td>✓ ✓ ✓ ✓ X</td>
<td>✓ ✓ ✓ ✓ X</td>
<td>X ✓ ✓ X X</td>
</tr>
<tr>
<td>14</td>
<td>✓ ✓ ✓ X ✓</td>
<td>✓ X ✓ X X</td>
<td>✓ ✓ X ✓ X</td>
</tr>
<tr>
<td>15</td>
<td>✓ X ✓ X X</td>
<td>✓ ✓ ✓ ✓ ✓</td>
<td>✓ ✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>16</td>
<td>✓ X ✓ X X</td>
<td>✓ ✓ ✓ ✓ ✓</td>
<td>✓ ✓ ✓ ✓ ✓</td>
</tr>
</tbody>
</table>

Note: ✓, indicates participant answered the item correct, and X, indicate participant answered the item incorrect.
4. Please carefully read the items below and select each that would be a **Trademark**
☐ A sound system that has special shape and sound
☐ Nationwide Insurance's Slogan
☐ Ohio University Logo
☐ A written post on a website about Industrial Revolution
☐ A lyrics composed by the Beatles
☐ A software specially designed for voice recognition

Figure 15. Quiz 1 Item 4

5. Please carefully read the items below and select each item that would be a **Copyrighted** work.
☐ A sound system that has special shape and sound
☐ Nationwide Insurance's Slogan
☐ Ohio University Logo
☐ A written post on a website about Industrial Revolution
☐ A lyrics composed by the Beatles
☐ A software specially designed for voice recognition

Figure 16. Quiz 1 Item 5

Again, as shown in Table 8 half of participants in group B answered item 5 in quiz 2 and item 4 in quiz 3 incorrect. These two items are conceptual questions that required participants to apply their conceptual understanding of the previously learned concepts. Figures 17 and 18 represent the two items respectively.
Tables 9 and 10 display how much time each participant spent on the instance. Table 11 provides the descriptive information of the data. As shown in Table 9, the average time participants in group A spent on quiz 1, 2 and 3 are 14 min 43 sec, 11 min 39 sec, and 9 min 36 sec respectively. Also, as shown in Table 10 the average time group B participants spent on the three quizzes are 8 min 29 sec, 8 min 53 sec, and 12 min 22 sec. Comparatively, participants in group A spent more time on quiz one and two than their counterparts in group B.
Table 9

Time Spent on the Lesson (Group A)

<table>
<thead>
<tr>
<th>Participants</th>
<th>Quiz 1</th>
<th>Quiz 2</th>
<th>Quiz 3</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participant 1</td>
<td>20 min 10 sec</td>
<td>18 min 12 sec</td>
<td>12 min 1 sec</td>
<td>40 min 23 sec</td>
</tr>
<tr>
<td>Participant 2</td>
<td>12 min 20 sec</td>
<td>15 min 15 sec</td>
<td>8 min 11 sec</td>
<td>35 min 36 sec</td>
</tr>
<tr>
<td>Participant 3</td>
<td>20 min 15 sec</td>
<td>15 min 3 sec</td>
<td>10 min 2 sec</td>
<td>45 min 20 sec</td>
</tr>
<tr>
<td>Participant 4</td>
<td>15 min 7 sec</td>
<td>6 min 6 sec</td>
<td>9 min 1 sec</td>
<td>30 min 17 sec</td>
</tr>
<tr>
<td>Participant 5</td>
<td>9 min 25 sec</td>
<td>6 min 10 sec</td>
<td>5 min 20 sec</td>
<td>20 min 55 sec</td>
</tr>
<tr>
<td>Participant 6</td>
<td>16 min 12 sec</td>
<td>13 min 10 sec</td>
<td>10 min 1 sec</td>
<td>39 min 23 sec</td>
</tr>
<tr>
<td>Participant 7</td>
<td>4 min 5 sec</td>
<td>11 min 8 sec</td>
<td>10 min sec</td>
<td>25 min 18 sec</td>
</tr>
<tr>
<td>Participant 8</td>
<td>20 min 18 sec</td>
<td>8 min 5 sec</td>
<td>12 min 4 sec</td>
<td>40 min 27 sec</td>
</tr>
</tbody>
</table>

Table 10

Time Spent on the Lesson (Group B)

<table>
<thead>
<tr>
<th>Participants</th>
<th>Quiz 1</th>
<th>Quiz 2</th>
<th>Quiz 3</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participant 9</td>
<td>9 min 6 sec</td>
<td>11 min 4 sec</td>
<td>12 min 10 sec</td>
<td>30 min 20 sec</td>
</tr>
<tr>
<td>Participant 10</td>
<td>8 min 10 sec</td>
<td>4 min 10 sec</td>
<td>10 min 13 sec</td>
<td>22 min 33 sec</td>
</tr>
<tr>
<td>Participant 11</td>
<td>8 min 5 sec</td>
<td>17 min 6 sec</td>
<td>15 min 9 sec</td>
<td>40 min 20 sec</td>
</tr>
<tr>
<td>Participant 12</td>
<td>10 min 15 sec</td>
<td>5 min 15 sec</td>
<td>17 min 20 sec</td>
<td>32 min 55 sec</td>
</tr>
<tr>
<td>Participant 13</td>
<td>10 min 18 sec</td>
<td>7 min 2 sec</td>
<td>7 min 25 sec</td>
<td>25 min 45 sec</td>
</tr>
<tr>
<td>Participant 14</td>
<td>10 min 8 sec</td>
<td>9 min 5 sec</td>
<td>12 min 10 sec</td>
<td>31 min 23 sec</td>
</tr>
<tr>
<td>Participant 14</td>
<td>5 min 30 sec</td>
<td>10 min 20 sec</td>
<td>9 min 5 sec</td>
<td>24 min 55 sec</td>
</tr>
<tr>
<td>Participant 16</td>
<td>6 min 22 sec</td>
<td>7 min 2 sec</td>
<td>15 min 20 sec</td>
<td>28 min 44 sec</td>
</tr>
</tbody>
</table>
Table 11

Descriptive Information of Time Spent on the Quizzes

<table>
<thead>
<tr>
<th>Group A</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quiz 1</td>
<td>4 min 5 sec</td>
<td>20 min 20 sec</td>
<td>14 min 43 sec</td>
</tr>
<tr>
<td>Quiz 2</td>
<td>6 min 6 sec</td>
<td>18 min 12 sec</td>
<td>11 min 39 sec</td>
</tr>
<tr>
<td>Quiz 3</td>
<td>5 min 20 sec</td>
<td>12 min 4 sec</td>
<td>9 min 36 sec</td>
</tr>
</tbody>
</table>

**Group B**

<table>
<thead>
<tr>
<th></th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quiz 1</td>
<td>5 min 30 sec</td>
<td>10 min 18 sec</td>
<td>8 min 29 sec</td>
</tr>
<tr>
<td>Quiz 2</td>
<td>4 min 10 sec</td>
<td>17 min 6 sec</td>
<td>8 min 53 sec</td>
</tr>
<tr>
<td>Quiz 3</td>
<td>7 min 25 sec</td>
<td>17 min 20 sec</td>
<td>12 min 22 sec</td>
</tr>
</tbody>
</table>

Frequency and average score percentage were performed for each quiz to show how participants in both groups performed. Tables 12, 13 and 14 represent frequency and average score percentage of the three quizzes. As shown in Table 11, group A participants had a frequency of 36 representing 90% answered items in quiz 1 correctly, and 4 representing 10% answered the items wrong. Group B participants had a frequency of 27 representing 67.5% of participants who answered items in quiz 1 correctly, and 13 representing 35.5 answered incorrectly. In comparison, participants in group A outperformed their counterparts in group B. Again, as shown in Tables 12, 13 and 14 it can be concluded that participants in group A performed better in all the three quizzes than that their counterparts in group B.
Table 12

Frequency and Average Performance Score of Participants for Quiz One

<table>
<thead>
<tr>
<th>Items</th>
<th>Group A</th>
<th></th>
<th>Group B</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N=8</td>
<td>f (%)</td>
<td>N=8</td>
<td>f (%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Correct</td>
<td>Incorrect</td>
<td>Correct</td>
<td>Incorrect</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>7 (87.5)</td>
<td>1 (12.5)</td>
<td>4 (50)</td>
<td>4 (50)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>8 (100)</td>
<td>0 (0)</td>
<td>8 (100)</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>8 (100)</td>
<td>0 (0)</td>
<td>6 (75)</td>
<td>2 (25)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>6 (75)</td>
<td>2 (25)</td>
<td>5 (62.5)</td>
<td>3 (37.5)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>7 (87.5)</td>
<td>1 (12.5)</td>
<td>4 (50)</td>
<td>4 (50)</td>
<td></td>
</tr>
<tr>
<td>ALL</td>
<td>36 (90)</td>
<td>4 (10)</td>
<td>27 (67.5)</td>
<td>13 (35.5)</td>
<td></td>
</tr>
</tbody>
</table>

Table 13

Frequency and Average Performance Score of Participants for Quiz Two

<table>
<thead>
<tr>
<th>Items</th>
<th>Group A</th>
<th></th>
<th>Group B</th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>N=8</td>
<td>f (%)</td>
<td>N=8</td>
<td>f (%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Correct</td>
<td>Incorrect</td>
<td>Correct</td>
<td>Incorrect</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>8 (100)</td>
<td>0 (0)</td>
<td>7 (87.5)</td>
<td>1 (12.5)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>7 (87.5)</td>
<td>1 (12.5)</td>
<td>5 (62.5)</td>
<td>3 (37.5)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>7 (87.5)</td>
<td>1 (12.5)</td>
<td>8 (100)</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>8 (100)</td>
<td>0 (0)</td>
<td>7 (87.5)</td>
<td>1 (12.5)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>7 (87.5)</td>
<td>1 (12.5)</td>
<td>4 (50)</td>
<td>4 (50)</td>
<td></td>
</tr>
<tr>
<td>ALL</td>
<td>37 (92.5)</td>
<td>3 (7.5)</td>
<td>31 (77.5)</td>
<td>9 (22.5)</td>
<td></td>
</tr>
</tbody>
</table>
Table 14

Frequency and Average Performance Score of Participants for Quiz Three

<table>
<thead>
<tr>
<th>Items</th>
<th>Group A</th>
<th></th>
<th>Group B</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N=8</td>
<td>f (%)</td>
<td>N=8</td>
<td>f (%)</td>
</tr>
<tr>
<td></td>
<td>Correct</td>
<td>Incorrect</td>
<td>Correct</td>
<td>Incorrect</td>
</tr>
<tr>
<td>1</td>
<td>6 (75)</td>
<td>2 (25)</td>
<td>6 (75)</td>
<td>2 (25)</td>
</tr>
<tr>
<td>2</td>
<td>8 (100)</td>
<td>0 (0)</td>
<td>8 (100)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>3</td>
<td>8 (100)</td>
<td>0 (0)</td>
<td>8 (100)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>4</td>
<td>8 (100)</td>
<td>0 (0)</td>
<td>4 (50)</td>
<td>4 (50)</td>
</tr>
<tr>
<td>5</td>
<td>6 (75)</td>
<td>2 (25)</td>
<td>6 (75)</td>
<td>2 (25)</td>
</tr>
<tr>
<td>6</td>
<td>7 (87.5)</td>
<td>1 (12.5)</td>
<td>5 (62.5)</td>
<td>3 (37.5)</td>
</tr>
<tr>
<td>ALL</td>
<td>43 (89.6)</td>
<td>5 (10.4)</td>
<td>37 (77.1)</td>
<td>11 (22.9)</td>
</tr>
</tbody>
</table>

Chapter Summary

The present chapter reports findings of the study related to the use of formative research method approach to improving component display theory, an existing instructional design theory. Two instructional instances were designed, *Standard CDT* and *Limited CDT*. Eight participants from group A and B were assigned to the *Standard CDT* and *Limited CDT* respectively. All data sources are generally in agreement with one another. Participants learning experience seemed to favor primary presentation form. The preferred content presentation was Generality + Example + Practice. The debriefing data from participants revealed that secondary presentation forms are necessary to elaborate on the primary presentation forms. This finding can be further explained by the quantitative data, which indicated that participants who had secondary presentation forms component in their lesson performed better than their counterparts who did not have SPF. It also suggested that group A participants benefited from the secondary presentation forms components of CDT. Table 15 presents some major findings across each data source.
Table 15

Major Findings across Each Data Source

<table>
<thead>
<tr>
<th>Data Type</th>
<th>Research Question 1</th>
<th>Research Question 2</th>
<th>Research Question 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>What are the strengths and challenges of utilizing CDT in computer-based instruction?</td>
<td>What improvements or modifications can be made to CDT to increase its relevance in computer-based instruction?</td>
<td>Are all CDT presentation forms types necessary for designing quality computer-based instruction?</td>
</tr>
<tr>
<td>Debriefing/Interview</td>
<td>Presentational Sequence (Generality + Example + Practice) was the highest strength. Students had some amount of control over the lesson (Learner control)</td>
<td>The instances should be relevant and contextual to the learner. Offer learners with multiple and diverse instances to choose from</td>
<td>All SPF were necessary. Alternative representation and feedback were the most important. Prerequisite knowledge stood out to be the most challenging component</td>
</tr>
<tr>
<td>Researcher</td>
<td>Time consuming. CDT seemed to be predictive and deterministic instead of probabilistic. More Analytical. Writing conceptual questions were challenging.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Chapter 5: Discussion and Conclusion

This chapter is divided into three sections. The first section will discuss each of the research questions based on the data analysis results to identify the strengths and challenges of utilizing component display theory (CDT) prescriptions for designing computer-based instruction, and improvements that can be made to the theory. The second section addresses the implications of the findings, and the last section suggests areas for future research.

This study aimed at identifying the strengths and challenges of CDT prescriptions as an attempt to improve the theory. This study employed qualitative research methodology analysis to explore and answer the following formative research questions:

1. What are the strengths and challenges of utilizing CDT in computer-based instruction?

2. What possible improvements or modifications can be made to CDT to increase its relevance to computer-based instruction?

3. Are all CDT presentation form types necessary for designing quality computer-based instruction?

The researcher designed two instances based on CDT prescriptions to teach college learners the concept of copyright and fair use. The first instance incorporated all the three presentation forms of CDT, thus: primary presentation forms, secondary presentation forms, and interdisplay relationships (Standard CDT), and the second instance was designed with only primary presentation forms and interdisplay
relationships (*Limited CDT*). The design process for the two instances lasted approximately seven months long, from May 2016 to November 2016.

Sixteen undergraduate students were recruited to critique the instances to further evaluate CDT prescriptions. For clarity purposes, the terms lesson and instance will be used interchangeably in this chapter. Eight students participated in the *Standard CDT* version of the instance, and the other half participated in the *Limited CDT* version. The researcher used debriefing interview technique, observation, notes, test scores, and document analysis for data collection.

The strengths, challenges, and recommendations regarding CDT are organized by its presentation forms. Strengths are strategies or presentation forms that the participants found helpful and which worked well for them, whereas challenges are strategies or presentation forms that they found ineffective in the learning process. The researcher as a data source also reported the challenges of utilizing CDT for designing the two instances. Possible improvements for CDT prescriptions are provided as well.

**Research Question 1. What Are the Strengths and Challenges of Utilizing CDT in Computer-Based Instruction?**

**Strengths of CDT prescriptions.** Primary presentation forms, according to Merrill (1983), at the micro level, is the main vehicle of designing instruction. The four primary presentation forms are rule (expository presentation of a generality), examples (expository presentation of instances), recall (inquisitory generality), and practice (inquisitory instance) (Merrill, 1983). An example for primary presentation form is written in equation as (EG + Eegs + Iegs.N + Iegs.N) (Merrill, 1994, p.169). Thus, in
content presentation first, an expository presentation consisting of generality (definition/rule) (EG) is presented to the learner followed by expository instance (Eegs) (examples), finally inquisitor instance (Iegs. N), this is normally presented in the form of question to the learner to apply (practice) the generality in unencountered situation.

A majority of the participants indicated that the lesson, especially the sequence (i.e., *Generality + Example + Practice*), was well-organized. They mentioned that the sequencing of the *Generalities, Instances*, and *Practice* made it easy to follow the lesson. This finding corroborates studies by Shock (1991) and Portwood (1995) which concluded that the sequencing of the primary presentation forms *Generality + Example + Practice* was superior to rule only or *Rule + Example* only.

Respondents also pointed out that all the concepts were well-defined and that helped for learning to take place. They seemed to be motivated because of the logical presentation of the learning materials. This finding is in accordance with what Keller and Reigeluth (1982) found in their study which concluded that the most important way to help a student to learn a concept is to present generality in more explicit manner. Concept teaching requires logical presentation, and prescriptions for describing the process of the instruction at each stage (Merrill, Tennyson & Posey, 1992).

Another component of primary presentation forms that participants found useful was the *expository instance* (Eegs) (examples). All participants indicated that the examples presented in the lesson were useful and helped them to make a connection to the *generality* for learning to take place. Participants from both groups mentioned that the examples were diverse to the extent that it provided them with multiple perspectives to
gain an understanding of the *generality* presented. They seemed to be motivated because the examples presented were familiar and diverse. However, they did not specify the number of examples they needed. The implication is that when the generality is well presented to the learners, it can reduce the number of examples learners will need to better understand the generality (Litchfield, Driscol, & Dempsey, 1990). It is worth noting that learners may not have the ability to judge the number of examples that are optimal to master a concept. Instructional designers should be concerned with the learners’ ability to judge how many examples are optimal to facilitate learning. In case learners are not able to select examples optimally, the instructional designer will be required to over design the instructional event. Thus, more than necessary examples should be provided to the learner. Another implication is that instructional designers need to spend more time when presenting *generalities* to the learner.

Learners reported that they were more motivated to learn if they perceived that examples would help them to understand the fundamental concept. This was evident from the responses from Participants 2, 5, 8, and 11. For example, Participants 2 and 5 reported that the examples were familiar to them and were in the right context. Again, the test score data of these four participants support their qualitative responses. Those learners performed significantly well in the three quizzes. This technique implies that presentation of relevant and contextual examples of the generality to the learner can facilitate learning (Akbuluttas & Coskun, 2012). Providing learners with precise examples rather than ambiguous examples promotes learners understanding in the process of concept acquisition (Akbuluttas & Coskun, 2012).
Again, *inquisitory instance* (legs) is another component of primary presentation forms where the learner gets an opportunity to practice and check for understanding. In other words, this is where the teacher asks the learner questions to find out if learning has taken place. Each participant completed three sets of quizzes. Participants described quiz items as an important component of the lesson. They felt that the quiz items were appropriate for them to measure their understanding of the concepts they have learned. This finding supports Merrill’s (1983) assertion that practice items have to provide learners with an opportunity to apply newly acquired knowledge to solve real-world problems in the unencountered situation. Participants mentioned that the practice items were appropriate, neither too difficult nor too easy.

**Secondary presentation forms.** Secondary presentation forms are elaborations added to the primary presentation forms that provide additional context to the learner to facilitate learning (Merrill, 1983). The *Standard CDT* instance was designed with all the three presentation forms of CDT, whereas the *Limited CDT* instance was designed with primary presentation forms and interdisplay relationships. The intention of excluding secondary presentation forms component was to explore if it is necessary to include them in the context of this lesson. It was meant to gain insight from participants from both groups, on the importance of elaborations that secondary presentation form provides. The secondary presentation forms that the researcher applied in the *Standard CDT*, but excluded from the *Limited CDT* are *mnemonics, help, alternative representation, prerequisite information, and feedback.*
Mnemonics. Participants mentioned that the use of mnemonics was motivational. Some participants specifically expressed their view that mnemonics helped them to memorize steps of obtaining permission from a copyright owner. Some participants felt that it was a good technique to remember some important or salient information in the lesson. Moreover, others indicated that the use of mnemonic was efficient in that it reduced the amount of time that they had to spend on the lesson. However, two participants mentioned that they would prefer to create their mnemonics because that could help them to quickly remember them better than the ones given in the lesson.

Responses from participants in Group B confirmed the comments made by participants in Group A concerning the use of mnemonics in the lesson. Comments from participants in Group B confirmed that adding mnemonics technique to the lesson could make the lesson more effective for processing. Participants from both groups pointed out that the use of mnemonics technique in a lesson was an efficient and effective way to learn important information about the learning material. It should be noted that mnemonics’ effectiveness is limited to the factual domain (Merrill, 1983).

Alternative representation. Comments from participants in group A support the idea that alternative representation components are a strength of CDT. The alternative representation consisted of video, pictures, and text. Participants mentioned that the videos were helpful and added more value to the textual part of the learning material. Some participants reported that the video was effective in the sense that it served as an entry level of the lesson. They pointed out that the content of the video summarized the key components of the lesson which motivated them to focus on the lesson. Participant 1
revealed that she is an audio-visual learner and expected to have more videos in the lesson. A personal learning style, although largely unsupported by evidence, is a common perception among learners at the time of writing and thus may have a placebo or motivational effects (Guterl, 2013). Other participants also commented that the audio-visual component of the lesson motivated them to learn. Participants in Group B held the view that alternative representations of Generality to the learner is an important characteristic of primary presentation forms. This finding suggests that instructional designers have to select an Instance and test if the alternative presentation of the Generality can facilitate learners learning.

Help. Seven out of Eight participants from group A identified attention-focusing devices such as arrows, color, and boldface type as an important component in the lesson. They mentioned that arrows used in the lesson were very useful for condensing the lesson. Some participants in group A pointed out that boldface type was helpful particularly in the practice section of the lesson. They mentioned that it helped them identify some relevant information in the questions. Similarly, participants from Group B perceived that integrating those attention-focusing devices into the lesson could make it more efficient. However, boldface and color were not perceived as important elements. If attention-focusing devices are correctly applied in a lesson, they help learners to process the learning material and enhance retention of knowledge more easily (Reigeluth & Schwartz, 1989).

Feedback. The results showed that participants wanted to know how they performed in the quiz items. Some participants preferred instant feedback while others
preferred delayed feedback. Findings from participants who preferred delayed feedback support Merrill’s (1983) idea that all feedback must be delayed till the student finished the entire test because instant feedback can lead to less learning and could decrease learners’ test performance. This view is opposite to Skinner (1968) who encourages immediate feedback as a foundational principle of Behaviorism. Participants reported that they were confident of receiving accurate feedback. Some participants wanted to receive instant feedback after answering the individual questions than to receive overall feedback at the end of the test. Researchers (Azevedo and Bernard, 1995; Bangert-Drowns, Kulik, Kulik, and Morgan, 1991; Corbett and Anderson, 1989; Moreno, 2004; Pridemore and Klein, 1995) have shown the importance of feedback in an educational context. Providing learners with appropriate feedback facilitates learning and improve self-regulation (Van der Kleij, Feskens & Eggen, 2015). It appears that learners had different notions of how feedback should be provided. This finding concurs with Cohen’s (1985) opinion that feedback is one of the most important variables in instructional design, but it is the least understood in educational context. The implication is that the way feedback is delivered to the learner can positively or negatively influence learning. Therefore, Instructional designers should be concerned with an appropriate method of delivering feedback to learners to facilitate learning.

**Interdisplay relationship.** Learners described the interdisplay relationship as an important component of the lesson. They felt that directions on how to process the learning material helped them to learn. Also, they expressed that instructions on how to
work with the learning material helped them to work in the learning environment without any difficulty.

**Challenges of utilizing CDT in designing computer-based instruction.** When utilizing CDT for designing computer-based instruction, designers should consider other motivational theories. Based on observational notes, the researcher held the perception that participants were motivated to learn and focus on the lesson when relevant and contextual information was presented.

It seems that the application of CDT in designing computer-based instruction is time-consuming. It requires instructional designers to build the instructional presentation from fundamental components of the theory. The instructional designer is required to make a close consultation to CDT taxonomy in the process of identifying content, corresponding performance level, the specification of learning objectives, adequacy level, and presentation forms. From the researcher’s experience, this process was time-consuming. Also, CDT is more analytical, and for Instructional designers to apply it appropriately, it requires a deeper understanding of the individual components of its prescriptions.

The researcher also perceived that the resulting instruction could only teach learners the components of the concepts but not integrated knowledge. CDT seems to be more predictive and deterministic, but instructional design theory is not predictive rather is probabilistic, thus providing the best means of attaining the desired learning outcomes (Reigeluth, 1999).
Finally, the researcher found out that it was challenging to write and craft appropriate conceptual questions for practice and quiz items in the instructional event. There is a temptation to write factual questions instead of writing appropriate conceptual questions to test for learner understanding of the concept. Nonetheless, the researcher was able to utilize the available resources to apply the theory in practice.

**Summary**

The qualitative responses from the participants in both groups indicated that all the presentation forms, both primary and secondary, of CDT were necessary and instruction would maximally effective if all the presentation forms were present. Primary presentation forms provide a logical sequence of helping a learner to achieve the required learning objectives of the lesson. The findings from this study showed that secondary presentation forms are necessary to elaborate on primary presentation forms to facilitate learning. Therefore, it is important for instructional designers to use the secondary presentation form of CDT when designing an instructional event.

The test scores data from both groups shed more light on the qualitative data. Table 14 displays the average percentage scores of both groups in the three quizzes. The data revealed that participants in group A performed better in all the three quizzes than their counterparts in group B. This has demonstrated that the Limited CDT Version was not as effective as the Standard CDT Version.

Results from the quantitative analysis also indicate that participants in group A spent more time on quiz 1 and 2 as well as performing better than participants in group A who spent less time. This supports findings by Schnackengerg et. al. (1998) who reported
that learners who achieved higher scores in practice items spent more time and those who achieved lower scored less time. Conversely, group B participants spent more time in quiz 3, yet their counterparts in group A outperformed them. This might be that the Limited CDT was not as effective. An implication is that the design of the instructional event should encourage learners to spend more time on the lesson as well as practice. Table 16 represents the summary of participants’ average percentage score in the three quizzes.

Table 16

<table>
<thead>
<tr>
<th>Quiz</th>
<th>Group A N= 8</th>
<th>Group B N= 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quiz 1</td>
<td>90</td>
<td>67</td>
</tr>
<tr>
<td>Quiz 2</td>
<td>92.5</td>
<td>77.5</td>
</tr>
<tr>
<td>Quiz 3</td>
<td>89.6</td>
<td>77.1</td>
</tr>
</tbody>
</table>

Research Question 2. What Possible Improvements or Modifications Can Be Made to CDT to Increase Its Relevance to Computer-Based Instruction?

From the context of this study, the following revisions and recommendations can be made to CDT to improve it.

1. Present multiple and diverse instances to learners so that they can choose the one that will help them best learn the concept. The instance should be focused on real-world problems and should be easy for the learner to understand. At best the instances should be relevant and contextual to the learners’ learning situation.
Eliminate complex examples that do not enhance learners’ understanding of the Generality. Complex examples can be ambiguous and would not facilitate learning. Providing learners with divergent examples within a level of complexity can facilitate learning. It is also worth further investigation to determine if informing the learner of the degree of example prototypicalness would be of value.

2. Apparently, a significant strength of CDT is the sequencing of primary presentation forms. The sequencing from Generality + Example + Practice seemed to be effective, and all participants benefited from it. CDT does not prescript a set sequence. This study suggests that the Generality + Example + Practice sequence was successful. Further studies may be needed to confirm this sequence or to determine if an inductive approach would be equally effective.

3. Elaboration of primary presentation forms is necessary. If the instruction involves concept classification, the learner needs alternative representation of the concept apart from the textual explanation. Multimedia elements such as videos and animations can be used as an elaboration tool to help the student understand the concept. The use of video as an alternative representation appears to benefit all the participants. Again, if the instruction requires learners to use their previous knowledge, the prerequisite element must be chosen carefully because learners’ inability to recall previous knowledge about the concept can cause frustrations.

If the instruction involves a particular technique such as mnemonic to facilitate learning in the fact domain, inform learners that they can use such technique. Most often
instructors provide learners with a specific mnemonic technique they should use but allowing learners to form theirs could facilitate learning. An implication is that designers have to provide learners with hints that could help them master a particular concept or fact in a lesson.

**Research Question 3. Are All CDT Presentation Form Types Necessary for Designing Quality Computer-Based Instruction?**

None of the information collected shows that certain CDT prescriptions should be deleted. In general, it was evident that the secondary presentation forms offered substantial support to the learner and it is recommended that they are treated as a requirement instead of an option. However, design priority should still be placed on primary presentation forms because it is the main vehicle of instruction (Merrill, 1983).

The following are recommendations for improving CDT prescriptions. These recommendations are subject to verification by future replications or extensions of this study.

**Prerequisite information.** The data revealed that some participants were confused when they could not relate their previous knowledge to the concepts they were about to learn. Participants suggested that an improvement should be made in that component. Some participants felt that they wasted time trying to connect the concepts presented to their previous knowledge of the concepts. In computer-based instruction, this can be solved by providing learners with multiple instances so that they can have the opportunity to choose appropriate ones that will help them relate to the concept. Also, it is important to understand learners’ previous knowledge of concepts; as it can serve as a
guideline to identify the entry level of the learners. For example, participants 2, 3, 5, 6, & 8 demonstrated they were not familiar with the term intellectual property. This knowledge gap did not help the participants to relate the concept of intellectual property to the concept of copyright. This element of CDT was challenging and proved to be ineffective in this application because participants in both groups struggled to retrieve their previous knowledge on copyright and fair use. It is recommended that designers focus more attention on pre-requisite knowledge, with emphasis on useful linking concepts.

**Mnemonics.** Majority of the participants in group A indicated that mnemonic techniques in the fact domain were a helpful component in secondary presentation forms. However, two participants mentioned that they would prefer to form their own. This issue can be resolved by indicating in the section of the lesson where the use of mnemonic technique could be helpful in processing the learning material. Responses from Participant 4 from group A regarding the use of mnemonics demonstrates that it would be helpful for instructional designers to indicate in a section of the lesson where mnemonics technique could be applied. Participants in group B perceived and suggested that the use of mnemonic technique could save time and facilitate learning.

**Alternative representation.** No participant mentioned any weaknesses in the alternative representation used in the lesson. However, while examining screen recordings of participants in group A, the researcher found that learners paid more attention to the video that was used as an alternative representation than the text provided. Additionally, many participants expressed a desire for a video explanation.
Adding video may match a learner preference and may increase the appeal of the instruction. It is unclear whether video may improve achievement from the data in this study. This suggests that integrating visual formats would have added a higher value to the outcomes of this research since participants were more interested in the digital content of the module. The instructional implication is that learning can be facilitated if multiple strategies are used to present an instructional event. A learner characteristic such as learner preference is an important factor to consider when designing instruction with CDT prescriptions. The alternative representations of CDT component can be improved by offering learners multiple presentations of the concept. For example, a single concept can be taught by using video, diagram, chart, and text. In this case, the instructor will have offered the learner multiple alternative ways of learning the same concept. The learner may choose to use video or diagram to master the concept or the combination of both, or all of them.

**Feedback.** The results showed that learners had varied opinions on how feedback was delivered. While some preferred instant feedback, others wanted delayed feedback. This is an implication that feedback can serve as a motivational element for learners to learn, but in the same way, it can demotivate learners if it is not appropriately delivered. It is important for designers to select an appropriate method of providing learners feedback. In CDT, Merrill (1983) suggests that feedback should be delayed until the student has finished the entire test items, but in this study Participants (1, 2, 5, 6) preferred to see their test scores for individual items instantly while Participants (4, 7, 8) preferred delayed feedback. In computer-based instruction, it would be appropriate for
instructional designers to update CDT to provide learners with instant feedback or give learners the possibility to pick the type of feedback (instant or delayed) at the beginning of the lesson. Likewise, learners can be provided the option of switching choices in the middle of the lesson if they realized that they picked the wrong choice. This can resolve the problem of nervousness that some learners expressed and might help or contribute to the yielding of a better score on their test as they have absolute control over when they need feedback.

The qualitative responses from both groups indicated that incorporation of primary and secondary presentation forms is necessary to facilitate learning. From qualitative analysis of the participants’ learning experience, all the presentation forms of CDT are necessary for designing efficient and effective instruction. The strengths of CDT that were revealed from the results including the following:

- Learners become engaged when a piece of instruction optimally includes all the three primary presentation forms (*Generality/rule, Instance/Example, and Practice*).
- Even though CDT does not provide a specific way to sequence the primary presentation forms, it seems from this study that learners preferred that information should be presented in the following order: *Generality, Instance, and Practice*.
- The primary presentation forms, secondary presentation forms, and interdisplay relationships were independent and increased learners’ motivation to learn.
• Learners become motivated when they have control over the lesson. Learners had some level of freedom to make their own decision regarding some aspects of the instructional event, such as pace, flow, ability to go from practice exercise to examples and strategies.

• Learners favored the secondary presentation forms that were added to the primary presentation forms to facilitate learning.

Also, this chapter identified some issues that need to be improved when applying CDT as an instructional design framework. These are summarized into three major points:

• Most learners were not familiar with the content and could not connect with the prerequisite information used in the lesson.

• Feedback was not definitively constructive to learners because it only showed them if they got a question correct or incorrect instead of providing them with relevant information.

• Most learners in Group B (limited CDT) did not find the lesson effective compared to learners in Group A.

Suggested Improvements

The following are areas that participants suggested that improvement should be made to CDT prescriptions used in this study.

**Inquisitory instance.** At the *use* level of CDT, learners were asked to identify copyright from patent and trademark. Some participants suggested that they spent more time identifying the differences among copyright, patent, and trademark. The implication is that instructors have to offer learners with diverse and more examples that would
clearly help them to identify concepts. Ten participants opined that the use of examples and nonexamples to differentiate among these concepts were confusing. The implication for changes in CDT is that examples and nonexamples should not be ambiguous when teaching learners how to identify one concept from another and that attention should be placed on stating the point of nonexamples.

**Mnemonics.** Two participants suggested that there should be an indication in the lesson where mnemonic technique could be used to facilitate learning. The implication is that learners should have the opportunity to form their mnemonic technique that would facilitate learning. Responses from Participants 1, 2, 3, 5, 6, & 8 indicate that the use of the mnemonic technique in a lesson could save time and help learners to easily identify and remember important information in the lesson. The data suggest that mnemonics are quite effective in the learning process and should be maintained in CDT.

**Alternative representation.** Seven participants agreed that it would be appropriate for learners to be provided with multiple forms of presentation to facilitate the learning of the concepts. They specifically suggested that audio-visual and text could be the best options. It has also been insisted that each presentation must be independent. The rationale is that learners can choose to read the text and not the video or view the video not to read the text. This implies that instruction should provide the learner some autonomy over the instruction.

**Prerequisite knowledge.** Majority of the participants suggested that they could not relate academic integrity to the concepts of copyright and fair use, something that
caused great confusion. This implies that providing appropriate prerequisite information to learners could promote learning.

**Feedback.** All the participants suggested that feedback should not merely provide learners with information about right or wrong answers; rather it should provide learners with relevant information as to why the answer is right or wrong. This finding is in accordance with what Hattie (2015) found in his meta-analysis study which revealed that providing learners with constructive feedback increase learning and helps to correct errors and misconceptions. Moreover, participants preferred delayed feedback to instant feedback. However, based on the mixed results gathered through collected data, further testing and research need to be done in this area to weigh the pros and cons of appropriate feedback timing and the manners in which it should be provided for better and effective results. The implication is that learners can be demotivated if feedback is not properly delivered.

In summary, the qualitative results clearly indicate the strength of CDT prescriptions, and areas that need to be modified. It is worth pointing that the qualitative results did not reflect that certain components should be deleted.

**Implications for Education (Teachers and Learners)**

The major pedagogical and design implications revealed from the analysis of the study include the following: Instructional presentation, relevance, contextual clues, diversity, and learner control.

**Instructional presentation.** The logical presentation of the content material is one of the important methods in facilitating learning. The findings from this study
revealed that participants were motivated to learn the concepts because of the logical sequence of the lesson. Participants felt that simple-to-complex sequencing promoted their ability to master the concepts presented to them.

**Relevance.** The responses from the participants indicate that irrespective of how a concept is presented, it must be relevant to the student. Participants expressed that they were interested in learning the concepts of copyright and fair use because of their relevance. Knowles, Holton, and Swanson’s (2005) andragogy theory proposed that “adults need to know why they need to learn something before undertaken to learn it” (p. 64). The relevance of the content could serve as a motivation for adults to learn because they know how it would benefit them in the future (Knowles, Holton & Swanson, 2005). Learning will be facilitated if the objective of the lesson is relevant to the student. It is recommended that when formulating objectives based on CDT, the relevance of the learning objectives to the student should be considered.

To make information relevant to the student, instructional designers have to adopt strategies that will make the concepts personally meaningful to the student. Tessmer, Wilson, and Driscoll (1990) described these strategies as a declarative component of an instructional event. They also suggest that instructors can employ procedural strategies such as practice and feedback to help the student to master accurate concept classification.

To design effective instruction with CDT prescriptions, the designer has to select elements that are relevant to the student for the presentation of the generalities, instances, and practices. Presenting relevant instances could motivate the student and build one’s
interest to learn the material. In the same direction, presenting practice items that are relevant to the student can increase student performance (Merrill, 1983). The findings showed that learners were motivated because the examples used in the module were relevant to them.

Moreover, secondary presentation forms should contain relevant information to the student as they elaborate on the primary presentation forms. The findings from the study revealed that participants were motivated because they had both multimedia and text as the vehicle they would use to learn the concepts. Therefore, designers should consider selecting relevant information to enhance learners’ understanding of the generality.

The results of the study also revealed that sometimes participants were demotivated because they could not relate the prerequisite information presented in the lesson. Some participants reported that they became frustrated at some point because they had to waste time to think about how to make the right connection. At this point, multiple methods should be applied so that learners will get an opportunity to choose one that could help make the right connection.

**Contextual clues.** Participants’ responses revealed that learning occurs when real-world examples are presented to explain the generality. Presenting contextual examples to learners can facilitate learning. Presenting contextual information is another key element designers have to consider in the primary presentation forms. The instructional designer should select and present information that can help the student to relate it to the real-life situation. If the instruction is for learners to learn conceptual
information, the alternative representation information should be presented in the context of the learners’ situation. The instructional designers should present alternative representations that are familiar to the learner.

**Diversity.** The instructional designer has to consider diversity from both the learner and the instructional perspective. For CDT prescriptions to be effective, student characteristics such as learning preference need to be considered. Even though is no evidence of audio-visual learning style, some learners reported that they perceived that they were audio-visual learners. The implication is that divergent elements have to be presented to avoid redundancy and to help the transfer of knowledge. For example, the alternative representation of the learning material could be diverse enough for the student to select one in which they believe would be most effective. Again, the instances should be diverse enough to reduce redundancy and to help the student to identify the attributes of the generality. The practice items are not an exception; they also have to be diverse enough to help the student apply the newly acquired knowledge to solve real-world problems in unencountered situations.

**Learner control.** It is one of the important variables that instructional designers should consider when applying CDT prescriptions. The results of this study revealed that learners were confident and comfortable working through the lesson because their lesson was autonomous. According to Merrill (1983), this is one of the strengths and a variable that makes CDT more potent than other instructional design theories and models. Learner control helps learners to exert some degree of control over the instructional events
(Merrill, 1983). Learners were motivated because they could make their decisions regarding the flow sequence, and the pace of learning.

The sequence of the instructional event may not be the most critical component to the student, but instructional designers must ensure that the presentation of the instructional material should give the learner an opportunity to select strategies and segments that will suit their learning preference (Merrill, 1983).

**Recommendation for Practitioners**

While this study presents a single case in applying CDT prescriptions, it should serve as support for practitioners to apply CDT prescriptions to design computer-based instruction at the micro level of instructional design. One important recommendation emerging from this study is to spend a considerable amount of time identifying specific secondary presentation forms that can facilitate learners’ learning of the *generalities* presented. This study shows that secondary presentation forms are an important component of CDT. Therefore, designers are challenged to consider learner characteristics and select appropriate secondary presentation forms to facilitate learning.

Also, instructional designers have to explicitly reveal learning goals because that can motivate the learner to attach some personal relevance to the instructional event.

Furthermore, an instruction must be sequenced in a logical way that promotes clarity and transparency to avoid learner confusion. Moreover, the instruction must have an element of autonomy on the side of the student.
Recommendation for Future Research

Based on the findings of the study there are several future research opportunities for improving the theory. Further research is recommended for applying CDT to design an instance with Adobe Articulate Studio and deliver it on mobile learning environment to find out how that would affect CDT prescriptions. The Adobe Articulate Studio has the capabilities for designing and delivering instruction in a virtual world.

This study employed formative research methods which are qualitative in nature and focused on the in-depth understanding of a single topic. It may be helpful to employ quantitative research approach to describe CDT prescriptions regarding their effectiveness, appeal, and efficiency (Reigeluth & Frick, 1999).

Also, further formative research is needed to apply other prescriptions of CDT with Adobe Articulate Studio on other content areas to explore how the theory could be improved so that it can lead to better understanding of effective practices in instructional design.

In addition, the primary presentation form sequence for this study was a Generality, Instance, and Practice; however, CDT does not recommend a particular sequence of the primary presentation forms. Therefore, it would be helpful to conduct formative studies that would use a different sequence as a way of improving the theory.

Furthermore, additional studies are needed to evaluate CDT with similar content with graduate learners to find out if similar results will be obtained because participants for this study were undergraduate learners. Future research with instructors will be a valuable area for researchers to explore.
Another area that will be worth researching is to explore learners’ ability to judge the optimal number of examples that could help them master a concept.

Again, it appears that design research on CDT has been done primarily in the United States. It will worth applying CDT to design an instructional intervention to try it in other parts of the world.

Finally, further studies are needed to apply CDT prescriptions to design an instance by incorporating suggestions proposed in this study with different content and population to test if the results obtained from this study can be applied to other situations.

**Chapter Summary**

The analysis of the learners’ self-report learning experience indicates that CDT prescriptions can serve as a useful theory for designing instruction at the micro level. Even though the presentation of the individual components is one of the strengths of CDT, each component of the instruction has to show some relevance, context, diversity, and learner control to facilitate learning.

The sequencing of the primary presentation forms was effective and appealing to participants in this study. This provides some evidence that CDT can be applied with current educational tools although it has rarely been used in recent instructional design practices. More importantly, some ways were revealed to improve the presentational forms used in this study, which may reflect ways to improve CDT prescriptions. Further studies are needed to extend these findings to improve the theory.

In general, the formative research approach seems to have been effective for achieving its purpose in this study by finding possible strengths, weaknesses, and ways to
improve CDT. It provided a systematic way of collecting data that made it possible to improve the theory.
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Appendix A: Participants Demographic Information

Demographic Information of Participants

Major ________________________________________________________________

Gender ________________________________________________________________

Please circle your age range below

Age: 18-22
     23-27
     28-32
     33-37
     38-42
     43above

Please rate yourself with the following statements. Circle the number that you feel best fits you.

I feel comfortable taking computer-based instructions.
1 = Very uncomfortable
2 = Uncomfortable
3 = Not sure
4 = Comfortable
5 = Very Comfortable

I have adequate skills to browse a webpage
I feel comfortable taking computer-based instructions.
1 = Strongly disagree
2 = Somewhat disagree
3 = Neither Agree or Disagree
4 = Agree
5 = Strongly Disagree

Today’s Date: __________________________________________________________
Appendix B: Debriefing/Interview Questions

Debriefing/Interview Questions (Group A)
Could you please tell me what did you like about the lesson?
Can you tell me more about the organization of the lesson?
Tell me what you did not like about the lesson?
Could you please share with me what you think about the examples presented in the lesson?
What do you think about the content materials? And why?
Tell me what other way do you think this lesson could have been presented to help you learn better?
What did you like about mnemonics technique applied in the lesson?
Look at this slide carefully and tell me what elements were useful when you got to this section of the lesson? And why?
Tell me what you know about the term Intellectual Property?
Could you please tell me how the feedback was delivered? Was it helpful? And Why?
So, when you got a question wrong how did you feel?

Debriefing/Interview Questions (Group B)
Tell me what did you like about the lesson?
Can you further explain that?
Can you tell me why you were confused?
Tell me what you did not like about the lesson?
What difference do you think the incorporation of videos, picture, and diagrams could have made to this lesson?
Could you please share with me what you think about the examples in the lesson?
Why are you saying the quiz questions were appropriate?
Why are you saying the quiz questions were difficult?
What did you find specifically useful about the presentational sequence of the lesson?
Please have a closer look at this section of the lesson and tell what you think could have helped you learn better compared to the one you just took?

Carefully look at this section of the lesson and tell me what you think is new from the lesson you just took, and share with me how it could have helped you learn the concepts better?

Please share with me what I can do to make this lesson [Limited CDT) more efficient, effective, and engaging?

Could you please share with me what you knew about copyright and fair use before you were introduced to this lesson?

Please tell me if you were to receive feedback what kind of feedback you were expecting and why?
Appendix C: End-of-Lesson Survey

Please complete this end of lesson survey. It will take you few minutes to complete. Rate each item on the scale shown below to indicate your level of agreement.

1 = Strongly Disagree
2 = Disagree
3 = Neutral
4 = Agree
5 = Strongly Agree

1. The resources were useful for me
   1 □
   2 □
   3 □
   4 □
   5 □

2. The learning materials were useful for me
   1 □
   2 □
   3 □
   4 □
   5 □

3. The presentation style and techniques were appropriate for the topic being presented
   1 □
   2 □
   3 □
   4 □
   5 □

4. The tutorial was well organized in terms of presentation
   1 □
   2 □
   3 □
   4 □
   5 □

5. The tutorial increased my understanding of the topic presented
   1 □
   2 □
   3 □
   4 □
   5 □
6. The tutorial will be valuable for my student teaching practice
   1 ☐
   2 ☐
   3 ☐
   4 ☐
   5 ☐

7. The tutorial will likely result in positive changes in my professional practice
   1 ☐
   2 ☐
   3 ☐
   4 ☐
   5 ☐

8. The feedback from the tutorial were constructive
   1 ☐
   2 ☐
   3 ☐
   4 ☐
   5 ☐

9. The tutorial modeled effective integration of technology on practice
   1 ☐
   2 ☐
   3 ☐
   4 ☐
   5 ☐

10. Would you recommend this tutorial to your colleagues who want to know more about this topic?
    Yes ☐
    No ☐

11. What recommendations do you have for improving this tutorial?
    Type your text here
Appendix D: Component Display Theory Prescriptions for Standard CDT Version

Lesson on copyright and fair use in a digital learning environment

Learning objectives: By the end of the lesson student will be able to:

- Classify copyright, trademark, and patent works
- Classify appropriate copyright limitations
- Explain or predict probable outcomes of different scenarios based on fair use standards
- Employ a general process of determining how to use copyrighted work in an academic setting

Rule 8: Performance Level: Use Content Type: Concept: Copyright, Trademark, Patent

Objective: Student will be able to distinguish copyright work from other intellectual property such as trademarks and patents.

Instructional method: The information will be presented with definition and characteristics of each concept that will help student to identify different types of intellectual property. Different visual materials will be presented to elaborate differences between each concept. The examples section will follow by practice which requires student to identify copyrighted works from trademarks and patent works. Student will have control over the lesson through navigational features in the learning platform.

Evaluation: By providing definitions and attributes learners will correctly identify different types of intellectual properties.

Primary Presentation Forms

(a) EG + Eegs = Iegs.N + Ieg.N
First, an expository presentation consisting of generality will be presented followed by different kinds of examples that will help the student to apply the concept in new environment or situation.

(b) EG = definition – Based on CDT prescriptions, first the name of the concept should be presented, followed by superordinate class of the concept, attributes, and values which distinguishes the class from coordinate classes.

(c) Eegs = Examples – Specific examples that illustrates the attributes and values of the definition will be presented.

(d) IG. N (new set of instances) = New instances will be presented and student will be asked to classify or recall. New instances must be different from previous instances to reduce under or overgeneralization on the part of the student.

Secondary Presentation Forms

With EG:

(e) Mnemonic = yes - memory aids
(f) Prerequisite information = yes – Concept components will be given
(g) Alternative representation= yes – pictures, diagrams, and videos
With Eeg:
  (h) Help = yes  –  Additional information will be added to help the student relate the instance to the generality
  (i) Alternative representation = yes  –  charts, diagrams, videos, and other explanation
With Iegs:
  (j) Alternative representation = yes  –  charts, diagrams, videos, and other explanation
  (k) Feedback = ca + h  –  Correct answer will be given as feedback

Interdisplay Relationship
For all presentation:
  (l) Divergence = Diverse examples will be presented
  (m) Isolation = yes  –  PPF will be clearly separated
  (n) Learner control = yes  –  Students will have control over the pace of the presentation forms in the learning environment
For EG + Eegs presentations:
  (o) Matching = Examples and nonexamples will be used
  (p) Fading = yes  –  feedback examples will decrease as student progresses
  (q) Range = easy-to-hard
For Iegs.N practice
  (r) Matching = examples and nonexamples
  (s) Fading = feedback information will decrease as student progresses
  (t) Range = haphazard  –  Random in difficulty
For Iegs.N performance
  (u) Matching = examples and nonexamples
  (v) Help = No  –  No attention focusing
  (w) Feedback = no feedback is given
  (x) Response delay = untimed  –  students will be given enough time to respond to the questions
  (y) Criteria = sliding  –  will depend on the real-world use of the knowledge

Rule 8: Performance Level: Use Content Type: Concept: Copyright Limitations

Objective: Student will be able to identify works that would be included as part of public domain.

Instructional method: Different types of legal exemptions related to the use of copyright work will be present by providing definitions and characteristics of each concept. Different visual materials will be presented to elaborate differences between each concept. The examples section is followed by practice which requires student to classify items to the appropriate type of intellectual property then followed by feedback. Student has control over the lesson through navigational features in the learning platform.

Evaluation: Student will be required to identify different types of copyright limitations.

Primary Presentation Forms
  (a) EG + Eegs = Iegs.N + Ieg.N
First, an expository presentation consisting of generality will be presented followed by different kinds of examples that will help the student to apply the concept in new environment or situation.

(b) \( EG = \) definition – Based on CDT prescriptions, first the name of the concept should be presented, followed by superordinate class of the concept, attributes, and values which distinguishes the class from coordinate classes.

(c) \( Eegs = \) Examples – Specific examples that illustrates the attributes and values of the definition will be presented.

(d) \( IG. N \) (new set of instances) = New instances will be presented and student will be asked to classify or recall. New instances must be different from previous instances to reduce under or overgeneralization on the part of the student. Student will be given new specific object, event, or symbol and be asked to identify or recall its name.

Secondary Presentation Forms

With \( EG: \)

(e) Mnemonic = yes - memory aids

(f) Prerequisite information = yes – Concept components will be given

(g) Alternative representation= yes – pictures, diagrams, and videos

With \( Eeg: \)

(h) Help = yes – Additional information will be added to help the student relate the instance to the generality

(i) Alternative representation = yes – charts, diagrams, videos, and other explanation

With \( Iegs: \)

(j) Alternative representation = yes charts, diagrams, videos, and other explanation

(k) Feedback = ca + h - Correct answer will be given as feedback

Interdisplay Relationship

For all presentation:

(l) Divergence = Diverse examples will be presented

(m) Isolation = yes – PPF will be clearly separated

(n) Learner control = yes – Students will have control over the pace of the presentation forms in the learning environment

For \( EG + Eegs \) presentations:

(o) Matching = Examples and nonexamples will be used

(p) Fading = yes - feedback examples will decrease as student progresses

(q) Range = easy-to-hard

For \( Iegs.N \) practice

(r) Matching = examples and nonexamples

(s) Fading = feedback information will decrease as student progresses

(t) Range = haphazard – Random in difficulty

For \( Iegs.N \) performance

(u) Matching = examples and nonexamples

(v) Help = No – No attention focusing

(w) Feedback = no feedback is given
(x) Response delay = untimed – students will be given enough time to respond to the questions
(y) Criteria = sliding - will depend on the real-world use of the knowledge

**Rule 6: Performance Level: Remember Generality. Type: Procedure**

**Objective:** Student will recall the process of obtaining copyright permission for academic purposes

**Instructional Method:** The learning material is presented with the three major steps of obtaining copyright permission. Examples will be presented and student will be asked to state the processes. The practice will follow by feedback of the correct answers. Also, student will be asked to identify instances where they need to obtain permission from the copyright owner.

**Evaluation:** Student will recall the process of securing permission from the copyright owner for academic purpose.

**Primary Presentation Forms**
(a) EG + Eeg + IG.P + IG.P
An expository presentation with generality, followed by example and series of instances that will require the student to state the definition.

**PPF Content**
(b) EG + Activity – The presentation will consist of the name of the procedure, conditions, and steps. Will use a flowchart to elaborate the steps involve in securing permission from the copyright owner.
(c) Eeg = (reference examples) = Demonstration – examples of procedure and condition where steps involve in securing copyright permission.
(d) IG.P = State steps – Student will be asked to state the steps to secure copyright permission.

**Secondary Presentation Forms**
With EG:
(e) Mnemonics = yes- memory aid

With Eeg:
(f) Help = yes - Added information to help the student to instance to generality

With IG:
(g) Feedback = ca + h – An expository presentation is presented after student’s attempt

**Interdisplay Relationships**
For all:
(h) Isolation = yes – PPF is clearly separated with diagrams
(i) Learner control = yes – student has control over the learning material

**For EG + Eeg presentation:**
(j) Chunking = yes – Student will be asked to remember at least five new items at one time

**For IG.P practice/performance**
(k) Response delay = Student has short delay in responding to questions
(l) Criterion = high – High accuracy in responding to questions
(m) Number of items = at least two – Two instances are needed for adequate instruction.
Appendix E: Component Display Theory Prescriptions for the Limited CDT

Lesson on copyright and fair use in a digital learning environment

Learning objectives: By the end of the lesson student will be able to:

- Classify copyright, trademark, and patent works
- Classify appropriate copyright limitations
- Explain or predict probable outcomes of different scenarios based on fair use standards
- Employ a general process of determining how to use copyrighted work in an academic setting

Rule 8: Performance Level: Use Content Type: Concept: Copyright, Trademark, Patent

Objective: Student will be able to distinguish copyright work from other intellectual property such as trademarks and patents.

Instructional method: The information will be presented with definition and characteristics of each concept that will help student to identify different types of intellectual property. Different visual materials will be presented to elaborate differences between each concept. The examples section will follow by practice which requires student to identify copyrighted works from trademarks and patent works. Student will have control over the lesson through navigational features in the learning platform.

Evaluation: By providing definitions and attributes learners will correctly identify different types of intellectual properties.

Primary Presentation Forms

(a) EG + Eegs + Iegs.N + Ieg.N
First, an expository presentation consisting of generality will be presented followed by different kinds of examples that will help the student to apply the concept in new environment or situation.

(b) EG = definition – Based on CDT prescriptions, first the name of the concept should be presented, followed by superordinate class of the concept, attributes, and values which distinguishes the class from coordinate classes.

(c) Eegs = Examples – Specific examples that illustrates the attributes and values of the definition will be presented.

(d) I.G.N (new set of instances) = New instances will be presented and student will be asked to classify or recall. New instances must be different from previous instances to reduce under or overgeneralization on the part of the student.

Secondary Presentation Forms

No Secondary Presentation Forms Included
Interdisplay Relationship
For all presentation:
(a) Divergence = Diverse examples will be presented
(b) Isolation = yes – PPF will be clearly separated
(c) Learner control = yes – Students will have control over the pace of the presentation forms in the learning environment

For EG + Eegs presentations:
(d) Matching = Examples and nonexamples will be used
(e) Fading = yes - feedback examples will decrease as student progresses
(f) Range = easy-to-hard

For Iegs.N practice
(g) Matching = examples and nonexamples
(h) Fading = feedback information will decrease as student progresses
(i) Range = haphazard – Random in difficulty

For Iegs.N performance
(j) Matching = examples and nonexamples
(k) Help = No – No attention focusing
(l) Feedback = no feedback is given
(m) Response delay = untimed – students will be given enough time to respond to the questions
(n) Criteria = sliding - will depend on the real-world use of the knowledge
(aa) IF CMX = high THEN number of items = more than 5
(bb) IF CMX = low THEN number of items = 3-5
(cc) IF DVG = high THEN number of items = more than 5
(dd) IF DVG = low THEN number of items = 3-5

Rule 8: Performance Level: Use Content Type: Concept: Copyright Limitations
Objective: Student will be able to identify works that would be included as part of public domain.

Instructional method: Different types of legal exemptions related to the use of copyright work will be present by providing definitions and characteristics of each concept. Different visual materials will be presented to elaborate differences between each concept. The examples section is followed by practice which requires student to classify items to the appropriate type of intellectual property then followed by feedback. Student has control over the lesson through navigational features in the learning platform.

Evaluation: Student will be required to identify different types of copyright limitations.

Primary Presentation Forms
(a) EG + Eegs + Iegs.N + Ieg.N
First, an expository presentation consisting of generality will be presented followed by different kinds of examples that will help the student to apply the concept in new environment or situation.

(b) EG = definition – Based on CDT prescriptions, first the name of the concept should be presented, followed by superordinate class of the concept, attributes, and values which distinguishes the class from coordinate classes.

(c) Eegs = Examples – Specific examples that illustrates the attributes and values of the definition will be presented.

(d) IG.N (new set of instances) = New instances will be presented and student will be asked to classify or recall. New instances must be different from previous instances to reduce under or overgeneralization on the part of the student. Student will be given new specific object, event, or symbol and be asked to identify or recall its name.

Secondary Presentation Forms
No Secondary Presentation Forms Included

Interdisplay Relationship

For all presentation:
(a) Divergence = Diverse examples will be presented
(b) Isolation = yes – PPF will be clearly separated
(c) Learner control = yes – Students will have control over the pace of the presentation forms in the learning environment

For EG + Eegs presentations:
(d) Matching = Examples and nonexamples will be used
(e) Fading = yes - feedback examples will decrease as student progresses
(f) Range = easy-to-hard

For legs.N practice
(g) Matching = examples and nonexamples
(h) Fading = feedback information will decrease as student progresses
(i) Range = haphazard – Random in difficulty

For legs.N performance
(j) Matching = examples and nonexamples
(k) Help = No – No attention focusing
(l) Feedback = no feedback is given
(m)Response delay = untimed – students will be given enough time to respond to the questions
(n) Criteria = sliding - will depend on the real-world use of the knowledge

(aa) IF CMX = high THEN number of items = more than 5
(bb) IF CMX = low THEN number of items = 3-5
(cc) If DVG = high THEN number of items = more than 5
(dd) If DVG = low THEN number of items = 3-5
**Rule 6: Performance Level: Remember Generality. Type: Procedure**

**Objective:** Student will recall the process of obtaining copyright permission for academic purposes

**Instructional Method:** The learning material is presented with the three major steps of obtaining copyright permission. Examples will be presented and student will be asked to state the processes. The practice will follow by feedback of the correct answers. Also, student will be asked to identify instances where they need to obtain permission from the copyright owner.

**Evaluation:** Student will recall the process of securing permission from the copyright owner for academic purpose.

**Primary Presentation Forms**

- (e) EG + Eeg + IG.P + IG.P
  
An expository presentation with generality, followed by example and series of instances that will require the student to state the definition

**PPF Content**

- (f) EG + Activity – The presentation will consist of the name of the procedure, conditions, and steps. Will use a flowchart to elaborate the steps involve in securing permission from the copyright owner.

- (g) Eeg = (reference examples) = Demonstration – examples of procedure and condition where steps involve in securing copyright permission.

- (h) IG.P = State steps – Student will be asked to state the steps to secure copyright permission.

**Secondary Presentation Forms**

- No Secondary Presentation Forms Included

**Interdisplay Relationships**

**For all:**

- (a) Isolation = yes – PPF is clearly separated with diagrams

- (b) Learner control = yes – student has control over the learning material

**For EG + Eeg presentation:**

- (c) Chunking = yes – Student will be asked to remember at least five new items at one time

**For IG.P practice/performance**

- (d) Response delay = Student has short delay in responding to questions

- (e) Criterion = high – High accuracy in responding to questions

- (f) Number of items = at least two – Two instances are needed for adequate instruction.
Appendix F: Request for Expert Review of Component Display Theory

Dear Reviewer,

My name is Samuel Antwi, a doctoral student working on my Ph.D. in Instructional Technology at Ohio University, Athens, Ohio. My experience in both instructional design and online education has motivated me to write a dissertation on designing instructional module using Component Display Theory (CDT) in a computer-based environment. My goal is to apply CDT to design computer-based instruction to teach copyright and fair use concepts with undergraduate students.

To make sure that CDT is faithfully applied to this instructional design, I am asking your help to review the instructional material and provide feedback. Also, please note that to ensure content validity, judge, if the items are stated correctly, for example, if the language used is appropriate in individual items. You qualify to review this instructional material if you have a minimum of two years of experience as an instructional designer.

If you agree to participate, you will be asked to review the instructional design document in two occasions; each will last for approximately 1 hour to complete. You are not required to complete this review process in the presence of the researcher. After you are done with the reviews, please send your questions and comments regarding the instructional design strategies via email to the researcher.

Please direct any question pertaining to the rights of this research to IRB Ohio University, Athens, Ohio. Phone: 740 – 593 – 0664

Thank you for participation in this study.

Sincerely,

Samuel Antwi, M. Ed
Instructional Technology (Ph.D. Candidate)
Patton College of Education
Department of Educational Studies
Ohio University, Athens, OH
Email: sa530111@ohio.edu
Appendix G: Overview of Component Display Theory

The Component Display Theory (CDT) is an instructional design theory developed by M. David Merrill in 1980. The CDT is a complete micro level instructional design theory that focused on designing instructional strategies for a single idea, concept, principle, and procedure. It is based on the assumption that instructional outcome can be classified according to student performance and the subject matter content. The combination of the performance-content matrix provides an ideal conditions, behavior, and criterion for achieving the desired learning outcome.

The descriptive CDT clearly displays the mechanisms of the instructional process. The descriptive component of CDT identifies and summarizes learner performance and the content to be taught. The prescriptive CDT consists of 13 instructional design prescriptions for each performance content outcome. The three main patterns of display parameters are (Primary Presentation Form, Secondary Presentation Form, and Interdisplay Relationship). Based on student characteristics, environment and task variables the prescriptions can be modified. Merrill (1983) pointed out that CDT is meant for achieving cognitive learning objectives. For detailed explanation of CDT please refer to Merrill (1983) (green book volume I pp. 279-333) or Merrill and Twitchell (1994) Instructional design theory (pp. 111-213).

Expert Review Process
1. First, review the background of CDT
2. Second, review the CDT prescriptions (Refer to the design guide or Merrill & Twitchell, 1994, Instructional Design Theory)
3. The link below will lead you to the instance or the prototype designed with CDT file:///C:/Users/sa530111/AppData/Local/Temp/Rar$EXa0.309/presentation_html5.html
4. Please email your questions and comments to the researcher at sa530111@ohio.edu

Contact Information
Samuel Antwi, M. Ed
Instructional Technology (Candidate)
Patton College of Education
Department of Educational Studies
Ohio University, Athens, OH
Email: sa530111@ohio.edu
Appendix H: Adult Consent Form with Signature

Ohio University Adult Consent Form with Signature

Title of Research: Formative Research on Instructional Design Theory in Computer-Based Instruction
Researcher: Samuel Antwi

You are being asked to participate in research. For you to be able to decide whether you want to participate in this project, you should understand what the project is about, as well as the possible risks and benefits in order to make an informed decision. This process is known as informed consent. This form describes the purpose, procedures, possible benefits, and risks. It also explains how your personal information will be used and protected. Once you have read this form and your questions about the study are answered, you will be asked to sign it. This will allow your participation in this study. You should receive a copy of this document to take with you.

Explanation of Study
The purpose of this study is to employ formative research methodologies to evaluate and improve instructional material. This study is being done because it is one of the best approaches to improve an existing instructional design theory. Also, it will contribute to best practices in designing computer-based instructions.

If you agree to participate in this study, you will be asked to first, take computer-based instruction on copyright and fair use concept in which your computer screen will be visually recorded. You will not be identified from the computer screen recording it is only your computer screen that will be recorded. Second, your will respond to debriefing interview questions by providing your experience after taking the lesson. Your response to the debriefing interview questions will be audio recorded. The researcher will be observing you while you are taking the lesson. These activities will last for about 1 hours. You should not participate in this study if you are not above 18 years of age and not a student of Ohio University in Athens campus. Also, you cannot participate in this study if you are not computer literate. You should have basic computer skills to participate in this study. For example, you should know how to navigate in a webpage.

Risks and Discomforts
No risks or discomforts are anticipated.

Benefits
This study is important to science/society because it will benefit instructional designers, instructors, stakeholders, and decision-makers about the best practices of designing computer-based instruction to improve our educational system. Also, to extend my appreciation for your participation, I will send you a link to the final results of our study for those who are interested. Individually, you may not directly benefit from this study. However, you will have an opportunity to use a modern technology, Adobe Articulate Studio 13 to learn about copyright and fair use concept. Finally, you will receive $10 gift card for your participation.
Confidentiality and Records
Your study information will be stored on a Standard Definition card (SD card) and will be kept confidential in a locked cabinet. Your name will not be used in any written reports or publications which results from this study. Your information will not be disclosed to anyone only with your permission or as required by law. All your identifying data will be destroyed latest by December 31, 2017.
Additionally, while every effort will be made to keep your study-related information confidential, there may be circumstances where this information must be shared with:
* Federal agencies, for example the Office of Human Research Protections, whose responsibility is to protect human subjects in research;
* Representatives of Ohio University (OU), including the Institutional Review Board, a committee that oversees the research at OU;

Contact Information
If you have any questions regarding this study, please contact the investigator Samuel Antwi, email: sa530111@ohio.edu, phone: 701-200-8096. Or Dr. David Richard Moore, email: moored3@ohio.edu, phone: 740-597-1322.

If you have any questions regarding your rights as a research participant, please contact Dr. Chris Hayhow, Director of Research Compliance, Ohio University, (740)593-0664 or hayhow@ohio.edu.

By signing below, you are agreeing that:
• you have read this consent form (or it has been read to you) and have been given the opportunity to ask questions and have them answered;
• you have been informed of potential risks and they have been explained to your satisfaction;
• you understand Ohio University has no funds set aside for any injuries you might receive as a result of participating in this study;
• you are 18 years of age or older;
• your participation in this research is completely voluntary;
• you may leave the study at any time; if you decide to stop participating in the study, there will be no penalty to you and you will not lose any benefits to which you are otherwise entitled.

Signature_________________________________________ Date________

Printed Name________________________________________
Appendix I: IRB Approval

The following research study has been reviewed and approved by the Institutional Review Board at Ohio University for the period listed below. This review was conducted through an expedited review procedure as defined in the federal regulations as Category(-ies):

6, 7

Project Title: Formative Research on Component Display Theory in Computer-Based Instruction

Primary Investigator: Samuel Antwi
Co-Investigator(s): David Richard Moore

Faculty Advisor: David Richard Moore
(If applicable)

Department: Educational Studies

Approval Date: 2-23-16
Expiration Date: 2-22-17

This approval is valid until the expiration date listed above. If you wish to continue beyond the expiration date, you must submit a periodic review application and obtain approval prior to continuation.

The approval remains in effect provided the study is conducted exactly as described in your approved application. Any additions or modifications to the project must be reviewed and approved by the IRB (as an amendment) prior to implementation.

IRB approval does not supersede other regulatory requirements, such as HIPAA, FERPA, PPRA, etc.

Adverse events/unanticipated problems must be reported to the IRB promptly.

Rebecca Cole, AAIC, CIIP
Shelly Rex, BS
Robin Stack, CIIP

Office of Research Compliance Staff
Appendix J: Acceptance Email from Dr. Glazatov

Hi Samuel
Sorry for the delayed response. Yes, you may replicate my study. You should also take a look at Merrill’s “First Principles of Instruction: Identifying and Designing Effective, Efficient, and Engaging Instruction” (2013) as it is the latest of his work to bring the CDT to closure, with simpler vocabulary, some changes, and additional elaboration.
Best of luck
Trelisa
Trelisa Glazatov, Ph.D.
Instructional Technology Specialist

-------------------------------------------------
Technology and Educational Support Services
San Bernardino Community College District
1289 Bryn Mawr Avenue, Suite B
Redlands, CA 92374
PH: 909.384.4318
Email: tglazato@sbccd.cc.ca.us
24/7 helpdesk: http://stac.sbccd.org or 1-877-241-1756
Appendix K: Participants Activities Flow Chart

- Participants
  - Undergraduate College Students enrolled in Integration of Computers in Education course (EDCT 2030)

- Ethical Consideration
  - Researcher explains the purpose of the study
  - Participant can ask questions and be

- Activities
  - Participant completes CBI lesson on copyright and fair use in the research lab
    - Screen recording
    - Participant completes end-of-lesson

- Debriefing
  - Participant responds to debriefing questions
  - Self-report learning
  - Debriefing session recorded

- Thank you, Message,
  - Thank you for your participation in this study
## Appendix L: Specification of Objectives: CDT Performance-Content Matrix

<table>
<thead>
<tr>
<th>Performance/Content</th>
<th>Use/Concept</th>
<th>Condition</th>
<th>Behavior</th>
<th>Criterion</th>
<th>As shown by</th>
</tr>
</thead>
<tbody>
<tr>
<td>The student will be able</td>
<td>Of/for</td>
<td>A description</td>
<td>Copyright</td>
<td>classify</td>
<td>Sorting Answer from multiple choice</td>
</tr>
<tr>
<td>Remember/Procedure</td>
<td>A word</td>
<td>Permission</td>
<td>Copyright</td>
<td>State steps</td>
<td>Ordering Steps of obtaining copyright permission</td>
</tr>
<tr>
<td>The student will be able</td>
<td>Given</td>
<td>A phrase</td>
<td>Copyright</td>
<td>Identify the correct</td>
<td>Sorting</td>
</tr>
<tr>
<td>Remember/Procedure</td>
<td>The Direction</td>
<td>Copyrighted material</td>
<td>Identify the correct</td>
<td>Sorting</td>
<td></td>
</tr>
<tr>
<td>process of using copyrighted material on Blackboard</td>
<td>Answer from multiple choice</td>
<td>correct answer</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Appendix M: Screenshots of Standard CDT Lesson

<table>
<thead>
<tr>
<th>Slide Number</th>
<th>Slide</th>
<th>Slide Properties</th>
</tr>
</thead>
</table>
| 1            | ![Slide 1](image1.png) | Log in Required: No  
Logo: Ohio University Logo  
Text Caption: **Lesson on Copyright and Fair Use in a Digital Learning Environment for College Students**  
Designed by: Samuel Antwi  
Patton College of Education |
| 2            | ![Slide 2](image2.png) | Video: Yes  
Audio: Yes  
Text Caption: Please click on the Play button of the video to view a short tutorial on how to navigate in this lesson. You can click on “Notes” at the Top right corner to view close caption of this video |
| 3            | ![Slide 3](image3.png) | 1. Text Caption: How to go about this Lesson  
2. Text Caption: This lesson is designed to teach college students about copyright and fair use in digital learning environment.  
3. The increase in digital materials as technology advance in the field of education had presented challenges to both faculty and students on how to cope with copyright regulations  
4. This lesson will help to understand how to work with copyright materials in digital learning environment.  
5. Click NEXT button on your right corner to begin the lesson  
6. On each slide click next on your right bottom corner to |
| 4 | Text Caption: Learning Objectives  
- Student will be able to:  
  - Classify copyright, trademark, and patent work  
  - Classify appropriate copyright limitations  
  - Employ a general process of determining how to use copyrighted work in an academic setting |
|---|---|
| 5 | Video: Yes  
Audio Yes  
Text Caption: Please click on the Play Button of the video below to view. This video will give you an overview of the lesson you are about to take. Please make sure you watch the entire video till end. You can click on “Notes” at the Top right corner to view close caption of this video  
(video credit: https://www.youtube.com/watch?v=suMza6Q8J08) |
| 6 | 1. Text Caption: Copyright, Trademark, and Patent  
2. Text Caption: Introduction  
Intellectual Property Laws are laws that protect commercially and valuable product created by an individual or group of people. The two main categories of intellectual property laws are industrial property and copyright law. |
Industrial property consists of trademarks and patents. Copyright is literary and artistic work. Intellectual property can be used for personal or professional purposes; however, one needs to understand whether the property is industrial or copyright.

The main characteristics that distinguish copyright, trademark, and patent are:

1. The scope of the works the law protects
2. Requirements for legal ownership of the work
3. The length of legal protection

<table>
<thead>
<tr>
<th>1. Text Caption: Copyright</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Text Caption: According to the U.S. A. Copyright Office (2016) copyright is the ownership of an intellectual property within the limits prescribed by a nation’s or international law (para 1). Copyright is a form of intellectual property related to certain forms of creative work. Have you created any work that has copyright license?</td>
</tr>
</tbody>
</table>

Copyright law in the United States for example, gives the right to the owner of a property to print, distribute, and copy the work for any purpose. However, other than the owner of the property who wants to use the property for similar purpose must obtain permission from the owner of the property.
Normally authors obtain copyright for their property as soon as the work is created. Although registration of a property makes the copyright more visible to others who want to use the product. Also, authors can strengthen their legal copyright protection by registering their works.

It is important to note that copyright can be unpublished or published works. The U. S. A. law extends copyright for 50 years beyond the life of the author. After that the work becomes available in the public domain.

Text Caption: Examples of Copyright
1. Text Copyright: Articles, website blogs, fiction, poetry
2. Music Copyrights: original music composition (Written or recorded music)
4. Image credit: creativecommons.com

Short Answer
In your own words define copyright?

Points: 5
Type: Graded
Passing grade: Continue
Failing grade: Continue
Number of Attempts: 1
Trademark can be a symbol, words, or phrase that can be used to distinguish the source of a product among other parties.

Companies can legally register their trademark to distinguish them from other companies. One of the main goals of trademark is to allow consumers to easily identify the producers of goods and services and avoid confusion. As mentioned in copyright law, registered trademarks have some degree of legal protection compared to unregistered trademark.

Text Caption: Examples of Trademark

- Ohio University Logo
- CNN Logo
- Nike Logo

Patent

- According to World Intellectual Property Organization (2015) a "patent is an exclusive right granted for an invention, which is a product or a process that provides a new way of doing something or offers a new technical solution to a problem" (para 2).

- The owner of the patent is protected by the patent protection of the invention. Generally, patent protection is limited to about 20 years.

- When an invention is registered for patent protection it means no one cannot commercially produce, use, distribute or sell without the patent owner’s consent.
Within the patent invention period the patent owner has the right to decide who may or may not use the patented invention.

The patent owner may sell the invention to someone else within the patented period.

After the patented period expires the invention becomes available in the public domain. Thus, the owner will no longer have exclusive rights the invention; hence the invention will be available for commercial exploitation by other who is interested.

Acquiring patent for an invention is necessary because it provides incentive and offers recognition to the inventor. It also promotes innovations which enhance quality of life.

<table>
<thead>
<tr>
<th>Image 1: Computer Software</th>
<th>Image 2: Apple TV</th>
<th>Image 3: Energy saving bulb</th>
</tr>
</thead>
</table>

Text Caption: Examples of Patent work

- **Software Patent**: A mathematical software such as SPSS that analyze data which is different from current ones may be protected by a patent
- **Design Patent**: The size, shape, and appearance of a device such as music device may be protected by a patent
- **A utility Patent protects how a product functions or operates. Energy saving bulb has a unique function of consuming**
<table>
<thead>
<tr>
<th>13</th>
<th>Short Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>When we say Patent what does it mean? Describe it in your own words.</td>
<td></td>
</tr>
<tr>
<td>Points: 5</td>
<td></td>
</tr>
<tr>
<td>Type: Graded</td>
<td></td>
</tr>
<tr>
<td>Passing grade: Continue</td>
<td></td>
</tr>
<tr>
<td>Failing grade: Continue</td>
<td></td>
</tr>
<tr>
<td>Number of Attempts: 1</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>14</th>
<th>Short Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>What do you understand by the term Trademark? Briefly describe it in your own words.</td>
<td></td>
</tr>
<tr>
<td>Points: 5</td>
<td></td>
</tr>
<tr>
<td>Type: Graded</td>
<td></td>
</tr>
<tr>
<td>Passing grade: Continue</td>
<td></td>
</tr>
<tr>
<td>Failing grade: Continue</td>
<td></td>
</tr>
<tr>
<td>Number of Attempts: 1</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>15</th>
<th>Text Caption: Quiz 1 Item 1. Multiple Choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Please, carefully read the items below and select each that would be <strong>patent</strong></td>
<td></td>
</tr>
<tr>
<td>☐ A sound system that has special shape and sound</td>
<td></td>
</tr>
<tr>
<td>☐ Nationwide Insurance's Slogan</td>
<td></td>
</tr>
<tr>
<td>☐ Ohio University Logo</td>
<td></td>
</tr>
<tr>
<td>☐ A written post on a website about Industrial Revolution</td>
<td></td>
</tr>
<tr>
<td>☐ A lyrics composed by the Beatles</td>
<td></td>
</tr>
<tr>
<td>Quiz 1 Item 2</td>
<td>A software specially designed for voice recognition</td>
</tr>
</tbody>
</table>
| Quiz 1 Item 2 | Points: 20  
Type: Graded  
Passing grade: Continue  
Failing grade: Continue  
Number of Attempts: 1  
Recall your favorite Basketball or Football team. Would you classify the **Logo** of your team as a **Patent**?  
☐ Yes  
☐ No |
| Quiz 1 Item 3 | Points: 20  
Type: Graded  
Passing grade: Continue  
Failing grade: Continue  
Number of Attempts: 1  
You were invited to perform as a Singer in a concert and you recorded your show with your own lyrics. Is the recorded lyrics a Copyright?  
☐ Yes  
☐ No |
| Quiz 1 Item 4 | Points: 20  
Type: Graded  
Passing grade: Continue  
Failing grade: Continue  
Number of Attempts: 2  
Please carefully read the items below and select each that would be a **Trademark** |
<table>
<thead>
<tr>
<th>Points: 20</th>
<th>Text Caption: Quiz 1 Item 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type: Graded</td>
<td>Points: 20</td>
</tr>
<tr>
<td>Passing grade: Continue</td>
<td>Type: Graded</td>
</tr>
<tr>
<td>Failing grade: Continue</td>
<td>Passing grade: Continue</td>
</tr>
<tr>
<td>Number of Attempts: 2</td>
<td>Failing grade: Continue</td>
</tr>
</tbody>
</table>

- A sound system that has special shape and sound
- Nationwide Insurance's Slogan
- Ohio University Logo
- A written post on a website about Industrial Revolution
- A lyrics composed by the Beatles
- A software specially designed for voice recognition

**Copyright Limitations**

- There are some exceptions that apply to how copyrighted work can be used for educational purposes.
- Copyright limitations are exceptions to copyright laws which allow someone to use copyrighted work without a
• Copyright limitations and exceptions allow creator to access and build upon the knowledge generated by others. It also promotes innovation in for the benefit of mankind.
• Without exceptions and limitations, it would be challenging to fully benefit from copyrighted works. For example, it would be challenging to use copyrighted work for educational purposes, research, and scholarship just to mention a few.
• One of the main goals of copyright exceptions and limitations is to encourage learning and dissemination of knowledge. Almost all of the international copyright agreements permit certain exceptions to the exclusion rights of the authors.

Photo: Built-in photo in Articulate Studio

Text Caption: Fair Use Explanation

• The good news is that there is a way to use a copyrighted work with less stress.
• Fair use is a type of limitation on the exclusive rights of copyright holder. Fair use allows public consumers to make copy of part or all copy righted work even without obtaining permission from the copyright owner. Fair use is an
ideal way to allow the public to benefit from copyrighted works. It is intended to move created works into the public domain before and after the protected time.

• If a product is considered as “fair” it means its use does not infringe copyright. However, it is important to note factors that determine fair use of a copyrighted work.

| Photo: Built-in photo in Articulate Studio |
| Text Caption: Fair Use in Blackboard Courseware |

• So how can you use copyrighted material such as article on Blackboard? Note that most library databases acquire license for some materials that Professors can use an article for teaching courses in an online learning environment. In this case the Professor can post, for example the entire article on Blackboard for students. The professor can even use those materials for repeated semesters. Other than that, the Professor needs to obtain permission from the owner of the work, and cannot be used for repeated semesters.

• Note that instructor do not need to obtain permission to use works produced by United States government however, they need permission to use works that has been contracted with other entity.
Even though copyrighted work can be used under “fair use” condition there are four main factors that need to be considered. The four factors are listed in the top box.

- The purpose and character of your use
- The effect of the use upon the potential market
- The nature of the copyrighted work
- The amount and substantiality of the portion taken

The use of copyrighted work for educational purposes is considered as fair use.

This standard is clearly met if the copies as used temporarily and not part on an anthology

The use of the copyrighted work should not affect the sale of the work

Creative work can be more considered as fair use than actual or published work

Taking a portion of the copyrighted work that are short or smaller in relation to the original work can be considered fair use

The use of the work would be considered as fair use if all of the standards are clearly met.

(PURENA)
Have you been in a situation where you have to contact copyright owner of a material before you can accomplish your work? Now let’s look at the procedure to use copyright work.

**The General Procedure to use Copyrighted Work**

- Does the work fall under the category of copyright?
- Does the work have any academic exceptions to exclusive rights to the copyright work?
- Does the work have any legal limitations to exclusive right to the copyright work?
- If the answer to any of the above questions is Yes then you need to obtain permission before you can use the work
- Obtain any permission
- Acknowledge/attribute the work

**The TEACH Act**

- In 2002, the Technology, Education, and Harmonization (TEACH Act) was signed as an amendment to the US Copyright Act Law. TEACH Act addresses digital use of
copyright materials in an online learning environment. It allows faculty to use portions of copyrighted work online without the consent of the copyright owner. One should abide by all stipulations in TEACH Act in order to use it

Text Caption: **Steps to Obtain Permission from a Copyrighted work (ConSeKeep)**

- Contact the Copyright Owner: When you identify the copyright owner you need to request for permission to use the work. Sometimes publisher provides a way to contact the copyright owner. In the process of obtaining permission you need to be patient and consistent because sometimes it takes a while for owners to grant permission or reply.
- Secure Permission: Contact the owner or the publisher to confirm the copyright ownership
- Keep a record: Make sure you keep all the correspondence/communication in this process the will happen in the process of gaining permission to the work.
Text Caption: Quiz 2 Item 1.
Multiple-choice

Points: 20
Type: Graded
Passing grade: Continue
Failing grade: Continue
Number of Attempts: 2

What are the best ways to use Copyrighted materials in Blackboard courseware? Check all options that apply

☑ All the materials should be acquired legally
☐ Only students who enroll in the class can have access to the materials
☐ Students would be allowed to redistribute the material because they are enrolled in the class
☐ All the materials should be blocked at the end of the class
☐ All licensed electronic materials should be linked to the library database

Text Caption: Quiz 2 Item 2.
Multiple-choice

Points: 20
Type: Graded
Passing grade: Continue
Failing grade: Continue
Number of Attempts: 2

Please carefully read this scenario and answer the questions that follows. Your Psychology Professor, Mr. Bans searched Ohio Link and found an excellent article for his class in this Fall semester. This article was published in 2013 and he wants to share this article with his students on
Blackboard Courseware. If the article falls under Fair Use what is the best practice he needs to consider so that he doesn't infringe on Copyright law? Select the best answer from the choices below.

☒ Scan and upload the article on Blackboard for his students
☐ Link the article source in Ohio Link so his students can access it directly
☐ Obtain permission from the author of the article
☐ Print and distribute the article to his students

Text Caption: Quiz 2 Item 3. Click and drop
Points: 20
Type: Graded
Passing grade: Continue
Failing grade: Continue
Number of Attempts: 2

Assume that Professor Clark finds and excellent video in DVD on Industrial Revolution that is Copyrighted and he wants to use it in his class. What are the steps that he needs to follow so that he can use it for his History class? Arrange the steps below in order. Please you have to click and hold, and drag to arrange them in right order.

☒ Contact the Copyright owner of the video
☐ Secure permission
☐ Keep a record
### Quiz 2 Item 4.

#### Multiple-choice

**Points:** 20  
**Type:** Graded  
**Passing grade:** Continue  
**Failing grade:** Continue  
**Number of Attempts:** 2

Which of the following materials can be used in the classroom without obtaining copyright permission? Check all options that apply.

- [x] Work with an expired Copyright date
- [ ] Works in the public domain
- [ ] Works produced by the United States government that has not been contracted with other entity
- [ ] Photographs that are exact reproduction works in the public domain
- [ ] Articles in journals that explicitly allow non-profit education use without permission

---

### Quiz 2 Item 4. Click and drop

**Points:** 20  
**Type:** Graded  
**Passing grade:** Continue  
**Failing grade:** Continue  
**Number of Attempts:** 2

Read the following and arrange them according to the general process to use Copyrighted work. Please click the drop down menu to select the right answer in each step.

- [ ] Determine if the work falls under Copyright category

---

Text Caption: Quiz 2 Item 4.
1. Your Sociology Professor has only two copies of a textbook and decided to make copies for her students because the bookstore did not have them available for students to purchase. The semester has reached third week and she wants her students to catchup with the class. What are the possible questions that your Professor need to ask herself before she can make copies for her students? Check all that applies.

☐ Did I legally acquire the two copies of the book?
☐ Does the textbook fall under Fair Use or Copyright exemptions?
☐ Who owns the textbook?
☐ Where can I purchase more copies of the textbook?
☐ Is the textbook eligible for Copyright protection?

Text Caption: Quiz 3 Item 1.
Multiple-choice

Points: 20
Type: Graded
Passing grade: Continue
Failing grade: Continue
Number of Attempts: 2
Text Caption: Quiz 3 Item 2. Multiple-choice

Points: 20
Type: Graded
Passing grade: Continue
Failing grade: Continue
Number of Attempts: 2

All of the options below are rights Copyright holders have, except?
☐ They can distribute the work publicly
☐ They can own their work forever
☐ They can sell the work to others
☐ They can reproduce the work

Text Caption: Quiz 3 Item 3. True or False

Points: 20
Type: Graded
Passing grade: Continue
Failing grade: Continue
Number of Attempts: 1

Please carefully read this scenario and answer the question that follows.
Peter found a piece of work that fall under Fair Use for his class project, but later his intended use of the work went beyond the scope of Fair Use. Peter decided to contact the owner of the work to obtain permission so that he can use the work for other purpose after he has done with his school project. Did Peter do the right thing?

☐ Yes
☐ No
4. You have been given an assignment that requires you to create a website project that use copyright materials. Read through the sentences below and select one of the most important thing you need to consider.

- Materials on the Internet may be protected by Copyright even if there is no Copyright notice.
- Materials on the Internet are usually free if they are used for educational purposes.
- Materials on the Internet are usually considered as Fair Use.
- Materials on the Internet may be protected by Copyright even if there is no Copyright notice.

☐ Materials on the Internet are usually considered as creative commons
☐ Materials on the Internet are usually free if they are used for educational purposes
☐ Materials on the Internet are usually considered as Fair Use
☐ Materials on the Internet may be protected by Copyright even if there is no Copyright notice

5. Fair Use is not a blanket exemption for Copyright law.

☒ True
☐ False
Text Caption: Quiz 3 Item 6. Multiple-choice

Points: 20
Type: Graded
Passing grade: Continue
Failing grade: Continue
Number of Attempts: 2

All of the following are best practices for using Copyrighted materials in Blackboard courseware, **Except?**

☐ Only students enrolled in the class should have access to the material in Blackboard
☒ Making digital copies of the material to students rather than making electronic link to a licensed material by the school library
☐ Blocking students access to the material at the end of each semester
☐ Using legally acquired materials
## Appendix N: Screenshots of the Limited CDT Lesson

<table>
<thead>
<tr>
<th>Slide Number</th>
<th>Slide</th>
<th>Slide Properties</th>
</tr>
</thead>
</table>
| 1            | ![Slide 1](image1.png) | Log in Required: No  
Logo: Ohio University Logo  
Text Caption: **Lesson on Copyright and Fair Use in a Digital Learning Environment for College Students**  
Designed by : Samuel Antwi  
Patton College of Education |
| 2            | ![Slide 2](image2.png) | Text Caption: Instructions on how to navigate on the learning platform.  
Video: Yes  
Audio: Yes  
Text Caption: Please click on the Play button of the video to view a short tutorial on how to navigate in this lesson. You can click on “Notes” at the Top right corner to view close caption of this video |
| 3            | ![Slide 3](image3.png) | Text Caption: How to go about this Lesson  
Text Caption: This lesson is designed to teach college students about copyright and fair use in digital learning environment.  
The increase in digital materials as technology advance in the field of education had presented challenges to both faculty and students on how to cope with copyright regulations  
This lesson will help to understand how to work with copyright materials in digital learning environment.  
Click NEXT button on your right corner to begin the lesson |
On each slide click next on your right bottom corner to advance to the next stage of the lesson.

<table>
<thead>
<tr>
<th>Learning Objectives</th>
<th>Text Caption: Learning Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Student will be able to:</td>
<td></td>
</tr>
<tr>
<td>• Classify copyright, trademark, and patent work</td>
<td></td>
</tr>
<tr>
<td>• Classify appropriate copyright limitations</td>
<td></td>
</tr>
<tr>
<td>• Employ a general process of determining how to use copyrighted work in an academic setting</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Missing Secondary Presentation Forms: Video was used as Alternative Representation of copyright and fair use concepts.</th>
</tr>
</thead>
</table>

| Missing Secondary Presentation Form: Intellectual property concept was used to help students to retrieve information from their mind concerning situation they have come across that can help them to learn copyright and fair use concepts. |

<table>
<thead>
<tr>
<th>Text Caption: Copyright</th>
</tr>
</thead>
</table>

Text Caption: According to the U.S. A. Copyright Office (2016) copyright is the ownership of an intellectual property within the limits prescribed by a particular nation’s or international law (para 1). Copyright is a form of intellectual property related to certain forms of creative work. Have you created any work that has copyright license?

Copyright law in the United States for example, gives the right to the owner of a property to print, distribute, and
copy the work for any purpose. However, other than the owner of the property whoever wants to use the property for similar purpose must obtain permission from the owner of the property.

Normally authors obtain copyright for their property as soon as the work is created. Although registration of a property makes the copyright more visible to others who want to use the product. Also, authors can strengthen their legal copyright protection by registering their works.

It is important to note that copyright can be unpublished or published works. The U. S. A. law extends copyright for 50 years beyond the life of the author. After that the work becomes available in the public domain.

Missing Secondary Presentation Forms: Images to represent examples of copyright.

Text Caption: Examples of Copyright

5. Text Copyright: Articles, website blogs, fiction, poetry
6. Music Copyrights: original music composition (Written or recorded music)
8. Image credit: creativecommons.com
<table>
<thead>
<tr>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short Answer</td>
</tr>
<tr>
<td>In your own words define copyright?</td>
</tr>
<tr>
<td>Points: 5</td>
</tr>
<tr>
<td>Type: Graded</td>
</tr>
<tr>
<td>Passing grade: Continue</td>
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<tr>
<td>Failing grade: Continue</td>
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<tr>
<td>Number of Attempts: 1</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Text Caption: Examples of Trademark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trademark can be a symbol, words, or phrase that can be used to distinguish the source of a product among other parties.</td>
</tr>
<tr>
<td>Companies can legally register their trademark to distinguish them from other companies. One of the main goals of trademark is to allow consumers to easily identify the producers of goods and services and avoid confusion.</td>
</tr>
<tr>
<td>As mentioned in copyright law, registered trademarks have some degree of legal protection compared to unregistered trademark.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Text Caption: Patent</th>
</tr>
</thead>
<tbody>
<tr>
<td>• According to World Intellectual Property Organization (2015) a &quot;patent is an exclusive right granted for an invention, which is a product or a process that provides a new way of doing something or offers a new</td>
</tr>
</tbody>
</table>
The owner of the patent is protected by the patent protection of the invention. Generally, patent protection is limited to about 20 years.

When an invention is registered for patent protection it means no one cannot commercially produce, use, distribute or sell without the patent owner’s consent.

Within the patent invention period the patent owner has the right to decide who may or may not use the patented invention.

The patent owner may sell the invention to someone else within the patented period.

After the patented period expires the invention becomes available in the public domain. Thus, the owner will no longer have exclusive rights the invention; hence the invention will be available for commercial exploitation by other who is interested.

Acquiring patent for an invention is necessary because it provides incentive and offers recognition to the inventor. It also promotes innovations which enhance quality of life.

**Technical Solution to a Problem**

**10**

Missing Secondary Presentation Forms:


Text Caption: Examples of Patent work
- **Software Patent**: A mathematical software such as SPSS that analyze data which is different from current ones may be protected by a patent
- **Design Patent**: The size, shape, and appearance of a device such as music device may be protected by a patent
- **A utility Patent**: Protects how a product functions or operates. Energy saving bulb has a unique function of consuming less energy compared to other bulbs

---

### Short Answer

When we say Patent what does it mean? Describe it in your own words.

**Points**: 5  
**Type**: Graded  
**Passing grade**: Continue  
**Failing grade**: Continue  
**Number of Attempts**: 1

---

### Short Answer

What do you understand by the term Trademark? Briefly describe it in your own words.

**Points**: 5  
**Type**: Graded  
**Passing grade**: Continue  
**Failing grade**: Continue  
**Number of Attempts**: 1

---

### Text Caption: Quiz 1 Item 1. Multiple Choice

1. Please carefully read the items below and select each that would be patent
   - Noise-canceling headphones
   - A better pencil than standard lead pencils
   - A website that has several colors
   - A software specially designed for voice recognition
   - A song composed by the Beatles

**Points**: 20  
**Type**: Graded  
**Passing grade**: Continue  
**Failing grade**: Continue  
**Number of Attempts**: 2
<table>
<thead>
<tr>
<th>Number</th>
<th>Text Caption: Quiz 1 Item 2</th>
<th>Points: 20</th>
<th>Type: Graded</th>
<th>Passing grade: Continue</th>
<th>Failing grade: Continue</th>
<th>Number of Attempts: 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>Recall your favorite Basketball or Football team. Would you classify the Logo of your team as a Patent?</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number</th>
<th>Text Caption: Quiz1 Item 3</th>
<th>Points: 20</th>
<th>Type: Graded</th>
<th>Passing grade: Continue</th>
<th>Failing grade: Continue</th>
<th>Number of Attempts: 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>You were invited to perform as a Singer in a concert and you recorded your show with your own lyrics. Is the recorded lyrics a Copyright?</td>
<td>Yes</td>
<td></td>
<td></td>
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<td>16</td>
<td>No</td>
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<tr>
<td><strong>Text Caption: Quiz 1 Item 4</strong></td>
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<tr>
<td>Points: 20</td>
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<tr>
<td>Type: Graded</td>
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<tr>
<td>Passing grade: Continue</td>
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<tr>
<td>Failing grade: Continue</td>
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<tr>
<td>Number of Attempts: 2</td>
<td></td>
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</tr>
<tr>
<td>Please carefully read the items below and select each that would be a <strong>Trademark</strong></td>
<td></td>
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<td></td>
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<tr>
<td>☐ A sound system that has special shape and sound</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>☐ Nationwide Insurance's Slogan</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>☐ Ohio University Logo</td>
<td></td>
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<tr>
<td>☐ A written post on a website about Industrial Revolution</td>
<td></td>
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<td></td>
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<tr>
<td>☐ A lyrics composed by the Beatles</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>☐ A software specially designed for voice recognition</td>
<td></td>
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<table>
<thead>
<tr>
<th>17</th>
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</thead>
<tbody>
<tr>
<td><strong>Text Caption: Quiz 1 Item 5</strong></td>
<td></td>
</tr>
<tr>
<td>Points: 20</td>
<td></td>
</tr>
<tr>
<td>Type: Graded</td>
<td></td>
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<tr>
<td>Passing grade: Continue</td>
<td></td>
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<tr>
<td>Failing grade: Continue</td>
<td></td>
</tr>
<tr>
<td>Number of Attempts: 2</td>
<td></td>
</tr>
<tr>
<td>☐ A sound system that has special shape and sound</td>
<td></td>
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<td>☐ Nationwide Insurance's Slogan</td>
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</tr>
<tr>
<td>☐ Ohio University Logo</td>
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<tr>
<td>☐ A written post on a website about Industrial Revolution</td>
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<tr>
<td>☐ A lyrics composed by the Beatles</td>
<td></td>
</tr>
<tr>
<td>☐ A software specially designed for voice recognition</td>
<td></td>
</tr>
</tbody>
</table>
Missing Secondary Presentation form:
Prerequisite information: TEAC Act was used as a synopsis to help students to make connection to copyright limitations.

Photo: Built-in photo in Articulate Studio

Text Caption: Copyright Limitations
- There are some exceptions that apply to how copyrighted work can be used for educational purposes.
- Copyright limitations are exceptions to copyright laws which allow someone to use copyrighted work without a license from the copyright owner.
- Copyright limitations and exceptions allow creator to access and build upon the knowledge generated by others. It also promotes innovation in for the benefit of mankind.
- Without exceptions and limitations, it would be challenging to fully benefit from copyrighted works. For example, it would be challenging to use copyrighted work for educational purposes, research, and scholarship just to mention a few.
- One of the main goals of copyright exceptions and limitations is to encourage learning and dissemination of knowledge. Almost all of the international copyright agreements permit certain exceptions to the exclusion rights of the authors.
The good news is that there is a way to use a copyrighted work with less stress.

Fair use is a type of limitation on the exclusive rights of copyright holder. Fair use allows public consumers to make copies of part or all copyrighted work even without obtaining permission from the copyright owner. Fair use is an ideal way to allow the general public to benefit from copyrighted works. It is intended to move created works into the public domain before and after the protected time period.

If a product is considered as “fair” it means its use does not infringe copyright. However, it is important to note factors that determine fair use of a copyrighted work.

So how can you use copyrighted material such as an article on Blackboard? Note that most library databases acquire license for some materials that Professors can use an article for teaching courses in an online learning environment. In this case the
Professor can post, for example the entire article on Blackboard for students. The professor can even use those materials for repeated semesters. Other than that, the Professor needs to obtain permission from the owner of the work, and cannot be used for repeated semesters.

- Note that instructor do not need to obtain permission to use works produced by United States government however, they need permission to use works that has been contracted with other entity.

| 21 | Missing Secondary Presentation Forms:  
The use of arrows changed the structure of the presentation  
Mnemonic technique: PURENA  
Extra textual presentation  
Text Caption: Fair Use Standards  
- The purpose and character of your use  
- The effect of the use upon the potential marked  
- The nature of the copyright work  
- The amount and substantiality of the portion taken |

| 22 | Photo: Built-in photo in Articulate Studio  
Text Caption: Obtaining Copyright Permission  
Have you been in a situation where you have to contact copyright owner of a material before you can accomplish your work? |
Now let’s look at the procedure to use copyright work.

**Missing Secondary Presentation Forms:**
- Arrows that connect each procedure

**Text Caption:** *The General Procedure to use Copyrighted Work*

- Does the work fall under the category of copyright?
- Does the work have any academic exceptions to exclusive rights to the copyright work?
- Does the work have any legal limitations to exclusive right to the copyright work?
- If the answer to any of the above questions is Yes then you need to obtain permission before you can use the work
- Obtain any permission
- Acknowledge/attribute the work

**Steps to Obtain Permission from a Copyrighted work**

- Contact the Copyright Owner: When you identify the copyright owner you need to request for permission to use the work. Sometimes publisher provides a way to contact the copyright owner. In the process of obtaining permission you need to be patient and consistent because sometimes it takes a while for owners to grant permission or reply.
- Secure Permission: Contact the owner or the publisher to confirm the copyright ownership.
- Keep a record: Make sure you keep all the correspondence/communication in this process the will happen in the process of gaining permission to the work.

**Missing Secondary Presentation forms:**
- Mnemonic: ConSeKeep
- Arrows
- Structural presentation

**Text Caption:** Quiz 2 Item 1. Multiple-choice

- Points: 20
- Type: Graded
- Passing grade: Continue
- Failing grade: Continue
- Number of Attempts: 2
What are the best ways to use Copyrighted materials in Blackboard courseware? check all options that apply

- All the materials should be acquired legally
- Only students who enroll in the class can have access to the materials
- Students would be allowed to redistribute the material because they are enrolled in the class
- All the materials should be blocked at the end of the class
- All licensed electronic materials should be linked to the library database

Text Caption: Quiz 2 Item 2. Multiple-choice

Points: 20
Type: Graded
Passing grade: Continue
Failing grade: Continue
Number of Attempts: 2

Please carefully read this scenario and answer the questions that follows. Your Psychology Professor, Mr. Bans searched Ohio Link and found an excellent article for his class in this Fall semester. This article was published in 2013 and he wants to share this article with his students on Blackboard Courseware. If the article falls under Fair Use what is the best practice he needs to consider so that he doesn't infringe on Copyright law? Select the best answer from the choices below.
Assume that Professor Clark finds and excellent video on Industrial Revolution that is Copyrighted and he wants to use it in his class. What are the steps that he needs to follow so that he can use it for his History class? Arrange the steps below in order. Please you have to click and hold, and drag to arrange them in right order.

- Contact the Copyright owner of the video
- Secure permission
- Keep a record

Which of the following materials can be used in the classroom without...
| ☑ Work with an expired Copyright date |
| ☐ Works in the public domain |
| ☐ Works produced by the United States government that has not been contracted with other entity |
| ☐ Photographs that are exact reproduction works in the public domain |
| ☐ Articles in journals that explicitly allow non-profit education use without permission |

Text Caption: Quiz 2 Item 4. Click and drop

Points: 20
Type: Graded
Passing grade: Continue
Failing grade: Continue
Number of Attempts: 2

Read the following and arrange them according to the general process to use Copyrighted work. Please click the drop down menu to select the right answer in each step:

- ☐ Determine if the work falls under Copyright category
- ☐ Identify any legal limitations to exclusive rights to the Copyright work
- ☐ Identify academic exceptions
- ☐ Obtain any permission
- ☐ Acknowledge the work
Text Caption: Quiz 3 Item 1. Multiple-choice

Points: 20
Type: Graded
Passing grade: Continue
Failing grade: Continue
Number of Attempts: 2

Your Sociology Professor has only two copies of a textbook and decided to make copies for her students because the bookstore did not have them available for students to purchase. The semester has reached third week and she wants her students to catch up with the class. What are the possible questions that your Professor need to ask herself before she can make copies for her students? Check all that applies.

☐ Did I legally acquire the two copies of the book?
☐ Does the textbook fall under Fair Use or Copyright exemptions?
☐ Who owns the textbook?
☐ Where can I purchase more copies of the textbook?
☐ Is the textbook eligible for Copyright protection?

Text Caption: Quiz 3 Item 2. Multiple-choice

Points: 20
Type: Graded
Passing grade: Continue
Failing grade: Continue
Number of Attempts: 2

All of the options below are rights Copyright holders have, except?
☐ They can distribute the work publicly

☐ They can sell the work digitally
☐ They can sell the work to others
☐ They can make more copies of the work

☐ They can sell their work publicly
### Quiz 3 Item 3. True or False

**Points:** 20  
**Type:** Graded  
**Passing grade:** Continue  
**Failing grade:** Continue  
**Number of Attempts:** 1

Please carefully read this scenario and answer the question that follows. Peter found a piece of work that fall under Fair Use for his class project, but later his intended use of the work went beyond the scope of Fair Use. Peter decided to contact the owner of the work to obtain permission so that he can use the work for other purpose after he has done with his school project. Did Peter do the right thing?

- Yes  
- No

### Quiz 3 Item 4. Multiple-choice

**Points:** 20  
**Type:** Graded  
**Passing grade:** Continue  
**Failing grade:** Continue  
**Number of Attempts:** 2

You have been given an assignment that requires you to create a website project that use copyright materials. Read through the sentences below and select one of the most important thing you need to consider.

- They can own their work forever  
- They can sell the work to others  
- They can reproduce the work

### 32

3. Please carefully read this scenario and answer the question that follows.

Peter found a piece of work that fall under Fair Use for his class project, but later his intended use of the work went beyond the scope of Fair Use. Peter decided to contact the owner of the work to obtain permission so that he can use the work for other purpose after he has done with his school project. Did Peter do the right thing?

- Yes  
- No

### 33

4. You have been given an assignment that requires you to create a website project that use copyright materials. Read through the sentences below and select one of the most important thing you need to consider.

- They can own their work forever  
- They can sell the work to others  
- They can reproduce the work
| 34 | □ Materials on the Internet are usually considered as creative commons  
□ Materials on the Internet are usually free if they are used for educational purposes  
□ Materials on the Internet are usually considered as Fair Use  
□ Materials on the Internet may be protected by Copyright even if there is no Copyright notice |

Text Caption: Quiz 3 Item 5. True or False  
Points: 20  
Type: Graded  
Passing grade: Continue  
Failing grade: Continue  
Number of Attempts: 1  
Fair Use is not a blanket exemption for Copyright law.  
☑ True  
□ False |

| 36 | Text Caption: Quiz 3 Item 6. Multiple-choice  
Points: 20  
Type: Graded  
Passing grade: Continue  
Failing grade: Continue  
Number of Attempts: 2  
All of the following are best practices for using Copyrighted materials in Blackboard courseware, Except?  
□ Only students enrolled in the class should have access to the material in Blackboard |
| ☑ | Making digital copies of the material to students rather than making electronic link to a licensed material by the school library |
| ☐ | Blocking students access to the material at the end of each semester |
| ☐ | Using legally acquired materials |
Appendix O: Participants Quiz Scores

Group A: Participant Score for Quiz 1

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<tr>
<th>Participant</th>
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Note: 1 means participants answered the item correct and 0 means incorrect

Group A: Participant Score for Quiz 2

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Note: 1 means participants answered the item correct and 0 means incorrect

### Group A: Participant Score for Quiz 3

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Note: 1 means participants answered the item correct and 0 means incorrect

### Group B: Participants Score for Quiz 1

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Note: 1 means participants answered the item correct and 0 means incorrect Group B:
Group B: Participant Score for Quiz 2

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Note: 1 means participants answered the item correct and 0 means incorrect

Group B: Participant Score for Quiz 3

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Note: 1 means participants answered the item correct and 0 means incorrect
# Appendix P: Coding Scheme for Participants’ Learning Experience with CDT Prescriptions

## CDT Parameters

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<th>Coding Scheme</th>
<th>Themes/Descriptions</th>
<th>Examples of Participants’ comments</th>
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<tr>
<td>Primary Presentation Forms EG + Eegs + IegsN + IegsN</td>
<td>Logical sequence</td>
<td>Right attributes, well-defined concepts, clarity, explicit, succinct</td>
<td>I liked how the lesson was sequenced, because after learning definition of each concept, I had enough examples and practice items to work with. I think that makes a lot of sense. The concepts were well-defined and easy to understand.</td>
</tr>
<tr>
<td>EG – Expository Generality</td>
<td>Right attributes, well-defined concepts, clarity, explicit, succinct</td>
<td>• Use appropriate language to describe concept attributes. • Clarity in concept definition is important</td>
<td></td>
</tr>
<tr>
<td>Eegs – Expository Instance</td>
<td>Relevance, context, precise, specific, fidelity (actual representation)</td>
<td>• Use instances that are relevant to the student • Provide enough instances to the student • Provide examples that the student can relate to</td>
<td>I could relate the examples to my academic experience. I’m always careful when I’m using a copyrighted material because I can be in trouble if I don’t use it appropriately.</td>
</tr>
<tr>
<td>IegsN – Inquisitory Instance</td>
<td>complexity, context</td>
<td>• Provide specific examples of the generality • Provide real-world examples</td>
<td>The examples were straightforward and I could easily relate them to my daily academic experience.</td>
</tr>
<tr>
<td>IegsN – Inquisitory Instance New</td>
<td>Divergent, Transfer of knowledge, Real-world scenarios,</td>
<td>• Offer divergent examples • Offer easy-to-complex examples that can help the student to solve real-world problems</td>
<td>I think there wasn’t any redundancy in the examples. At each step in the lesson I had different set of examples of the same concept that</td>
</tr>
<tr>
<td><strong>Secondary Presentation Forms</strong></td>
<td>Elaborations</td>
<td>It is an important elaboration component that need to be added to primary presentation forms to facilitate learning</td>
<td></td>
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<tr>
<td>----------------------------------</td>
<td>--------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Mnemonics</td>
<td>Efficient, effective, motivation, interest</td>
<td>Offer the student an opportunity to form her/her own mnemonics Use appropriate mnemonics techniques That saved me time and helped me to memorize some important information in the lesson</td>
<td></td>
</tr>
<tr>
<td>Prerequisite Information</td>
<td>Confusion, Demotivated,</td>
<td>Student became frustrated because could not make clear connection to the prerequisite information. Use relevant information the learner can relate to It was kind of hard for me to retrieve from my mind what copyright and fair use is all about. I think I would be motivated if I already know some important information about the topic</td>
<td></td>
</tr>
<tr>
<td>Alternative Representation</td>
<td>Good entry point, helpful, more perspective, learning style</td>
<td>Use of multimedia is relevant in the context of alternative representation. Offer alternative representation of the generality The video you provided saved me time. I’m audio-visual learner so the video was helpful. I didn’t spend more time on reading some part of the text because I learned a lot from the video</td>
<td></td>
</tr>
<tr>
<td>Help</td>
<td>Appeal, efficient</td>
<td>Use appropriate help elaboration that could motivate the student to process the learning material The way arrows and boldface were used in the lesson was helpful because it condensed the lesson and made learning easier</td>
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<tr>
<td>Feedback</td>
<td>Motivated, Interest Clarity</td>
<td>Select appropriate feedback that could provide the student I was kind of glad to know my</td>
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</tr>
<tr>
<td>Inter-display Relationship</td>
<td>Process</td>
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</tr>
<tr>
<td>---------------------------</td>
<td>---------</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Learner Control</strong></td>
<td>Learner autonomy, learning preferences</td>
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<tr>
<td></td>
<td>- Provide the student an opportunity to have some degree of control over the lesson</td>
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<tr>
<td></td>
<td>- I could learn on my own pace, I could go back and learn concepts I didn’t understand. I could also go back to check for differences between concepts</td>
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<td><strong>Divergence</strong></td>
<td>Transfer of learning</td>
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<tr>
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<td>- Give the student an opportunity to apply acquired knowledge to solve real-world problems</td>
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<tr>
<td></td>
<td>- I think this lesson will help me a lot as I plan to go to graduate school</td>
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<tr>
<td><strong>Isolation</strong></td>
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<td>- Make clear distinction between primary and secondary presentation forms</td>
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<td>- I didn’t experience any confusion in the lesson the lesson was straight forward and clear</td>
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</table>
Appendix Q: Reply Message from Professor Charles Reigeluth

On April 4, 2017, at 1:37PM, Samuel Wrote:
Samuel Antwi
Ohio University
Athens, OH
Department of Educational Studies

Dear Professor Reigeluth,

I am a doctoral candidate at Ohio University writing my dissertation with Dr. David R. Moore as Chair of my committee.
I would like to use two figures of yours “Six Aspects of Instructional Design-Theory, 2009” and The Components of Instructional-design Theories, 1999" in my research study.
I will use these figures only for my research and will not use it for any compensated activities.
If you agree to grant me your permission, please indicate so by replying to me through email: sa530111@ohio.edu.

Sincerely,

Samuel Antwi
Doctoral Candidate.

On April 4, 2017, at 4:27PM, Professor Reigeluth Replied:
Samuel,

You have my permission, as long as you credit the source as a complete citation.

Charles.
Appendix R: Reply Message from Professor M. David Merrill

On April 4, 2017, at 1:37PM, Samuel Wrote:

Samuel Antwi
Ohio University
Athens, OH
Department of Educational Studies

Dear Professor Merrill,

I am a doctoral candidate at Ohio University writing my dissertation titled, Formative Research on Component Display Theory with Dr. David R. Moore as Chair of my committee.


I will use these figures only for my research and will not use it for any compensated activities.

If you agree to grant me your permission, please indicate so by replying to me through email: sa530111@ohio.edu.

Sincerely,

Samuel Antwi
Doctoral Candidate.

On April 4, 2017, at 2:11PM, Professor Merrill Replied:

Hi Samuel

You have my permission to reproduce the two figures you identified: Performance-Content Matrix and Primary Presentation Forms.

I wish you well with your study. Please keep informed. Thank you for your interest in my work.

Dave Merrill
M David Merrill
1812 West Sunset Blvd 1-145
St. George, UT 84770
http://mdavidmerrill.com
Mobile: 435 760-0419

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