INFLUENCE OF ADVERSARY INSTRUCTIONAL TECHNIQUE ON LEARNER ACHIEVEMENT IN BOOK KEEPING IN PUBLIC SECONDARY SCHOOLS IN KOMOTHAI ZONE, KIAMBU COUNTY, KENYA

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DECLARATION

I declare that this project is my original work and has not been submitted to any University for examination or for any other award.

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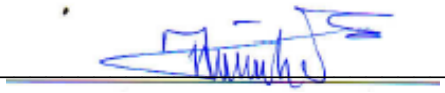
This project has been submitted with my approval as the University Supervisor



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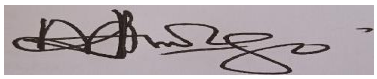

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DEDICATION

I dedicate this project to my Mother, Eunice Augo for her encouragement and continuous support from my early years of learning to date and attainment of all credentials during my life. She assisted me to overcome difficulties and to excel in my academic life. May she live to see her great grandchildren.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACRONYMS/ABBREVIATIONS

AC	Assimilating cognition
AIT	Adversary Instructional Technique
CA	Colour Accounting
CI	Confidence Interval
CL	Controversial Learning
DK	Declarative Knowledge
KNEC	Kenya National Examination Council
LABK	Learner Achievement in Book Keeping
IBSC	Integrated Business Studies Curriculum
SPSS	Statistical Package for the Social Science
UK	United Kingdom
UN	United Nations
ZPD	Zone of Proximal Development

ABSTRACT

The research titled Influence of Adversary Instructional Technique on Learner Achievement in Bookkeeping in public secondary schools in Komothai Zone, Kiambu County, Kenya aimed to examine the influence of adversarial teaching methods on students' ability to acquire bookkeeping skills. The research was conducted with the following aims: determine the effect of adversary technique in adopting controversy in learner achievement in bookkeeping on public secondary schools; assess the impact of adversary instructional technique in assimilating cognition in learner achievement in bookkeeping on public secondary schools and evaluate the impact of adversary technique in declarative knowledge in learner achievement in bookkeeping on public secondary schools in Komothai zone, Kiambu County. The study aimed to offer a deeper understanding of educators' perspectives regarding the utilization of adversarial instructional methods in the instruction and acquisition of bookkeeping, as well as its potential impact on learner performance. The results of this scholarly investigation may be utilized to enlighten policies and methodologies such as chromatic bookkeeping associated with the application of the method in the educational perspectives. The study utilized interpretative and positivist research frameworks and implemented a quasi-experimental methodology, specifically employing the Solomon four-group design, to assess and contrast the effects of two interventions and two control groups. Furthermore, both qualitative and quantitative research methodologies were employed for the purpose of data acquisition. The data was obtained through interviews, classroom observations, questionnaires, and achievement tests. Both descriptive and inferential statistics were computed using SPSS Version 22 to analyze the data generated and depicted in graphs, frequencies, and proportions. The findings of the study indicated that within the experimental group, the institution's name (B= 0.168, t=3.602, p=0.000), learner's attitude (B=0.191, t=4.201, p=0.000), controversy learning (B=0.121, t=2.575, p=0.010), and assimilating cognition (B=0.144, t=3.319, p-value of 0.001) exhibited positive and statistically significant effects on learner achievement in bookkeeping. Conversely, in the control group, the variables of school name (B=0.179, t=3.882, p=0.000) and learner attitude (B=0.163, t=3.414, p=0.001) demonstrated positive and significant associations with learner achievement in bookkeeping. The examination revealed that the corresponding educational institutions and learner disposition resulted in a beneficial impact on learner performance in both the control and experimental cohorts. Specifically, the learners mentioned convenience, simplicity, and utility in educational environments as primary factors. The study suggested that the Ministry of Education should formulate policies that are mindful of the distinctiveness among educational establishments. Furthermore, it is imperative for the administration of secondary schools to take into account the customization of instructional approaches in order to cater to diverse learning modalities, thereby enhancing students' comprehension and long-term retention of intricate ideas. Moreover, the research emphasizes the need for additional scholarly evaluation regarding the efficacy of the existing pedagogical approaches and educational initiatives.

CHAPTER ONE: INTRODUCTION

1.1 INTRODUCTION

This section introduced the study's context, including its historical context and the problem under investigation, followed by the study's objectives, research inquiries, importance, limits, and the explicit definitions of pivotal terms.

1.2 Background to the Study

Bookkeeping involves keeping a record of financial dealings, with the aim of maintaining accurate fiscal registers. Book keeping involve of systematizing, evaluating and summarizing all financial movements, such as purchases, sales, receipts, and payments, and is used to monitor the fiscal situation of a business (Karanja et al., 2020). Bookkeeping dates back to 1494 in Italy, where traders considered Book keeping as arithmetic operations carried out by a business (Smith, 2022). Pacioli (1446-1517) devised a double entry system, and lamented that he lacked access to a color printer, which would have enabled him to implement Color Accounting and improve the efficiency of his double entry system even further.

In secondary business studies education, bookkeeping is an important concept that teaches students the fundamentals of sound financial management. Students learn how to accurately record and track financial data and create financial reports, such as balance sheets, income statements, and cash flow statements. Bookkeeping also teaches students how to analyze financial data, identify trends and make informed business decisions. According to Corporate

Finance Institution (2015), book keeping is the keeping records of all financial transactions. Book keeping builds the foundation of keeping records of the financial affairs of a business. It is important for students to be familiar with this concept as it helps them to develop good financial habits early on, such as tracking their income and expenses and understanding the importance of budgeting. Additionally, teaching bookkeeping in secondary schools provides students with a better understanding of how businesses operate and how to make sound financial decisions.

Lack of comprehensive knowledge on bookkeeping among the secondary school learners pursuing business education has several drawbacks. First, without a basic understanding of bookkeeping, students may struggle to understand more advanced topics in business and finance. Second, without bookkeeping knowledge, students may not be aware of the importance of financial planning, budgeting, and decision-making. Third, without bookkeeping skills, students may not be able to properly analyze financial data and make informed decisions. Finally, without bookkeeping knowledge, students may lack the confidence to handle their own finances in the future. Proper comprehension of the concept therefore is a cornerstone of business studies education, as it helps learners gain an understanding of the financial aspects of businesses.

Bookkeeping is typically taught in secondary school at Form Three and Form Four as part of a business studies curriculum. (KNEC,2021). Students learn the fundamentals of bookkeeping, such as double-entry bookkeeping, the accounting equation, the chart of accounts, and the recording process. They also learn how to create financial statements, such as balance sheets and income statements. Additionally, students are taught how to analyze financial data and make informed decisions. Teachers may use a variety of methods to teach bookkeeping, such as

lectures, case studies, and class discussions. Lectures are a popular method for teaching the fundamentals of bookkeeping, such as double-entry bookkeeping, the accounting equation, and the chart of accounts. Case studies are often used to demonstrate how to apply bookkeeping principles in real-world situations. Finally, class discussions are a great way to engage students in the material and help them understand how to analyze financial data and make informed decisions.

Book keeping being an integral part of an interdisciplinary subject requires careful selection of suitable teaching technique(s) to enhance learner achievement in Book keeping. The teaching methods adopted by teachers as stated by Ganira, Odundo, Gatumu, Muasya (2019) revealed that appropriate teaching methods facilitates interaction between learner and content to achieve specific goals in relation to the curriculum content. In connection to this argument, Nasio et al (2018) assert that the suitability of teaching technique varies with circumstances and environment to bring about fundamental change in the life of the learner. Further, Tebabal and Khassay (2021) maintain that the primary purpose of adopting Instructional techniques at any level of education is to enhance learner achievement. The Encyclopedia International Vol.17(1979) cited in Koko (2019) describe appropriate Instructional technique as that which will enable a teacher provide guidance, suggest activities and supply materials to stimulate learning thus promoting learner achievement in Book keeping.

1.2.1 Adversary Instructional Technique of Teaching using Colour

Adversary instructional technique is a teaching method that encourages learners to think critically and challenge their assumptions by engaging in debate and discussion. According to Eberly Center (2016), adversary technique refers to an instructional approach where a teacher uses controversy to assist learners understand key concepts, principles, skills and abilities about Book keeping, which leads to learner achievement in Book keeping. This technique is based on the idea that the best way to assimilate new information and refine content is through dialogue and collaboration. Adversary instructional technique encourages learners to consider different perspectives and evaluate new ideas in order to come to an informed conclusion. This technique helps to foster critical thinking skills and encourages learners to become more engaged in the material. Additionally, adversary instructional technique helps to create an environment of collaboration, which can lead to deeper understanding of the subject matter.

The utilization of adversary instructional technique pedagogy in learner achievement is significant as it motivates individuals to explore their beliefs and question their assumptions. This methodology aids in developing critical thinking capabilities and stimulates students to become more involved in the subject matter. Furthermore, it assists in generating a collaborative atmosphere, which can result in a more thorough understanding of the material. For students who are struggling to grasp concepts, adversary technique can help to construct knowledge by offering them a chance to exchange ideas and debate. This approach of pedagogy assists in simplifying complicated topics, allowing them to be more easily comprehended by those struggling to understand them.

The disadvantages of adversary instructional techniques of learning involve the prospect of prejudice and the likelihood of collective thought. Adversary instructional techniques necessitate group discourse and argumentation, which can potentially result in bias if certain voices are given greater consideration than others. Furthermore, groupthink could arise if students concentrate too much on attaining agreement and neglect to question each other's ideas. Moreover, adversary instructional techniques can be time consuming and difficult to manage in larger classes. Lastly, students may become too fixated on the discussion and not pay enough attention to the subject matter.

Inventive educators may overcome the shortcomings of adversary instructional techniques of teaching by constructing a secure atmosphere for discourse and contention. They should guarantee that all voices are heard and respected, and that no one learner dominates the discussion. They should also establish regulations for argument and give explicit desires to learners. Moreover, instructors should apply a variety of teaching strategies to keep students captivated and guarantee that they are focusing on the subject matter. Lastly, teachers should guarantee that their students are suitably prepared for the lessons and have the relevant foundational knowledge to partake in meaningful discourse.

1.2.2 Adversary Instructional Teaching Techniques and Colour Teaching

Adversary instructional technique is a teaching method that encourages learners to think critically and challenge their assumptions by engaging in debate and discussion; which may be strengthened by using colour as an approach. This technique through debate arousal can be used

to improve learner achievement in bookkeeping by triggering their interest, motivation and engagement. (Quinn 2013). In support of this wick, (Hiddi & Renninger 2016; Renninger and Bachrach 2019) illustrated that triggering learning activity should be a debate of inspiration to learner achievement in Book keeping. For example, teachers can assign learners to teams and give them a real-world bookkeeping problem to solve. Learners can then debate and discuss the different solutions and come to a consensus on the best answer. This technique encourages students to think more deeply about the material, which can help them better understand the concepts and retain more information; thus learner achievement in Book keeping.

1.2.2.1 Controversial Learning using Colour in Book Keeping

Adversary instructional techniques and adopting controversy in learning can be beneficial for improving learner achievement in bookkeeping. Flinders University (2018) asserts that Controversial Learning is when a teacher helps learners move from black-white thinking to complex understanding of elements which constitute Book Keeping Through the use of adversary techniques, students can practice problem-solving skills and develop strategies for understanding different concepts and equations. This can help to improve their overall understanding of the material and prepare them for examinations and other assessments. Additionally, Rooy (2021) posits that adopting controversy in learning can help students to think critically about different issues, as they must consider multiple perspectives in order to make informed decisions that are geared towards learner achievement in Book keeping. This can further enhance their understanding of the material and help them to identify potential errors or

gaps in their knowledge. Ultimately, both of these strategies can help to foster a deeper understanding of the material and improve learner achievement in bookkeeping.

Adversary instructional technique involves two learners working together to solve problems. This approach can be used to improve learner achievement in bookkeeping by providing students with an opportunity to learn from one another. Through collaboration, learners can practice problem-solving skills and develop strategies for understanding different concepts and equations. Additionally, learners can use the adversary technique to practice their communication skills, as they must explain their processes and findings to their partner in order to successfully complete the task (Richa 2014). This can help to improve their overall understanding of the material and prepare them for examinations and other assessments.

The relationship between adversary instructional techniques and learner achievement in bookkeeping is an important one. Arousing debate can help to encourage learners to engage with the material and work together to find solutions to problems. In furtherance of this, Waddy (2023) maintains that arousing debate is designed to tantalize, energize and fortify the senses with a view to attaining learner achievement in Book keeping. This can help to improve their understanding of concepts, as well as foster critical thinking skills. Clarifying concepts can help learners to better understand the material and identify any areas of confusion to sustain learner achievement in Book keeping. Moreover, Kramer (1993) asserts that clarifying concepts is searching for meaning. Clarifying concepts borrows controversial learning in adversary technique to identify common misconceptions, employ students' prior knowledge, guide instructional adaptations and recognize the need for additional practice with a view to promote

learner achievement in Book keeping.(Vallath et al 2022) Unpacking complexity can also help learners to break down difficult concepts and equations into simpler components, allowing them to more easily comprehend them. This is in collaboration with Rhodes (2022) who observed that unpacking complexities help overcome blind spots in learning hence learner achievement in Book keeping.

All of these techniques can be used to improve learner achievement in bookkeeping. By engaging in debate, learners can gain a deeper understanding of the material, as well as practice their communication and problem-solving skills. Clarifying concepts can make it easier for learners to comprehend the material, while unpacking complexity can allow them to break down difficult equations into smaller parts. Ultimately, these techniques can help learners to gain a more comprehensive understanding of bookkeeping, which can lead to better performance on examinations and other assessments.

1.2.2.2 Assimilating Cognition using Colour in Book keeping

The relationship between adversary instructional techniques in assimilating cognition (AC) and learner achievement in bookkeeping is a complex one. In favour of this notion, Beauchamp (2022) opined that assimilating cognition leads to cognitive equilibrium; which Jean Piaget, as cited by Heick (2019) propagates AC as a state of balance attained when learner expectations based on prior knowledge fit with new knowledge. Balance sheet is a representation of Book keeping equation whereby an equilibrium is attained when total assets equal total liabilities plus capital. This approach can be used to improve learner achievement in bookkeeping by providing

students with learning activities that integrate new information into an existing schema of ideas; an aspect that boost learner achievement in Book keeping strategies. Individual learner feels confronted when having cognitive disequilibrium hence AC helps manage the discrepant ideas through Adversary technique for understanding different concepts and equations resulting into effective learner achievement in Book Keeping. AC can also help learners to better understand the basic principles of bookkeeping. By working with their partner, learners can identify and discuss the relationships between the different elements that constitute bookkeeping. In addition, Kendra (2022) amplified that AC can help learners improve their accuracy in recording transactions which is key to learner achievement in Book Keeping. This can lead to improved accuracy and ultimately, greater success in their bookkeeping endeavors.

The relationship between adversary instructional techniques and learner achievement in bookkeeping is one of integration and internalization. Fender & Keeley 2018) view integrating ideas as ability to fuse related claims into a single thought. Premised on this realization, Rosie Byrnes (2021) indicated that a teacher should help learners make connections by approaching problem from different angles to boost learner achievement in Book keeping. Adversary instructional technique acts as a bridge between the controversial issue and solution as it allows learners to integrate ideas and concepts by working together to solve bookkeeping problems so as to sustain learner achievement in Book Keeping. As observed by Kahu, Nelson & Picton (2017), Adversary InstructionalTechnique mixes theories with practice; a fundamental aspect in learning Book keeping that combines both logical and arithmetical analysis in order to attain learner achievement in Book keeping. This process encourages learners to think critically about

the material and synthesize their understanding into a cohesive whole. Internalizing connections also plays a role in learner achievement in bookkeeping, as learners must be able to draw connections between different pieces of information to solve problems. This is in agreement with Collins & Lanza (2020) who viewed the importance of internalizing connections as the latent transition analysis of key concepts in assimilating cognition to foster learner achievement in Book keeping. Further observation by Roorda (2021) maintain that students who depict internalizing behaviors have high and quality connections with their making it possible to attain learner achievement in Book keeping. Finally, adversary instructional techniques can help to refine content as it continually and progressively improve ideas by allowing learners to re-examine already existing information, modify content structure as driven by learning priorities; which is learner achievement in Book keeping. Kuhn (2014) considers refining content as a process of gradual enlightenment and knowledge improvement initiative. This can be beneficial to bookkeeping learners, as it can help them to better understand the material and prepare them for examinations and other assessments. Moreso, Mason Gordon, K.Chen & B.Hutchinson (2020) posit that refining content when utilizing Adversary instructional technique would remove fault hence learner achievement in Book Keeping.

1.2.2.3 Declarative Knowledge using Colour in Book Keeping

Adversary instructional technique builds the student's ability to defend their ideas and strategies to the instructor, using facts and evidence to support their arguments. Sharma (2019) designated that declarative knowledge incorporates domain knowledge into judgemental reasoning; which is practically essential for learner achievement in Book keeping. This technique encourages

students to think critically and think outside the box when it comes to problem solving. In the same vein, declarative knowledge is the ability to recall facts, rules, and concepts. Furthermore, Tai (2018) asserts that declarative knowledge boosts appropriateness and relevance of information disseminated to learners in mastering content hence learner achievement in Book keeping. It is the basis for understanding and learning new material. In bookkeeping, declarative knowledge includes the ability to recall and apply accounting principles, regulations, and laws. Additionally, it includes the ability to understand and interpret financial statements, balance sheets, and other financial documents.

The relationship between adversary instructional technique, declarative knowledge, and learner achievement in bookkeeping is that the use of adversary technique can help to improve learner achievement by improving the student's ability to use declarative knowledge. Adversary instructional technique encourages students to use critical thinking and reasoning skills to evaluate their ideas and strategies. This will help students to better understand and apply the accounting principles, regulations, and laws that are necessary for success in bookkeeping. Additionally, the use of adversary instructional technique can help students to better store and recall the declarative knowledge that is necessary for successful bookkeeping.

Adversary instructional techniques can be used to build declarative knowledge in learning and improve learner achievement in bookkeeping. Utilizing reasoning, learners can use the technique to practice problem-solving skills and develop strategies for understanding different concepts and equations. In support of these sentiments, Bolisani (2020) attested that learning manifests itself through the discipline and practical purpose of using knowledge as an object; a practice

that is significant to learner achievement in Book keeping. Through collaboration, they can practice their communication skills as they explain their processes and findings to their partner. This helps to improve their overall understanding of the material which in turn allows them to better conceptualize assertions and store experience. In connection to this argument, Tully (2022) proposed that knowledge and skills should be built on concepts rather than generalized theories; and as such learner achievement in Book keeping is realized. This can help them to better prepare for examinations and other assessments. Additionally, the technique can help to motivate learners and engage them in the learning process. Boller (1990) confirms that an argument in class becomes real if the assertions are used with intent to support learning thus learner achievement in Book keeping. In accordance to. Mc Gull (2018), content delivery should aim at knowledge retention in memory for later use; an aspect that is crucial for learner achievement in Book keeping. Influence of adversary instructional technique in storing experience promotes learner achievement in Book keeping because book keeping entails both explicit knowledge and tacit knowledge and of course adversary technique enables learner to gain subjective knowledge through skills, abilities, personal experience and context

1.3 Statement of the Problem

Knowledge of bookkeeping in business studies may help in unpacking accounting principles which promotes entrepreneurial practice for effective and efficient sustainable record management. In doing so, Book keeping is a critical component of navigating through Business development. Teaching is a complex multifaceted activity often requiring teachers to juggle multiple tasks to create conditions that support learner achievement in Book keeping. To achieve

this, adoption of complex multifaceted instructional approaches such as colour activate learner interest, sustained attention and raise attainment. Different approaches have been used to teach Business Studies. Book keeping entails logical and arithmetical skills to understand key accounting concepts and principles. Integration of Book keeping as a component of Integrated Business Studies Curriculum (IBSC) requires appropriate instructional technique that distinguishes it from other disciplines of the subject such as Economics, Commerce, Entrepreneurship and Office Practice. Inappropriately structured teaching methods of Book keeping may result in low learner achievement as conventional techniques may not fully impart skills that enable learners unpack complex concepts in Book keeping. Adversary Instructional Technique embeds itself in sophisticated pedagogical practice to enable educators in different domains design meaningful learning matters and learners are guided on innovative practices geared towards promoting learner achievement. In the same vein, the study sought to assess the influence of Adversary Instructional Technique using colour as a controversial learning approach on learner achievement in Book keeping in Public secondary schools in Komothai Zone, Kiambu County.

1.4 Purpose of the Study

The purpose of the study was to asses the influence of adversary instructional technique on learner achievement in bookkeeping in public secondary schools in Komothai Zone Kiambu County.

1.5 Objectives

The study was guided by the following specific objectives

i. To examine the influence of adversary instructional technique on learner achievement in bookkeeping in public secondary schools in Komothai Zone Kiambu County
ii. To determine the effect of adopting controversy in learner achievement in book keeping in public secondary schools in Komothai zone, Kiambu County
iii. To assess the impact of assimilating cognition in learner achievement in book keeping in public secondary schools in Komothai zone, Kiambu County
iv. To evaluate the impact of declarative knowledge in learner achievement in book keeping in public secondary schools in Komothai zone, Kiambu County

1.5 Research Questions

The study sought to answer the following questions:

i. To what extent does adversary instructional technique influence learner achievement in bookkeeping in public secondary schools in Komothai Zone Kiambu County?
ii. What is the effect of controversy in learner achievement in book keeping among public secondary schools in Komothai zone, Kiambu County?
iii. How does assimilation of cognition affect learner achievement in book keeping among public secondary schools in Komothai zone, Kiambu County?

iv. What is the impact of declarative knowledge on learner achievement in book keeping among public secondary schools in Komothai zone, Kiambu County?

1.6 Significance of the Study

The study will contribute to the practice of teaching business studies to secondary school learners in Kenya by providing valuable insights into the effectiveness of adversary technique in improving learner achievement in book keeping. The findings of the study will help educators identify areas where adversary instructional technique needs to be improved in order to increase student performance in the subject. The results of the research will also be useful for policy makers as they will be able to use the information to guide the implementation of strategies that will help ensure the success of learners in business studies. Furthermore, the findings of the study will be beneficial to other researchers who are interested in exploring the role of adversary instructional technique in learner achievement in book keeping.

This research will also provide valuable information to educators and policy makers as they will be able to identify areas where adversary instructional technique needs to be improved for better learner achievement in book keeping. Furthermore, the results of this study will be useful to other researchers who are interested in exploring the role of adversary instructional technique in learner achievement in book keeping.

1.7 Scope

This study focused on the influence of adversary instructional technique on learner achievement in book keeping in public secondary schools in Komothai zone, Kiambu County. It assessed the effect of adversary instructional technique in adopting controversy, assimilating cognition and declarative knowledge in learner achievement in book keeping.

1.8 Delimitations

The study targeted form three learners pursuing business studies as subject specialization in public secondary schools in Komothai zone, Kiambu County. Further, the study was premised on adversary instructional technique as manifested by controversial learning, assimilating cognition and declarative knowledge as influencers of learner achievement in bookkeeping. In addition, the study was restricted to public secondary schools within Kiambu county but targeting Komothai Zone.

1.9 Definition of Terms

Adversary technique: Refers to an instructional approach where a teacher uses controversy to assist learners understand key concepts, principles, skills and abilities.

Assimilating cognition : The process of making new information fit in with existing understanding.

Color Teaching: A bookkeeping concept that uses different colors to represent different elements which constitute bookkeeping equation

Book keeping: A systematic way of recording business transactions for future reference or for decision making.

Learner achievement: Refers to the extent to which a learner has attained their short term or long term educational goals

Controversial learning: Refers to a debate arousal approach used by the teacher to enable learner understand the idea better by incorporating argument, debate, critical thinking, cognition and assimilating knowledge about content delivered.

Declarative Knowledge: Refers to a representation of common sense reasoning which creates awareness and understanding of factual information about the world.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter presentented a review of literature relevant to use of adversary instructional technique to teach Book keeping in Public secondary schools in Komothai Zone, Kiambu County. This section also discussed the theoretical and conceptual framework guiding this study and ended with concluding summary and establishment of research gap.

2.2 Empirical review

2.2.1 Adoptiopn of Colour Teaching and Book keeping

Color accounting is a system of financial accounting that uses color-coded charts to help visualize financial information (Hoelscher & Mortimer, 2018). It is designed to help non-financial professionals understand financial concepts, patterns and trends. The system uses five primary colors to represent five categories of financial information: assets, liabilities, income, expenses, and equity. Each color is associated with a specific category, with blue representing assets, red representing liabilities, green representing income, yellow representing expenses, and purple representing equity. Color accounting can be used to track financial performance, identify areas of improvement, and make better decisions.

The concept of color accounting can be used to teach bookkeeping to secondary school learners. Color accounting can help students learn financial concepts by providing a visual representation of the concepts. Adversary Instructional Technique employs controversial learning which triggers curiosity through the use of colours to make elements vivid thus learner achievement in Book keeping. In support of this argument, Schumacher (2018) stated that curiosity and interest are central parts of intellectual behavior; an aspect that is key to learner achievement in Book

keeping. To support the wick, Ganira and Odundo (2020) opined that to support learning, teacher presents a question and a response hint which ma opined that to support learning, teacher presents a question and a response hint which may guide see the learner hence learning achievement in book keeping by use of colour to trigger interest. This can make bookkeeping more engaging and easier to understand. Additionally, the system can be used to identify areas of improvement and to make better decisions.

Color accounting has been used to teach bookkeeping in secondary schools in Europe, the United States, and Australia. For example, in the United States, color accounting has been taught in schools in California, Florida, and New York. In Europe, color accounting has been used in schools in Italy, the United Kingdom, and Germany. In Australia, color accounting has been used in schools in New South Wales, Victoria, and Queensland.

Colour serves both as an instructional approach and resource. In favour of this notion, Bekele, Ganira, Mwangi and Odundo (2022) echoed that instructional resource when used maximally support achievement of learning goals. Thus, efficient utilization of appropriate instructional technique of AIT by employing colour as a controversial learning approach enhances learner achievement in Book keeping.

2.2.1.1 Controversial learning and Learner Achievement in Book Keeping

Controversial learning, or “edu-tainment,” is a type of educational approach that uses controversial, thought-provoking topics to engage learners (Beaver 2023). It seeks to challenge traditional notions of what constitutes learning and to create an environment that encourages students to explore and debate topics in an open, honest and safe way. By allowing learners to examine complex and often controversial topics from a variety of angles, controversial learning

aims to help learners develop critical thinking skills, empathy, and a deeper understanding of the world around them.

Controversial learning has been met with both enthusiasm and criticism. Some critics argue that controversial learning is too provocative and may lead students to form extreme and unsubstantiated opinions (Pace 2022). In addition, the success of controversial learning depends on the context in which it is implemented and the skill of the teacher in facilitating the discussion (Barkley 2018). Others argue that it is essential to creating an environment that encourages students to explore and debate topics in an open and respectful manner. Its proponents though argue that it is essential to creating an environment that encourages students to explore and debate topics in an open and respectful manner.As noted by Odundo, Kinyua and Ganira (2018) study on adopting value pedagogy entails creating learning environment where teacher and learners are actively involved in see the learning process. Thus, activities involving matching colours to corresponding elements represented in see the book keeping equation may greatly impact learner achievement in book keeping. By allowing learners to ask difficult questions, challenge traditional notions of what constitutes learning, and weigh different points of view, controversial learning encourages critical thinking and encourages students to develop empathy for different perspectives. It is therefore important to ensure that the discussion remains respectful and that students are given the opportunity to express their opinions without fear of ridicule or retribution.

Controversial learning can be used to arouse debate and clarify concepts of book keeping in a classroom setting in a number of ways. For instance, a teacher could have students debate different methods of bookkeeping and the advantages and disadvantages of each. This could be

done through a structured debate, a pros and cons list, or a round-table discussion. In addition, the teacher could present a case study and have students analyze the data and draw their own conclusions (Schlegel 2021).

Smith, (2017) also noted that in using controversial learning to arouse debate and clarify concepts of book keeping, students discuss the ethical implications of certain bookkeeping practices. This could include topics such as tax evasion, fraud, and money laundering. This would give students the opportunity to explore the ethical and legal implications of certain practices and develop a deeper understanding of the material. Further, controversial learning can also be used to encourage students to think critically about bookkeeping concepts. For example, a teacher could present a hypothetical scenario and ask the students to come up with a solution. This would give students the opportunity to think critically about the material and develop their own creative solutions.

Controversial learning can be used to unpack complexities of bookkeeping in a variety of ways. For example, a teacher might lead a discussion on the ethical implications of various accounting practices (Parker & Northcott, 2016). This could include topics such as the use of offshore accounts to evade taxes, the role of auditors in preventing fraud, or the differences between public and private accounting standards (Wilson, 2021). By engaging in a discussion on these ethical issues, students can develop a deeper understanding of the complexities of bookkeeping and the ethical considerations that come with it.

In addition, controversial learning can be used to explore the social and economic implications of bookkeeping. For example, a teacher might lead a discussion on the impact of automation on the accounting profession or the increasing use of algorithms to generate financial statements. By

examining these topics from a variety of angles, students can gain an understanding of how their decisions as bookkeepers can have far-reaching implications on the economy, society, and the environment.

Finally, controversial learning can be used to explore the history of bookkeeping (Musa 2017). This could include topics such as the development of accounting practices in different countries, the role of women in the field, or the use of accounting technology to facilitate international trade. By engaging in these discussions, students can gain an understanding of the historical context in which bookkeeping has evolved and how it has impacted the world at large.

The relationship between controversial learning and color accounting in the learning of bookkeeping in secondary schools curriculum is one of mutual benefit. Color accounting has the potential to make bookkeeping more accessible to students, as it utilizes colorful visuals to help students understand and remember key concepts (Todorova, 2019). By combining color accounting with controversial learning, teachers can create an engaging learning environment that encourages students to explore and debate various bookkeeping topics. In the same vein, through controversial learning, students can explore the ethical and social implications of bookkeeping, as well as the historical context in which the profession has evolved. By using color accounting to illustrate key concepts, teachers can help students better understand and retain the information they are discussing. In addition, color accounting provides a visual way for teachers to present complex topics in a more accessible manner, which can help to engage students who may not be as interested in bookkeeping.

Overall, the study views the combination of controversial learning and color accounting to be an effective way to teach bookkeeping in secondary schools curriculum. By combining the two

approaches, teachers can create an engaging environment that encourages students to explore and debate various topics, while giving them the tools to better understand and remember key concepts. For instance, the colors of Red, black, blue, white, yellow and green can be used to express different elements in bookkeeping equation. Red in Accounting denotes losses or negative outcome; Black expresses caution and care; Blue represents the overall direct control that supervises the other elements as is the sky colour and White stands for purity. Further, Yellow indicates the light that makes it possible for one to see easily and Green symbolizes fertility and productivity. As such, adversary technique can employ color accounting as a controversial learning activity which arouse debate, clarifies concept and unpack complexities in explaining the implications of various transactions which affect elements that constitute the Book keeping equation hence promotes learner achievement in Book keeping.

2.2.2 Assimilating Cognition and Learner achievement in Book Keeping

Assimilating cognition as an adversary technique of teaching is an approach to teaching that involves allowing students to have an active role in their own learning. This approach encourages students to think for themselves, rather than relying on the teacher to provide answers. The goal is to make students more independent and self-directed learners. Proponents of this method including Lev Vygotsky, Jerome Bruner, and Howard Gardner, argue that it can help students become more creative and critical thinkers, as well as helping them to become more flexible and resilient in their learning. Other scholars such as Wartono et al., (2017) also argued that this approach can help reduce student stress and anxiety, due to the collaborative nature of the learning process.

Opponents of this technique including John Dewey, Jean Piaget, and B.F. Skinner argue that it can be too open-ended and can lead to students feeling overwhelmed and frustrated (Saunders & Wong, 2020). They also point out that it can be difficult to measure the effectiveness of this type of teaching, as it is largely subjective. Consequently, assimilating cognition as an adversary technique of teaching can be a useful approach to teaching, as long as it is used in moderation and is tailored to the needs of the students. It can be a great way to encourage students to think for themselves and to become more independent and self-directed learners.

Assimilating cognition as an adversary teaching technique is a powerful tool for integrating ideas in learning book keeping among secondary school learners (Esplendori, et al., 2022). This technique is based on the principle that learners absorb knowledge better when they are engaged in a competitive atmosphere. One instance of this technique is the use of quizzes and exams to challenge students to apply their knowledge of book keeping. By competing with their classmates to answer questions and solve problems, students are encouraged to think critically and apply their book keeping skills. This type of competition also encourages students to build on each other's ideas and encourages collaboration and teamwork.

Another instance of using this technique is through role-playing activities (Hanfstingl et al., 2021). In these activities, students take on different roles, such as an accountant, an auditor, or a book keeper, and act out various scenarios that require them to apply their book keeping knowledge. This type of activity provides students with an opportunity to practice their book keeping skills in a real-life setting and helps to reinforce their understanding of the material.

In addition, class room examples of assimilating cognition as an adversary teaching technique can include activities such as case studies (Morin et al., 2019). In these activities, students are

presented with a case and are asked to research it and develop solutions. This type of activity encourages students to think analytically and apply their book keeping skills to solve the problem. It also gives them an opportunity to practice their problem-solving and communication skills, which are essential for success in book keeping.

Assimilating cognition as an adversary instructional technique is a popular method of helping students to internalize connections in learning bookkeeping (Sithole, 2018). This method involves the teacher presenting a concept to the students, and then helping them to apply the concept to an example. This helps them to understand the concept more effectively and to make connections between the concept and the example. For example, in a secondary school in India, a teacher introduced the concept of double-entry bookkeeping to the students (Sanabre et al., 2020). They were then be presented with a real-world example involving a transaction between two businesses. The teacher then explained how this transaction should be recorded in the books of the two businesses. Through this example, the students understood how the concept of double-entry bookkeeping works in a real-world situation.

Hussain, Salia, & Karim, (2018) study **i**n a secondary school in the United Kingdom required the teacher to present the concept of financial statements to the students. They were then presented with an example of a company's financial statement, including its income statement and balance sheet. The teacher then explained how the financial statement is constructed and how it can be used to gain an understanding of the company's financial health. Through this example, the students understood how the concept of financial statements works in a real-world situation. In addition, Miriti & Moses (2014) said highlighted among case of a secondary school in Kenya, where a teacher may have introduced the concept of accounting ratios to the students. The

teacher presented learners with an example of a company's financial statement and its ratios. The teacher then explained how the ratios can be used to gain an understanding of the company's financial performance. Through this example, the students understood how the concept of accounting ratios works in a real-world situation.

Overall, assimilating cognition as an adversary teaching technique is an effective way to help students internalize connections in learning bookkeeping. Through the use of real-world examples, the students can gain a better understanding of the concepts and how they can be applied in a practical setting.

Diachenko et al., 2022 also add that the assimilating cognition as an adversary teaching technique can be enabled through the concept of color accounting. Color accounting is a powerful way to link the visual representation of basic bookkeeping principles with their underlying concepts. In this technique, each component of the financial statement is represented by a different color, thus making it easier to remember the connection between each item.This helps learners in quickly understanding the underlying principles of bookkeeping and accounting. As an example, the balance sheet can be represented in a color wheel, with each component of the balance sheet represented in a different color (Wild2017). This visual representation makes it easier to link the balance sheet to the other components of the financial statement, such as the income statement and statement of cash flows. By connecting the financial statements with the underlying principles of bookkeeping, learners can quickly internalize the connections between the different components.

In the classroom environment, teachers can use color accounting as an adversary teaching technique to engage learners in the process of assimilating the connections between the

components of financial statements (Hlongwane 2020). For example, teachers can use color-coded cards to represent each component of the financial statement, and then ask students to match the related components. This encourages learners to consider the connections between the different components and helps them to internalize those connections. Furthermore, teachers can also use different colored markers to illustrate the relationships between the different components of the financial statement on the board. This provides learners with a visual representation of the connections between the different components and helps them to quickly understand the underlying principles of bookkeeping and accounting.

Consequently, the research posit that assimilating cognition as an adversary teaching technique is an effective tool for helping secondary school business learners to internalize the connections between various components of the financial statement. Color accounting is a powerful way to link the visual representation of financial statements with their underlying principles, making it easier for learners to quickly understand the relationships between the components. In the classroom, teachers can use color-coded cards, markers, and other visual aids to help learners to assimilate the connections between the components of the financial statement.

In the context of refining content, assimilating cognition as an adversarial teaching technique is a popular method used in learning book keeping among secondary school learners in different countries. This technique is used to help learners gain a more comprehensive understanding of the material (Ahir et al,. 2020). By using this technique, students are able to learn the material more efficiently, become more engaged with the material, and retain the information for a longer period of time. For instance, in the United States, assimilating cognition is often used in the form of a Socratic dialogue (Clark 2015). In this type of dialogue, the instructor asks questions to the

student in order to get them to think more deeply about a given topic. For example, when learning about accounting, the instructor may ask questions such as, “What is the difference between a debit and a credit?” or “Why is it important to keep track of accounts receivable?” Through this type of dialogue, the student is able to gain a more comprehensive understanding of the material and is more likely to retain the information for a longer period of time. In the same vein, teachers in Mexico often use assimilating cognition by having students working together on projects (Ashwani 2011). For example, when learning about book keeping, the students may be asked to work together to create a budget or a report. By working together on these projects, the students are able to gain a better understanding of the material as they discuss it with each other.

Hanfstingl et al., (2022) discovered that in India, assimilating cognition is often used by having students work together to solve problems. For example, when learning about book keeping, the students may be asked to work together to solve a difficult accounting problem. By working together on the problem, the students are able to gain a better understanding of the material as they discuss it and come to a solution.

The research therefore perceive assimilating cognition as an adversarial teaching technique as highly effective in refining content in learning book keeping among secondary school learners in different countries. By using this approach, students are able to gain a more comprehensive understanding of the material, become more engaged with the material, and retain the information for a longer period of time. In the same vein, colour accounting can aid in assimilating cognition when utilizing adversary instructional technique to teach Book keeping. For instance, the colors of Red, black, blue, white, yellow and green can be used to express different elements in bookkeeping equation. Red represent transactions that reduce the value of

capital of a business; Black express caution to denote items owed to outsiders of the business hence they need to be handled with care. Similarly, Blue stands for long term and permanent resources owned by the business as white represent what the owner has directly invested into the business which remains as net worth of the business. Further, yellow constitute all those short term resources and items that can be easily liquidated to help in day to day business operations and lastly, green denotes injections and additional resources invested into the business as a result of productive transactions. Therefore, adoption of Adversary technique in teaching colour accounting enhance assimilating cognition in integrating ideas, internalizing connections and refining content aimed at learner achievement in Book keeping.

2.2.3 Declarative Knowledge and Learner achievement in Book Keeping

Declarative knowledge is a technique of teaching bookkeeping concepts that focuses on the explicit, factual information related to a concept. This type of knowledge is the most easily understood and quickly absorbed by students and is often used to introduce a topic or provide a foundation for further exploration (Lehocki 2022). By using declarative knowledge, teachers can help students understand the basics of bookkeeping concepts, such as debits and credits, the accounting equation, and the double-entry accounting system. This type of knowledge can be used to provide a starting point for further exploration of more complex topics, such as financial statements and financial analysis.

Declarative knowledge can also be used to teach students to identify and use the accounting vocabulary related to bookkeeping concepts (Karanja et al., 2020). This type of knowledge also helps students to become familiar with the different types of accounts that are used in bookkeeping, such as assets, liabilities, and equity accounts. Additionally, it can be used to teach

students how to read and interpret financial statements and how to analyze financial data. By using declarative knowledge to introduce bookkeeping concepts, teachers can ensure that students gain a strong foundation of knowledge, which they can then use to explore more complex topics.

Proponents of declarative knowledge believe that this type of knowledge is the most easily understood and quickly absorbed by students (Garcia et al,. 2020). Additionally, proponents believe that declarative knowledge is a great way to introduce a bookkeeping concept, provide a foundation for further exploration, and teach students the accounting terminology and how to read and interpret financial statements. On the other hand, its critics believe that it does not provide students with enough depth of knowledge or encourage students to explore more complex topics (Lodge et al., 2018). Additionally, opponents may argue that declarative knowledge is too simplistic and does not provide students with the ability to think critically or solve problems.

Declarative knowledge, or knowledge that is acquired through instruction and memorization, has been shown to be an effective technique for teaching bookkeeping and can lead to increased reasoning and secondary school learner achievement. In a study conducted in Brazil, researchers found that students who were exposed to traditional bookkeeping instruction using declarative knowledge had higher scores on overall reasoning tests than those who were taught using inductive and deductive reasoning methods (Saghafi, 2014). In another study conducted in the United States, researchers found that students who received traditional bookkeeping instruction using declarative knowledge had higher scores on a test of problem solving and mathematical reasoning than those who were taught using inductive and deductive reasoning methods

(Krivogorsky, 2011). Similarly, in the United Kingdom, a study conducted over a two-year period found that students taught using declarative knowledge had higher scores on a test of problem solving and mathematical reasoning than those who were taught using inductive and deductive reasoning methods (Lodico et al., 2010). The study also found that students taught using declarative knowledge had better grades in mathematics, English, and science.

Declarative knowledge has been found to be an effective teaching technique in many countries across the world. In Germany, a study conducted over a four-year period found that students taught using declarative knowledge had higher scores on a test of problem solving and mathematical reasoning than those taught using inductive and deductive reasoning methods (Beiske 2017). In China, a study conducted in 2004 found that students taught using declarative knowledge had better grades in mathematics, English, and science (Sneider & Larner, 2019). As a consequence, declarative knowledge is an effective technique for teaching bookkeeping, and can lead to increased reasoning and secondary school learner achievement. Studies have found that students taught using declarative knowledge have higher scores on problem solving and mathematical reasoning tests, and better grades in mathematics, English, and science. The research will assess the relevance of this teaching technique in teaching and learning book keeping among secondary school learners in Kenya.

Declarative knowledge in adversary teaching techniques is a form of teaching which encourages students to discuss and debate concepts and ideas, with the goal of engaging students in critical thinking and problem solving (Mattessich, 2008). This method of teaching is often used in secondary school business classes, where students are encouraged to develop their own concepts and assertions about bookkeeping. The aim of this teaching technique is to help students gain a

deeper understanding of the subject matter, by challenging their ideas and pushing their thinking to new levels. One example of this teaching technique can be seen in the UK, where teachers in secondary school business classes have been using adversary teaching techniques to discuss and debate various bookkeeping concepts (Liew et al., 2018). Here, students are encouraged to come up with their own assertions about bookkeeping, based on their own understanding of the subject matter. The teacher then responds to the students' assertions, challenging them to think more deeply about their ideas and potentially develop new concepts. This approach helps to foster critical thinking and encourages the students to explore different aspects of bookkeeping.

In addition, this teaching technique has been used in other countries around the world, including the United States, Canada, and Australia. For example, in the United States, teachers in secondary school business classes have used adversary teaching techniques to discuss and debate bookkeeping concepts, such as the use of double-entry bookkeeping and the impact of cash and accrual accounting (Shygun, 2020). In Canada, teachers have used this technique to discuss the importance of budgeting and the impact of taxation on business decisions. In Australia, teachers have used this teaching technique to talk about the importance of financial literacy, and the need to consider risk when making business decisions (Attard 2018).

The researcher opines that adversary instructional technique can be an effective way to help students understand and develop concepts about bookkeeping in secondary school business classes in Kenya. By engaging students in critical thinking and problem solving, this method of teaching can help students gain a deeper understanding of the subject matter, and better prepare them for success in the business world.

With regard to storing experiences, declarative knowledge in adversary instructional technique is a type of instruction that promotes student engagement and critical thinking. It is premised on the idea that students are encouraged to learn by questioning and challenging each other's ideas (Hong 2018). This type of teaching has been widely used in secondary schools, particularly in book keeping business teaching. In book keeping business teaching, declarative knowledge in adversary teaching can be used to help students develop a deeper understanding of the material. For example, by having students debate different accounting principles, they can learn how to apply the concepts in a real-world setting. This type of knowledge also encourages students to think critically and analytically, which is essential in the business world.

Color teaching is often used in declarative knowledge adversary teaching because color can be used to represent different elements of a concept, making it easier for students to visualize and remember (McGill 2018). For example, in accounting, green can be used to represent assets, blue to represent liabilities, and red to represent net worth (Marzano 2021). This helps students to quickly recognize and understand the different components of a financial statement. Additionally, color coding can help students to understand the relationships between different elements of a concept, such as how assets and liabilities are related (Taylor 2023). Color coding can also be used to highlight important information in a text, making it easier for students to remember and understand it. Overall, color accounting is a valuable tool for declarative knowledge adversary teaching, helping students to learn and understand complex concepts more quickly and effectively.

Overall, declarative knowledge in adversary teaching can be a powerful tool for teaching book keeping business in secondary schools. It allows for students to engage in meaningful discourse

and to practice critical thinking. Moreover, it encourages students to apply their knowledge in a real-world setting, helping to make them better prepared for the business world. In view of this, Adversary instructional technique uses declarative knowledge to attain learner achievement in Book keeping by teaching colour accounting. For instance, colours such as Red, black, blue, white, yellow and green can be used to affirm that transactions of the balance sheet would still attain the Book keeping equilibrium as justified by their individual implications on the Book keeping equation.. Thus, Red represent Losses, Black characterizes Liabilities while Blue denotes Fixed Assets. Further still, White, Yellow and Green indicate Capital, Current Assets and Profit respectively. Therefore, Adversary technique promotes declarative knowledge by utilizing reasoning, conceptualizing assertions and storing experience to enhance learner achievement in Book keeping.

2.3 Theoretical Framework

The study anchored itself on the Zone of Proximal Development Lev Vygotsky (1978). This theory propagates that learning can be achieved by continuous knowledge advancement from simple orientation to complex understanding. The primary orientation to life is that children interact with colours; which are assigned different meaning that they can easily associate with to understand various phenomena. The theory supports the fact that learning can be achieved through immediate support offered by colour coding. ZPD refers to distance between what the learner can do without help and what he can do with help in order to achieve the desired learning outcome. The ZPD has three levels: Lowest level composed of already learnt experiences (Colors); the middle level encompasses series of activities that aids in knowledge construction

(Teacher employs Adversary instructional technique in assimilating cognition to associate each colour with corresponding item of the Book keeping) and the extreme level (Teacher guides learners to gain declarative knowledge about each element as represented by colour on the Book keeping Equation). Further, the study was supported by Tom Senninger's theory which suggests that learners learn best when they are actively involved in the learning process, and when the material is presented in a meaningful context. In the same vein, the study exposed learners to six colours which helped them draw meaning in the context of elements which constitute the Book keeping equation hence learner achievement in Book keeping.

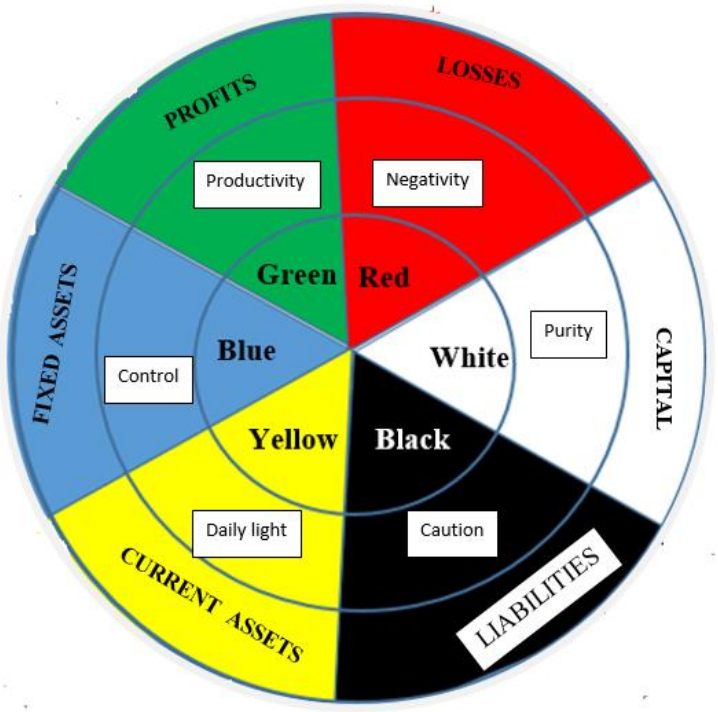

Figure 2-1: Color framework.

Summary: Blue +Yellow= Black + White-Red + Green

Book Keeping Equation: Total Assets= Liabilities+ Net Capital

2.4 Conceptual Framework

The conceptual framework outlined the relationships between the independent variables (Adopting Controversy, Assimilating Cognition, and Declarative Knowledge) and the dependent variable (Learner Achievement in Bookkeeping).

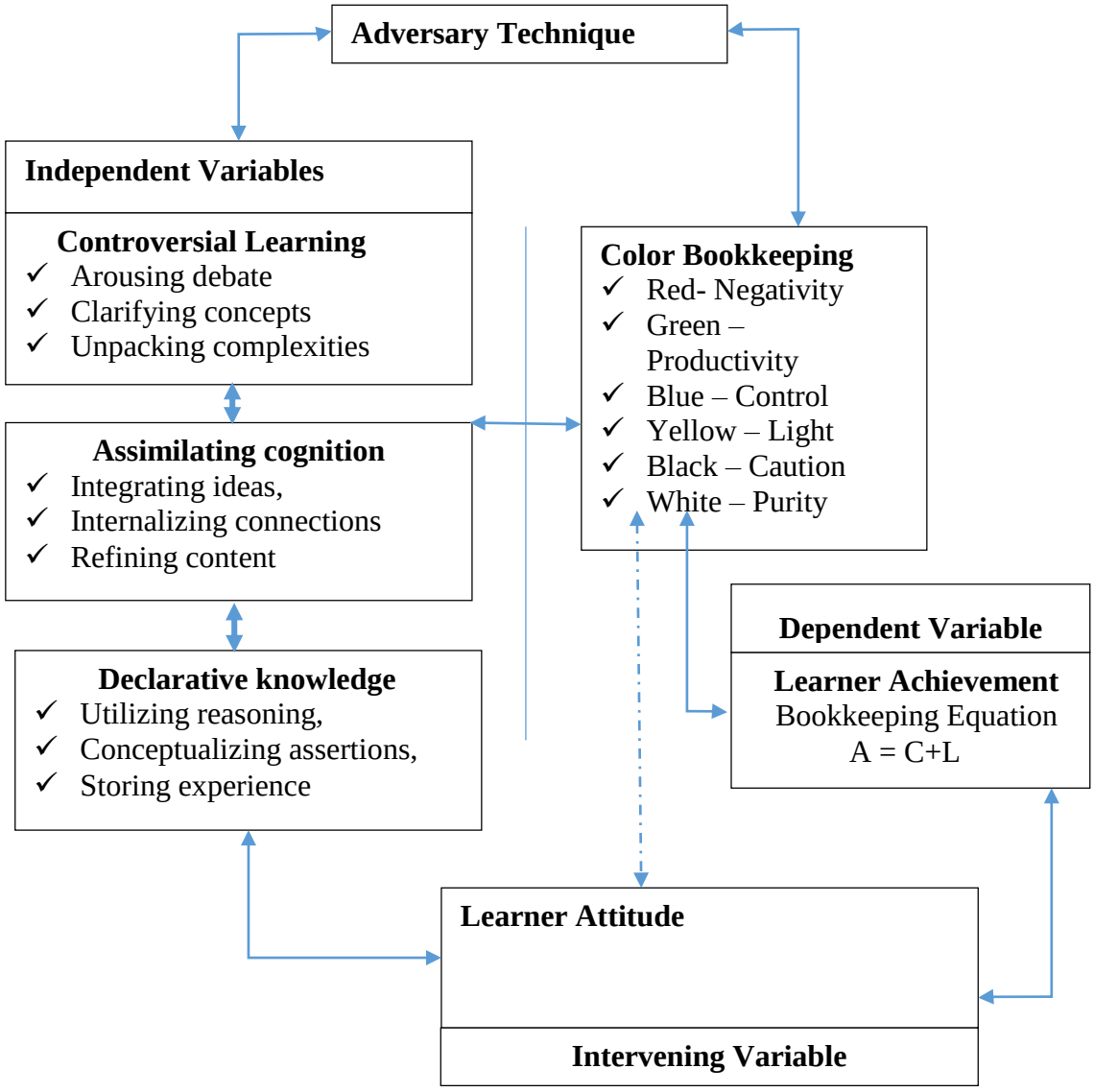

Figure 2-2: Perceived Frame for teaching-learning bookkeeping using colors

The above figure illustrated the Perceived Frame for teaching-learning bookkeeping using colors. The framework was based on the idea that the independent variables influence the dependent variable, and that the amount of learning achieved in bookkeeping is dependent upon the use of the independent variables. The framework suggested that the use controversial learning can enable learners to better understand and apply the concepts of bookkeeping including color accounting, and thus improve their learning achievement in book keeping.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

The purpose of this chapter was to provide an overview of the methodology to be used to conduct the research for this project; Influence of Adversary Instructional technique on learner achievement in Book keeping. It outlined the research philosophy, research design, data collection and analysis techniques employed. In addition, the ethical considerations taken into account during the research process were discussed.

3.2 Research Philosophy

This research employed both positivism and interpretivism philosophical schools of thought to investigate influence of Adversary Instructional technique on learner achievement in Book keeping in public secondary schools In Komothai Zone, Kiambu County. Positivism is based on the idea that reality is objectively available and can be studied scientifically, and involves collecting and analyzing quantitative data to identify relationships between variables. This allowed the researcher to understand the influence of the independent variables on the dependent variable, and to identify relationships between variables, thus make generalizations about the population based on the sample data. Thus, assess the influence of Adversary Instructional technique on learner achievement in Book keeping in Public secondary schools in Komothai Zone, Kiambu County. Interpretivism, on the other hand, focuses on understanding social phenomena from the perspective of the participants, and involves gathering qualitative data from participants through interviews and observation schedule to inform the study on influence of

Adversary Instructional technique on learner achievement in Book keeping in Public secondary schools in Komothai zone, Kiambu County. Although both philosophical schools were used, interpretivism was the primary focus as it provided insights into the attitudes of stakeholders towards the use of the adversary instructional technique in the teaching and learning of bookkeeping, and how this affected the learning outcomes of students.

3.3 Research Design

Kerlinger, (1973) defines a research design as a plan, structure and strategy of investigating into a problem with an aim to obtain answers to various research questions. Basically, research design is a logical strategy for planning research procedures and providing evidence for development of knowledge. In this view, the research adopted a quasi- experimental design involving the Solomon 4 group design to compare two treatments and two control groups. This involved assigning two groups of participants to a treatment group, and two to a control group. The two treatment groups received the adversary instructional technique, while the two control groups did not. This allowed the researcher to compare the results of the two treatments and the two control groups, and to control for extraneous variables.

3.4 Study Population

Target population is defined as all the members of a real or hypothetical set of people, events or objects to which a researcher wishes to generalize the results of the research study (Borg & Gall, 1989). The study's population targeted all the Six hundred and ninety one (691) form three learners pursuing Business Studies as subject specialization in the ten public secondary schools

in Komothai Zone in Kiambu County. In addition, all the ten (10) teachers of business studies were also targeted.

Table 3.1: Study Population

Name of school	Gathiruini Boys	Gathugu Mixed	Githima Boys	Kigumo Mixed	Kagema Mixed	JG Kiereini Boys	Komothai Boys	Komothai Girls	Thuita Mixed	Kambui Girls	**TOTAL**
F3 BST population	**83**	**62**	**52**	**49**	**45**	**91**	**72**	**107**	**17**	**113**	**691**

3.5 Sampling and Procedures

In order to ensure accuracy, the study utilized both probability and non-probability sampling techniques. Stratified sampling was used to select ten public secondary schools from the zone for the study, from which four schools were chosen to fulfill the requirements of the Solomon Four research design. Simple random sampling was used to select the learners in the selected schools to participate in the study. Orodho (2005) notes that the sample should be chosen in a way that ensures certain sub-groups in the population are represented in the sample in proportion to their numbers in the population.

One stream of form three learners from each of the selected schools was selected through purposive sampling. In the case of public secondary schools with more than two streams, simple random sampling (or the lottery method) was used to select one group to participate in the study.

In total, Four (4) teachers and 208 learners from four schools formed the sample population. Out of the four sampled schools, one school was randomly selected using the lottery method for observation. This ensured that each school had an equal chance of being selected, and that the sample was unbiased.

3.6 Research Instruments

The research tools that were adopted for the study included lesson observation schedule, interview guides, achievement tests and questionnaires. The research instruments used in the study above were relevant for gathering the data needed to answer the research questions. The lesson observation schedule was used to observe the teaching and learning process in the class setting and to understand how the adversary instructional technique was used. The interview guides were used to gain insights into the attitudes of teachers and other stakeholders towards the use of the technique. The achievement tests were used to measure the students' performance in the subject, and the questionnaires were used to collect quantitative data from the participants.

3.7 Data collection

The researcher developed key informant interview guide that outlined the broader topics of discourse, then administered to either Principal or HOD and teachers of Business Studies. Observation schedule was also developed in line with study dimensions and administered by the researcher in the selected class settings.Thereafter, the achievement tests were developed and administered to the learners according to the study instructions. Further, questionnaire was developed and administered to the learners to capture their view on colour book keeping concept. The researcher applied for a research permit from the Ministry of Higher Education; National Council for Science and Technology. The researcher then contacted the schools to explain the

purpose of the study and officially sought permission to undertake the research. The data was collected using Interview schedule, Questionnaires, Lesson Observation Checklist and Achievement tests. The questionnaires were administered through the HODs and teachers of Business Studies after which the researcher collected the questionnaires within the stipulated time. The researcher made arrangements and conducted lesson observation and items in the checklist were filled immediately after the lesson.

3.8 Piloting Research Instruments

The Achievement tests, lesson Observation Schedule and questionnaire were piloted in a school which was not part of the sample. The instruments were piloted to establish their reliability and validity.

3.8.1 Content Validity

A research instrument is valid if it measures what it is supposed to measure. Experts in matters of subject methods were requested to assess the relevance of the content to be used in the instruments developed. They examined the instruments individually and provided a feedback. Their recommendations were incorporated in the final instruments to enhance their validity

3.8.2 Reliability

According to Orodho, (2008), reliability of measurement concerns the degree to which a particular measuring procedure gives equivalent results over a number of repeated trials. The test-retest method was used to test on the reliability of the instruments. The test retest technique involved administering the same instruments twice to the same group of subjects, in a school that was not part of the sample. There was two weeks lapse between the first test and the second one.

The coefficient of stability was used to estimate the degree to which the same results can be obtained with a repeated measure of the same concepts.

3.9 Data analysis

Data analysis involved systematically searching and organizing interview scripts, field notes, data, and other materials obtained from the field in order to increase the researcher's understanding and to present them to others (Orodho, 2009). Qualitative data was analyzed using content analysis to categorize the responses into similar themes. Quantitative data was examined for errors and omissions, coded, and tabulated. Descriptive statistics such as mean, median, and mode were used to process the data and present it in frequency distribution tables and percentages. The data analysis was done using the Statistical Package for Social Sciences (SPSS).

3.10 Ethical Consideration

Ethical considerations for the study above included obtaining informed consent from the participants, ensured confidentiality and anonymity of the participants, protecting the participants' rights to privacy, and ensured the participants' safety. Informed consent was obtained from the participants before they participated in the study, and they were made aware of their rights and how their data would be used. For classroom achievement tests, the teacher in charge was responsible for the class consent. Confidentiality and anonymity was maintained throughout the research process, and any identifying information was kept secure. The participants were also protected from any potential harm that would arise from the research, as well as their right to privacy.

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION, INTERPRETATION AND DISCUSSIONS

4.1 Introduction

The chapter present the results generated from the data analysis process. The section is organized into five main sub-sections including the response rate, the demographic profiles of the respondents, univariate analysis, bivariate analysis and multivariate analysis. The discussions are presented below.

4.2 Questionnaire Return Rate

The term refers to the percentage of survey participants who provide usable data to the survey, which affects the validity and reliability of the study's findings. A low response rate may likely lead to sampling bias and mislead the representativeness of the sample in interpretating population characterisitcs. The study revolved around a sample of form three students who were chosen from four schools in the Komothai zone of Kiambu County, adhering to the principles of the Solomon 4-group design. Additionally, the respective school administrators and business studies educators also participated. The response rate is depicted as follows in the subsequent presentation in Table 4.1.

Table 4.1: Response Rate

Name of school	Class population	Pre-posttest participants	Questionnaire participants	Response rate
Gathugu (C)	62	62	62	100%
Githima (E)	52	52	51	98%
Kigumo (E)	49	49	49	100%
Kagema (C)	45	45	44	98%
Total	208	208	206	99%

The study resulted in a response rate of 99% among the students enrolled in business classes at the chosen educational institutions. The high rate was attributed to the significant support provided by the school administration and class instructors, which eventually enhanced the students' voluntary participation. According to Werner (2004), achieving a response rate of 80% or above on a survey is considered acceptable in order to make accurate inferences based on the collected sample. The response rate of the questionnaire, as indicated by this benchmark, exceeds the minimum threshold necessary to assure the accuracy of results and conclusions. In addition, the study successfully gathered extensive qualitative data from four principals and four business studies instructors, owing to the significant administrative support offered by the various authorities.

Moreover, the findings on response rate are in agreement with Odundo, Ganira and Ngaruiya (2018) assertion that learners' response to instruction as captured by tools gives feedback to see the teacher from which ammendments may be effected in instruction procedures.

4.3 Socio-demographic Characteristics of responses

The study investigated various variables including the educational institution's name, initial assessment classifications, instructional group, age groups, gender, average scores in business studies, and the frequency of color code utilization during instructional sessions. Furthermore, the analysis involved examining the interrelation of demographic factors with post-test results obtained from attainment assessments. These assessments were originally collected as interval variables and were later converted into nominal variables using specified ranges: below 39, 40 to 49, 50 to 59, 60 to 69, and 70 and above. This categorization is visually presented in table 4.2 for reference.

Table 4.2: **Socio-Demographics**

		Post test score categories												
Variable	Categories	39 and below		40 to 49		50 to 59		60 to 69		70 and above		Total		Chi-square x2, df, p-value
		n	%	n	%	n	%	n	%	n	%	n	%	
Name of school	S1	16	20%	10	28%	2	10%	8	30%	9	21%	45	22%	21.181,
	S2	17	21%	9	25%	7	35%	8	30%	11	26%	52	25%	12,
	S3	15	18%	8	22%	10	50%	4	15%	12	28%	49	24%	0.048
	S4	34	41%	9	25%	1	5%	7	26%	11	26%	62	30%	
	Total	82	100%	36	100%	20	100%	27	100%	43	100%	206	100%	
Assessment group	Control	50	61%	19	53%	3	15%	15	56%	20	47%	105	51%	14.24,
	Experimental	32	39%	17	47%	17	85%	12	44%	23	53%	101	49%	4,
	Total	82	100%	36	100%	20	100%	27	100%	43	100%	206	100%	0.007
Pretested	Not pretested	49	60%	17	47%	11	55%	11	41%	23	53%	110	53%	3.64, 4,
	Pretested	33	40%	19	53%	9	45%	16	59%	20	47%	96	47%	0.457
	Total	82	100%	36	100%	20	100%	27	100%	43	100%	206	100%	
Gender	Female	33	40%	13	36%	9	45%	11	41%	15	35%	81	39%	0.823,
	Male	49	60%	23	64%	11	55%	16	59%	28	65%	125	61%	4,
	Total	82	100%	36	100%	20	100%	27	100%	43	100%	206	100%	0.935
Age groupings	16 years	2	2%	3	8%	1	5%	1	4%	1	2%	8	4%	14.103,
	17 years	30	37%	15	42%	9	45%	10	37%	12	28%	76	37%	12,
	18 years	46	56%	16	44%	10	50%	14	52%	22	51%	108	52%	0.294
	Above 18 yrs	4	5%	2	6%	0	0%	2	7%	8	19%	16	8%	
	Total	82	100%	36	100%	20	100%	27	100%	43	100%	206	100%	

S1='Kagema high school'; S2='Githima Secondary School'; S3='Kigumo Secondary School'; S4='Gathugu Secondary School'

The results presented in the above-mentioned table demonstrate that among the 206 participants, 45 individuals (22%) were associated with the first educational institution (SS1), while SS2, SS3, and SS4 consisted of 52, 49, and 62 students respectively. Moreover, the chi-square analysis conducted on the association between school code and student achievement in the discipline of business studies resulted in a chi-square value of 21.181, accompanied by 12 degrees of freedom. The p-value is reported as being less than 0.050, indicating a substantial degree of statistical significance. Based on these findings, the analysis suggests that there is a noteworthy correlation between the educational institution identifier and student achievement in the domain of bookkeeping equation via adversery learning technique through color teaching. This suggests that the choice of educational institution may potentially impact the scholastic performance of students in the domain of bookkeeping equations.

Furthermore, the inquiry examined the classification of students into two pedagogical cohorts: experimental and control. The results suggest that 49% (101 participants) were designated to the experimental cohort, while 51% (105 participants) were assigned to the control cohort. The chi-square analysis conducted on the association between instructional group classification and learner achievement in accounting resulted in a chi-square statistic of 14.24, with 4 degrees of freedom. The p-value is reported as less than 0.050, signifying a substantial degree of statistical significance at a confidence level of 95%. The results indicate a significant association between group categorization (experimental versus control) and student achievement in the realm of business education. This suggests that the educational group or teaching approach utilized in the experimental class grouping might have influenced students' scholastic achievement levels compared to the control group. This implies that different instructional methods or interventions applied in the experimental group may have impacted learner achievement in the field of business studies.

The results pertaining to the classification of Pre-tests indicated that 96 participants (47%) engaged in pre-testing, whereas 110 participants (53%) did not partake in pre-testing. The Chi-square examination resulted in a score of 3.64, with degrees of freedom (df) being 4, and a p-value exceeding .000, indicating a dearth of statistical significance. The results indicated a dearth of substantial correlation between undergoing a preliminary assessment and the scholastic achievement of students in the discipline of Business studies. This suggests that students who underwent initial evaluation, as well as those who did not, demonstrated a consistent level of achievement. The preliminary evaluation, as a result, did not possess a decisive factor in preparing students for the pursuit of Business studies or identifying areas of improvement.

The findings regarding gender classifications indicated that 81 students (39%) self-identified as females, whereas 125 (61%) identified as males. The result of the chi-square test (X2 = 0.823, df = 4, p = .935) revealed a lack of significant association between gender and learner performance in the subject matter of bookkeeping. Consequently, the results indicate that the sex did not appear to possess a statistically noteworthy impact on their achievement in the realm of business studies. Hence, it can be inferred that gender does not demonstrate a statistically significant influence on the academic merit of students in this particular context. In an analogous manner, the results concerning age indicated that 8 individuals (4%) were of the age of 16 years, 76 (37%) were of the age of 17 years, 108 (52%) were of the age of 18 years, and 16 (8%) were of the age of 19 years and beyond. The result of the chi-square test (X2 = 14.103, df = 12, p = .294) revealed a lack of significant association between various age groups and the scholastic achievement of students in the discipline of business studies. Consequently, the results indicate that the age of the learner did not appear to exert a statistically noteworthy impact on their proficiency in the realm of business studies.

Table 4.3: Color Codes in Business Studies

		Posttest Score Categories												
		39 and below		40 to 49		50 to 59		60 to 69		70 and above		Total		Chi-Square tests
		n	%	n	%	n	%	n	%	n	%	n	%	
Average score in business studies?	Below 30	19	23%	5	14%	5	25%	4	15%	8	19%	41	20%	18.930, 16, 0.272
	Below 40%	27	33%	9	26%	4	20%	5	19%	12	28%	57	28%	
	Below 50%	26	32%	11	31%	8	40%	11	41%	12	28%	68	33%	
	Below 70%	7	9%	8	23%	3	15%	3	11%	4	9%	25	12%	
	Above 70%	3	4%	2	6%	0	0%	4	15%	7	16%	16	8%	
	Total	82	100%	35	100%	20	100%	27	100%	43	100%	206	100%	
Frequency of color codes teaching	Once a week	2	2%	0	0%	1	5%	0	0%	3	7%	6	3%	9.659, 8, 0.290
	Twice a week	0	0%	1	3%	0	0%	0	0%	0	0%	1	0%	
	Never	80	98%	34	97%	18	95%	27	100%	40	93%	199	97%	
	Total	82	100%	35	100%	19	100%	27	100%	43	100%	206	100%	

Table 4.3 displays the subject-specific variables, including the mean score in business studies in recent examinations and the frequency of the instructor of the corresponding subject utilizing a color-coded system in teaching the principles of bookkeeping.

With regards to the mean performance in business studies in the most recent examinations, a cumulative of 41 individuals (comprising 20% of the population) achieved a score below 30%, 57 (28%) attained a score lower than 40%, while 16 students (8%) obtained a score exceeding 70%. The result of the chi-square test ($X2 = 18.930$, $df = 16$, $p = .272$) suggested that there was no statistically significant association between prior achievement and scholastic performance in the domain of bookkeeping within the discipline of business studies. Regarding the frequency of utilization of color codes in bookkeeping equations, the vast majority of 199 participants (97%) indicated that the instructor in charge had never incorporated any hues in educational endeavors related to the subject matter of bookkeeping. The result of the chi-square test ($X2 = 9.659$, $df = 8$, $p = .290$ - lacking statistical significance) also indicated a lack of significant association between the number of color codes used as instructional aids and the academic achievement of students in the field of business studies. Hence, the research consequently falls short in definitively establishing the impact of previous familiarity with color schemes on student achievement in the domain of bookkeeping equations, as the instructors had not previously utilized color teaching as a means to facilitate the acquisition of accounting competencies.

4.4 Univariate Analysis of Dependent Variable

The research performed the independent sample T-Test on the dependent variable to uncover key insights and compare the test scores of the two different groups of learners who were taught using different teaching methods, with the experimental group being introduced to color teaching

while the control group being taught bookkeeping using the conventional approach. Further, the analysis served as a foundation for both bivariate and multivariate analyses that explore relationships between multiple variables.

4.4.1 Learner Achievement in Bookkeeping

The research aimed to evaluate the impact of adversarial instructional methods on learning outcomes in the field of bookkeeping in public secondary schools centered around the Komothai Zone of Kiambu County. In this context, the study sought to determine if there was a significant difference in the understanding of the bookkeeping equation using color teaching in the field of business studies between students in the experimental group and those in the control group. This was assessed by comparing the average scores obtained in the post-test. In this particular context, the t-test for independent samples was employed. The outcomes of the descriptive and t-test for Equivalence of means are displayed in the table provided.

Table 4.4: T-Test for Assignment Group

		N	**Mean**	**SD**	**SE**					
Post test scores	**Control**	107	42.57	25.72	2.48					
	Experimental	101	48.66	24.44	2.43					
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	SE	95% CI for mean	
									Lower	Upper
Post test scores	**Equal variances assumed**	.63	.428	4.182	205	.004	6.09	1.48	7.78	12.99
	Equal variances not assumed			4.112	202.59	.029	7.04	1.89	7.74	11.65

The descriptive findings provide an evaluation of the post-test outcomes among two cohorts: the Control cohort (N=107) and the Experimental cohort (N=101). The findings presented in table 4.4 indicate that the average post-test score exhibited a greater magnitude in the Experimental group (48.66) in contrast to the Control group (42.57).

The results indicate that both cohorts demonstrated a substantial range of scores, as evidenced by the standard deviations (Control: 25.729, Experimental: 24.443). Nevertheless, the standard deviation of the mean was comparatively diminutive for both cohorts (Control: 2.487, Experimental: 2.432), indicating that the sample means are probably proximate to the population means. The findings therefore suggest that, on average, the experimental group demonstrated better performance on the post-test evaluation compared to the control group as the cohort displayed higher mean scores in the post-test evaluation, decreased variability, and a more precise estimation of the average compared to the control cohort.

The results of the t-test assuming equivalent variances produced a t-value of 4.182 (degrees of freedom = 206, p-value < 0.05; 95% confidence interval = 7.78 – 12.99). The results indicated that there is a statistically significant difference in the means of the two groups (experimental and control) in terms of post-test scores, regardless of the assumption of equal variances. The t-scores and corresponding p-values are both below the conventional threshold of significance (e.g., 0.05), suggesting that the observed differences in means are unlikely to have occurred by chance. Moreover, the mean discrepancy (6.09) signified the typical advantage of the experimental group in comparison to the control group with regards to the scores achieved post-assessment. The results suggest that the experimental group demonstrated a significantly higher level of performance in comparison to the control group with regard to the scores achieved in the

post-test. The difference in means is statistically significant, indicating that the experimental intervention had a positive impact on learner achievement in the domain of Business studies. The findings highlight the potential benefits of integrating the color coding approach in the experimental group to improve learner achievement in the field of Business studies.

4.4.2 Learner Perception in Color Teaching

The investigations wished to assess learner attitude on color accounting in enhancing learner achievement in business studies.The results are presented in the table 4.6 and includes the frequency and percentage distribution of responses, as well as the mean and standard deviation of each item assessed.

Table 4.5: Learner Attitude in Color Accounting

Attitude Statements	**Strongly disagree**		**Disagree**		**Neither agree nor disagree**		**Agree**		**Strongly agree**			
	n	%	n	%	n	%	n	%	n	%	Mean	STD
Familiar with color accounting	42	20%	73	35%	41	20%	39	19%	11	5%	2.53	1.17
Comfortable using color accounting	21	10%	28	14%	31	15%	68	33%	57	28%	**3.55**	1.30
Color accounting simplify bookkeeping equation	18	9%	21	11%	36	18%	83	42%	39	20%	**3.53**	1.19
Face minimal challenges in color accounting	18	9%	32	16%	43	22%	65	33%	41	21%	**3.40**	1.23
Color accounting more advantageous than traditional bookkeeping methods	22	11%	30	15%	31	16%	70	35%	45	23%	**3.43**	1.30
Using Color easens learning	28	14%	29	15%	37	19%	60	31%	42	21%	3.30	1.34
Teachers use colours when teaching Book keeping equation.	48	24%	42	21%	32	16%	37	19%	38	19%	2.87	1.46
Excellent knowledge of color accounting	31	16%	36	18%	39	20%	47	24%	43	22%	3.18	1.38
Color accounting useful in class setting	23	12%	24	13%	31	16%	61	32%	49	26%	**3.47**	1.33
Average Mean Score											3.25	1.30

The study illustrates that the learners' disposition towards utilizing hues to resolve bookkeeping equations was predominantly favorable. The mean value of 3.25 indicates that, although numerous students exhibited enthusiasm towards color accounting, there remains room for enhancement in expanding the utilization and frequency range of hues in the pedagogy of bookkeeping within the field of business studies. Significantly, the utmost average ratings were observed for the ease of employing color accounting (average 3.55), streamlining of bookkeeping equation through employment of color codes (average 3.53), and the efficacy of color accounting in educational environments (average 3.47). This demonstrates that the learners are at ease with utilizing hues to enhance further knowledge development in bookkeeping equations, considering their straightforwardness and efficacy in educational environments. In contrast, the least favorable ratings were observed in the aspects of acquaintance with color-based financial analysis (average 2.53) and educators incorporating color-based financial analysis in the instruction of bookkeeping equations (average 2.87). This indicates that there is potential for improvement in these domains and that educators should consider implementing color coding as a adversarial method of instructing business studies.

4.5 Bivariate Analysis

The study conducted an analysis to facilitate the comparison between experimental and control groups, thereby enabling the investigation to present findings on the levels of learner accomplishment in bookkeeping through an adversarial teaching approach. The examination would demonstrate the possible influence of the factors such as controversial learning, assimilating cognition, and declarative knowledge in the experimental circumstances, on learner performance in the field of bookkeeping.

4.5.1 Controversial Learning in Color Coding and Learner Achievement

The researchers aimed to evaluate the effects of a controversial instructional approach on enhancing the ability to solve accounting equations. The findings are displayed in table 4.7 provided, encompassing the frequency and percentage allocation of responses, alongside the chi-square test outcomes.

Regarding the claim "Controversial learning can help to trigger interest in learning book keeping" the results indicate that among the cohort of students who obtained a score of 70% or above (n=40), 14 (35%) and 8 (20%) expressed agreement and strong agreement respectively. Additionally, 15 individuals (equivalent to 44% of those who scored between 40 and 49) within the aforementioned score range indicated their agreement with the aforementioned statement. In general, a significant proportion of 34% indicated concurrence with the proposition, while a minority of 14 individuals (7%) vehemently opposed it. The results of the chi-square analysis indicated a non-significant correlation between the use of controversial teaching method in color accounting within the educational setting to improve the expression of bookkeeping equation and student performance in the field of Business studies at a confidence interval of 95% ($\chi 2=13.814$, df=16, p=0.613). Similarly, a larger percentage of individuals who indicated agreement (A) with the proposition that utilizing color teaching in accounting may enhance comprehension of concepts in the study of bookkeeping, attained elevated scores within the brackets of 60 to 69 (44%). The chi-square analysis conducted revealed a dearth of correlation between the statement and learner accomplishment in the field of bookkeeping equation ($\chi 2=16.186$, df=16, p=0.440).

Table 4.6: Controversy Learning in Color Accounting

	posttest_categories											
	39 and below		40 to 49		50 to 59		60 to 69		70 and above		Total		Chi-Square
Controversial learning can help to trigger interest in learning book keeping													
SD	8	10%	3	9%	1	6%	1	4%	1	3%	14	7%	13.814,
D	13	16%	1	3%	2	12%	6	25%	7	18%	29	15%	16, 0.613
NAD	21	27%	8	24%	8	47%	7	29%	10	25%	54	28%	
A	26	33%	15	44%	4	24%	7	29%	14	35%	66	34%	
SA	11	14%	7	21%	2	12%	3	13%	8	20%	31	16%	
Total	79	100%	34	100%	17	100%	24	100%	40	100%	194	100%	
Color accounting can help to clarify concepts in learning bookkeeping													
SD	11	15%	0	0%	3	17%	2	8%	1	3%	17	9%	16.186,
D	5	7%	2	6%	2	11%	1	4%	2	6%	12	6%	16, 0.440
NAD	14	19%	7	21%	4	22%	7	28%	14	39%	46	24%	
A	29	39%	17	50%	6	33%	11	44%	14	39%	77	41%	
SA	16	21%	8	24%	3	17%	4	16%	5	14%	36	19%	
Total	75	100%	34	100%	18	100%	25	100%	36	100%	188	100%	
Controversial learning can help to increase understanding of bookkeeping concept													
SD	9	12%	1	3%	2	11%	0	0%	4	11%	16	9%	16.755,
D	8	11%	2	6%	2	11%	2	8%	5	13%	19	10%	16, 0.402
NAD	16	22%	2	6%	6	33%	6	25%	9	24%	39	21%	
A	24	32%	19	58%	5	28%	11	46%	12	32%	71	38%	
SA	17	23%	9	27%	3	17%	5	21%	8	21%	42	22%	
Total	74	100%	33	100%	18	100%	24	100%	38	100%	187	100%	
Controversial learning can be used to promote critical thinking in learning bookkeeping													
SD	15	20%	1	3%	1	6%	1	4%	2	5%	20	11%	19.283,
D	6	8%	2	6%	3	17%	3	12%	4	11%	16	8%	16,0.054
NAD	14	18%	8	24%	7	39%	8	32%	12	32%	42	22%	
A	29	38%	14	42%	4	22%	9	36%	11	29%	70	37%	
SA	12	16%	8	24%	3	17%	4	16%	9	24%	43	23%	
Total	76	100%	33	100%	18	100%	25	100%	38	100%	190	100%	
Controversial learning encourages pair discussion in learning bookkeeping													
SD	8	10%	2	6%	0	0%	1	5%	2	6%	13	7%	18.044,
D	7	9%	1	3%	2	11%	2	10%	5	14%	17	9%	16,0.321
NAD	11	14%	5	16%	6	33%	8	38%	7	19%	37	20%	
A	41	53%	15	47%	7	39%	5	24%	14	39%	82	44%	
SA	11	14%	9	28%	3	17%	5	24%	8	22%	36	19%	
Total	78	100%	32	100%	18	100%	21	100%	36	100%	185	100%	
Color accounting can help to explain complexities in learning bookkeeping													
SD	11	14%	4	13%	0	0%	0	0%	2	5%	17	9%	25.198,
D	8	10%	3	9%	1	6%	3	14%	5	14%	20	11%	16, 0.046
NAD	20	26%	2	6%	7	39%	8	38%	7	19%	44	24%	
A	25	32%	13	41%	8	44%	8	38%	10	27%	64	35%	
SA	13	17%	10	31%	2	11%	2	10%	13	35%	40	22%	
Total	77	100	32	100	18	100	21	100	37	100	185	100	

In relation to the item "*Controversial learning can help to increase understanding of bookkeeping concept*" The assessment revealed that within the group of students who attained a grade ranging from 60 to 69%, 11 individuals (46%) affirmed their agreement with the statement, while 9 individuals (12%) who received a score below 39% strongly disagreed. Moreover, the

chi-square analysis revealed an absence of a statistically substantial association between controversial instruction promoting comprehension of accounting principles and learner performance with a confidence level of 95% ($\chi 2$=16.755, df=16, sig=0.402). This result shows that learner who excelled well in bookkeeping equations were less likely to credit their success to the use of controversial color-teaching methods.

The results suggest that in relation to the statement "Controversial learning can be used to promote critical thinking in learning bookkeeping" it was observed that 23% of participants acknowledged a significant propensity to agree with the aforementioned assertion, while 20 individuals (11%) exhibited a pronounced inclination towards disagree. As a result, the corresponding chi-square analysis exhibited a statistically noteworthy association between controversial learning fostering the development of analytical reasoning and learner performance at a 90% confidence interval (CI). Hence, there exists sufficient evidence to establish a substantial correlation between the variables, whereby the high-performing students ascribed their accomplishments to controversial strategies that foster cognitive skills, thereby augmenting academic attainment in the field of business studies. Similarly, the results pertaining to the proposition "Color accounting can help to explain complexities in learning bookkeeping" unveiled that 35% and 22% of the participants agreed and strongly agreed with the assertion correspondingly. The findings of the chi-square examination demonstrated a statistically noteworthy association (X2=25.198, df=16, p=0.046) between the utilization of different hues in bookkeeping and the enhancement of learner achievement in the field of business studies. The findings suggest that the perspective of learners regarding the deconstruction of intricate ideas differed between the groups that obtained high and low scores.

4.5.2 Assimilating Cognition in Color Coding and Learner Achievement

The study aimed to evaluate the effects of incorporating assimilating cognition into the use of color teaching to improve learner performance in the bookkeeping equation. The findings are displayed in the table 4.8, encompassing the frequency and percentage distribution of responses, along with the chi-square test outcomes.

Results for the hypothetical item "Assimilating cognition can help to integrate ideas and build connections" demonstrated that, within the group of students who attained a grade of 70% or greater, 3 students (8%) exhibited robust disagreement, whereas 26 students (34% of those who achieved a score ranging from 39% and below) within the same score bracket conveyed their agreement with the proposition. In general, a total of 8% of participants expressed strong dissent towards the assertion, in contrast to 56 individuals who concurred (30%). The findings from the chi-square examination indicated a dearth of statistically noteworthy association ($X2=11.891$, $df=16$, $p=0.751$) between the process of assimilating cognition integrating and constructing connections, and enhancing learner achievement in the field of Business studies. The item stateted as “Controversial learning can help to facilitate the assimilation of knowledge” Observed was the participation of 8 individuals, constituting 36% of the learners falling within the range of scores from 60 to 69, who neither expressed agreement nor disagreement with the aforementioned assertion. Conversely, a considerable number of individuals, specifically 13 (33%), belonging to the category of learners who achieved scores of 70 or higher, expressed agreement with the claim. In contrast, the chi-square produced did not demonstrate a noteworthy correlation between the assertion and student performance in the field of bookkeeping. The findings suggest that the perspective of learners regarding the assimilation of knowledge through

the adversary technique was comparable for the groups of participants who obtained both elevated and diminished scores.

Table 4.7: Assimilating Cognition and Color Accounting

	Posttest Categories												
	39 and below		**40 to 49**		**50 to 59**		**60 to 69**		70 and above		Total		Chi-Square
	n	**%**	**n**	**%**	**n**	**%**	**n**	%	n	%	n	%	
Assimilating cognition can help to integrate ideas and build connections													
SD	6	8%	3	9%	1	6%	3	13%	3	8%	16	8%	11.891, 16,
D	11	14%	4	13%	1	6%	3	13%	7	18%	26	14%	0.751
NAD	18	24%	7	22%	8	47%	9	38%	12	30%	54	29%	
A	26	34%	11	34%	2	12%	4	17%	13	33%	56	30%	
SA	15	20%	7	22%	5	29%	5	21%	5	13%	37	20%	
Total	76	100%	32	100%	17	100%	24	100%	40	100%	189	100%	
Controversial learning can help to facilitate the assimilation of knowledge													
SD	7	9%	2	6%	0	0%	0	0%	0	0%	9	5%	12.544, 16,
D	7	9%	3	9%	2	13%	4	18%	6	15%	22	12%	0.706
NAD	21	28%	12	36%	7	44%	8	36%	16	41%	64	35%	
A	25	34%	10	30%	3	19%	5	23%	10	26%	53	29%	
SA	14	19%	6	18%	4	25%	5	23%	7	18%	36	20%	
Total	74	100%	33	100%	16	100%	22	100%	39	100%	184	100%	
Assimilating cognition about color accounting can help to internalize connections that exist among bookkeeping elements													
SD	9	12%	5	16%	0	0%	1	4%	3	8%	18	10%	24.264, 16,
D	14	18%	3	9%	4	27%	3	13%	5	13%	29	16%	0.034
NAD	21	28%	14	44%	8	53%	4	17%	8	21%	55	30%	
A	21	28%	8	25%	2	13%	8	35%	8	21%	47	25%	
SA	11	14%	2	6%	1	7%	7	30%	15	38%	36	19%	
Total	76	100%	32	100%	15	100%	23	100%	39	100%	185	100%	
Assimilating cognition about color accounting enhances content refinement in bookkeeping													
SD	7	9%	2	6%	1	7%	1	5%	2	5%	13	7%	23.584, 16,
D	18	24%	6	19%	2	13%	3	14%	6	15%	35	19%	0.019
NAD	18	24%	12	38%	6	40%	1	5%	6	15%	43	23%	
A	22	29%	8	25%	6	40%	7	32%	13	33%	56	30%	
SA	11	14%	4	13%	0	0%	10	45%	12	31%	37	20%	
Total	76	100%	32	100%	15	100%	22	100%	39	100%	184	100%	
Assimilating cognition can help me to make sense of complex concepts													
SD	10	13%	4	13%	0	0%	1	4%	3	8%	18	10%	19.241, 16,
D	9	12%	4	13%	3	19%	4	17%	0	0%	20	11%	0.052
NAD	19	25%	11	35%	7	44%	4	17%	10	26%	51	28%	
A	16	21%	7	23%	2	13%	8	33%	15	39%	48	26%	
SA	22	29%	5	16%	4	25%	7	29%	10	26%	48	26%	
Total	76	100%	31	100%	16	100%	24	100%	38	100%	185	100%	
Assimilating cognition can be used to promote active learning													
SD	5	7%	3	9%	0	0%	1	5%	2	5%	11	6%	18.631, 16,
D	7	9%	7	22%	2	12%	1	5%	5	13%	22	12%	0.288
NAD	22	30%	1	3%	7	41%	9	41%	11	28%	50	27%	
A	23	31%	10	31%	6	35%	7	32%	12	31%	58	32%	
SA	17	23%	11	34%	2	12%	4	18%	9	23%	43	23%	
Total	74	100%	32	100%	17	100%	22	100%	39	100%	184	100%	

With respect to the item "Assimilating cognition about color accounting can help to internalize connections that exist among bookkeeping elements", the findings revealed that within the group of students who attained a score of 70% or above, 3 individuals (8%) strongly disagreed while 15 individuals (38%) strongly agreed with the statement. Conversely, among those who scored less than 40%, 21 individuals (28%) expressed agreement. In general, a significant proportion of 30% demonstrated a state of impartiality towards the claim, while a smaller number of 18 individuals (10%) vehemently opposed it. Moreover, the chi-square analysis revealed the existence of a statistically noteworthy association between the utilization of color categorization to represent internal connections within the bookkeeping equation and the academic performance of students in the field of business studies, with a confidence level of 95% ($X2=24.264$, $df=16$, $p=0.034$). The results suggested that a significant number of academically successful students were more likely to attribute their achievements to their capacity for assimilating cognitive processes in order to internalize the connections between various elements of knowledge, as opposed to the students who performed poorly. In a comparable manner, the results regarding the topic presented as "Assimilating cognition about color accounting enhances content refinement in bookkeeping" indicated that 33% of students classified as high achievers (scoring 70% and above) affirmed their agreement with the statement, while 18 students (equivalent to 24% of the low achiever group - scoring 39% and below) expressed their disagreement. In general, a significant proportion of 56 individuals (constituting 30% of the total) indicated their concurrence with the statement, while a smaller fraction of 13 students (equivalent to 7% of the total) held a strong opposing viewpoint. As a result, the associated chi-square analysis exhibited a statistically noteworthy association between the process of integrating cognitive refinement of

the components of the bookkeeping equation and the academic performance of students in the field of business studies, with a confidence level of 95%. This suggests that there was a disparity in the effects of incorporating cognitive-enhancing content refinement in bookkeeping on the academic performance of high-achieving and low-achieving students.

With respect to the notion of "Assimilating cognition can help me to make sense of complex concepts," the findings indicated that within the cohort of students who attained a score of 70% or above, 15 individuals (39%) concurred with the assertion, while 10 individuals (13%) who obtained a score below 40% strongly dissented. In general, a significant proportion of 28% demonstrated a state of impartiality towards the claim, while a minority of 18 individuals (10%) vehemently held a contrary viewpoint. Moreover, the chi-square analysis revealed a statistically noteworthy association between the process of assimilating cognition, which involves comprehending intricate concepts, and the academic performance of students in the field of business studies, with a confidence level of 95% (X2=19.241, df=16, sig=0.052). The discovery suggested that students who attained superior outcomes in the field of Business studies were predisposed to ascribe their triumph to the factor of assimilating information and comprehending intricate principles of bookkeeping. Moreover, the results pertaining to the concept postulated as "Assimilating cognition can be used to promote active learning" indicated that 23% of participants in the high-performing group (70% and above) acknowledged robust concurrence with the aforementioned proposition, while 7 individuals (equivalent to 22% of the low-performing cohort – 40 and 49%) expressed dissent. In general, a significant proportion of 58 individuals (constituting 32% of the total) conveyed their concurrence with the statement, while a smaller fraction of 11 students (equivalent to 6%) vehemently expressed their dissent. As a

result, the associated chi-square examination did not exhibit a statistically noteworthy association between the process of incorporating cognitive abilities to encourage active learning and the academic performance of students in the field of business studies, with a confidence interval of 95%. Hence, both high-performing and low-performing learners encountered a comparable influence on learner attainment concerning the incorporation of cognitive processes to expedite educational processes.

4.5.3 Declarative Knowledge in Color Coding and Learner Achievement

The investigations sought to assess impact of declarative knowledge in color coding in enhancing learner achievement in bookkeeping equation. The results are presented in the table below and includes the frequency and percentage distribution of responses, as well as the chi-square test results.

The findings for the hypothetical items pertaining to declarative knowledge revealed that only one item postulated as "Declarative knowledge can be used to promote creative problem-solving" exhibited a significant correlation with learner performance in the field of business studies. The findings pertaining to the assertion indicated that within the group of students who attained a score of 70% or above, 10 (26%) and 11 (29%)3 individuals demonstrated agreement and strong agreement, respectively, while 18 students (equivalent to 24% of those who achieved a score between 39% and lower) within the same score range expressed neutrality towards the inference statement. In general, a minority of 6% of participants expressed strong disagreement with the assertion, in contrast to 61 individuals who exhibited agreement (constituting 34% of the total respondents). The findings of the chi-square examination indicated

a statistically significant association (X2=25.491, df=16, p=0.049) between the utilization of declarative knowledge to foster innovative problem-solving and enhancing learner accomplishment in the field of Business studies.

Table 4.8: Declarative Knowledgein Color Accounting

	Posttest Categories												
	39 and below		40 to 49		50 to 59		60 to 69		70 & above		Total		Chi-Square
Declarative knowledge can help me to reason and conceptualize assertions													
SD	5	7%	3	9%	0	0%	3	13%	2	5%	13	7%	17.360, 16,
D	8	11%	4	12%	4	22%	3	13%	4	10%	24	12%	0.363
NAD	16	22%	9	27%	7	39%	10	43%	17	43%	60	31%	
A	34	46%	12	36%	3	17%	5	22%	13	33%	68	36%	
SA	11	15%	5	15%	4	22%	2	9%	4	10%	27	14%	
Total	74	100%	33	100%	18	100%	23	100%	40	100%	192	100%	
Declarative knowledge can help to utilize color accounting concept to comprehend bookkeeping													
SD	6	8%	3	9%	0	0%	2	8%	2	5%	13	7%	13.005, 16,
D	8	11%	2	6%	1	6%	1	4%	4	10%	16	8%	0.672
NAD	18	24%	9	26%	9	50%	9	38%	18	45%	64	33%	
A	31	42%	15	44%	4	22%	8	33%	12	30%	71	37%	
SA	11	15%	5	15%	4	22%	4	17%	4	10%	29	15%	
Total	74	100%	34	100%	18	100%	24	100%	40	100%	194	100%	
Declarative knowledge can help to store experience in bookkeeping													
SD	6	8%	2	6%	0	0%	2	9%	1	3%	11	6%	21.386, 16,
D	8	11%	4	13%	2	13%	1	4%	9	24%	24	13%	0.164
NAD	15	20%	11	34%	10	63%	8	35%	11	29%	57	30%	
A	30	41%	10	31%	2	13%	10	43%	12	32%	65	35%	
SA	15	20%	5	16%	2	13%	2	9%	5	13%	30	16%	
Total	74	100%	32	100%	16	100%	23	100%	38	100%	187	100%	
Declarative knowledge can help to develop critical thinking skills													
SD	4	5%	2	6%	1	6%	2	9%	3	8%	12	7%	18.147, 16,
D	11	15%	4	13%	4	25%	3	13%	4	11%	27	14%	0.315
NAD	13	18%	5	16%	7	44%	7	30%	10	26%	43	23%	
A	25	34%	17	55%	2	13%	7	30%	11	29%	63	34%	
SA	20	27%	3	10%	2	13%	4	17%	10	26%	40	21%	
Total	73	100%	31	100%	16	100%	23	100%	38	100%	185	100%	
Declarative knowledge can be used to promote creative problem-solving													
SD	6	8%	1	3%	0	0%	4	18%	0	0%	11	6%	25.491, 16,
D	7	9%	2	6%	4	25%	1	5%	6	16%	20	11%	0.049
NAD	18	24%	10	32%	6	38%	4	18%	11	29%	49	27%	
A	29	39%	10	32%	4	25%	8	36%	10	26%	61	34%	
SA	15	20%	8	26%	2	13%	5	23%	11	29%	41	23%	
Total	75	100%	31	100%	16	100%	22	100%	38	100%	182	100%	
Declarative knowledge can be used to foster collaboration among students													
SD	3	4%	1	3%	0	0%	2	9%	1	3%	7	4%	10.535, 16,
D	12	16%	2	6%	3	19%	4	18%	8	21%	30	16%	0.837
NAD	20	27%	9	28%	6	38%	4	18%	10	26%	50	27%	
A	23	31%	11	34%	5	31%	10	45%	12	31%	62	33%	
SA	17	23%	9	28%	2	13%	2	9%	8	21%	39	21%	
Total	75	100%	32	100%	16	100%	22	100%	39	100%	188	100%	

The absence of a substantial correlation between the remaining five components of declarative knowledge and learner performance in the field of business studies suggested that the perspectives of learners regarding declarative knowledge, as manifested through the conceptualization of statements, enhanced understanding, retention of experiences, cultivation of critical thinking abilities, and promotion of collaborative learning among learners, were homogeneous among the groups that attained both high and low scores.

4.6 Multivariate Analysis

In this subsection, the research delved into the realm of multivariate analysis to explore relationships and patterns among multiple variables simultaneously, to extend the understanding beyond traditional univariate or bivariate analyses by considering the interactions and dependencies among several variables discussed in the preceding subsections. Simple linear regression model was performed to reveal the patterns among experimental and control groups as illustrated in the sections below.

4.7 Collinearity Diagnostic

The study conducted this examination to evaluate the existence and intensity of multicollinearity among the independent variables. Multicollinearity arises when two or more predictor variables in a regression model exhibit a strong correlation, thereby potentially resulting in erroneous inferences regarding the significance and direction of associations. In this regard, the normality test, autocorrelation test and multicollinearity tests were performed to ascertain the fitness of the variables for linear regression analysis.

4.7.1.1 Normality Test

The Shapiro-Wilk tests were employed to examine the normality of the independent variables, as illustrated in the table 4.10 provided.

Table 4.9: Normality Test for User Characteristics

	Kolmogorov-Smirnov[a]			**Shapiro-Wilk**		
	Statistic	Df	Sig.	Statistic	Df	Sig.
Learner attitude	0.067	213	0.200	0.991	213	0.107
Controversial learning	0.119	213	0.101	0.761	213	0.187
Assimilating cognition	0.055	213	0.100	0.787	213	0.187
Declarative knowledge	0.175	213	0.216	0.656	213	0.221

The applied the Shapiro-Wilk test to ascertain the normality of the variables. The results in the table indicate that all the 4 variables had a p-value greater than 0.05, thus confirm the hypothesis that data was collected from a normally distributed population.

4.7.3.4 Autocorrelation Test

The Durbin-Watson statistic was employed to examine the presence of autocorrelation in the residuals of regression models for both the control and experimental groups and results presented in table 4.11.

Table 4.10:: Auto Correlation Tests

Groups	**Durbin-Watson**
Control	1.853
Experiment	2.111

In relation to this matter, the control group exhibited a Durbin-Watson statistic of 1.853, while the experimental group displayed a statistic of 2.111. Moreover, the Durbin-Watson coefficients for both cohorts exhibit proximity to the value of 2, suggesting the absence of substantial autocorrelation in the residuals of the regression models for both cohorts.

4.7.2 Test of Multicollinearity

The assumption of multicollinearity for user attributes was tested using the Variance Inflation Factor (VIF) Test. The VIF test measures the correlation between each user attribute and all other attributes in the dataset. If the VIF values are above 10, it indicates high multicollinearity, meaning that the user attributes are highly correlated with each other. In such cases, it is necessary to address multicollinearity by removing one or more correlated attributes. Removing one or more correlated attributes can help reduce multicollinearity and improve the accuracy of the model. The results presented in table 4.12 show that all the variables indicated VIF values less than 4, which is less than 10. This indicated that no multicollinearity was detected in the data and therefore further inferential statistics are possible without creating bias in the study results.

Table 4.11: Multi Collinearity Tests

Group	Variables	Collinearity Statistics	
		1/VIF	VIF
Control	(Constant)		
	Name of school	.890	1.123
	Age groupings	.932	1.073
	Gender	.931	1.075
	Learner_attitude	.551	1.814
	controversial_learning	.369	2.714
	assimilating_cognition	.308	3.251
	declarative_knowledge	.474	2.109
Experimental	(Constant)		
	Name of school	.491	2.037

	Age groupings	.862	1.161
	Gender	.545	1.834
	Learner_attitude	.544	1.839
	controversial_learning	.559	1.789
	assimilating_cognition	.498	2.009
	declarative_knowledge	.438	2.281

4.8 Linear Regression Analysis

The table provides the results of a statistical analysis that compares two groups: the "Control" group and the "Experiment" group.

Table 4.12: Model Summary

Groups	R	R Square	Adjusted R Square	Std. Error of the Estimate
Control	.464[a]	.216	.136	1.415
Experiment	.576	.322	.287	1.265

The Pearson correlation coefficient, represented as the R value, was determined to be 0.464 and 0.576 for the control and experimental groups, correspondingly. These values indicate a stronger association between the predictor variable and outcome variables in the latter cohort. The determination coefficient, R Square, revealed that the predictors employed in the experimental group explained 32.2% of the variance observed in the dependent variable. The independent variables in the control group explained 21.6% of the variance observed in the dependent variable. This implies that the autonomous factors in the experimental group demonstrated a higher level of impact on the variability observed in the dependent variable, in contrast to the control group. The R-squared value that has been adjusted The percentage for the "Control" group was 0.136 (13.6%), while the percentage for the "Experiment" group was 0.287 (28.7%). Moreover, the Standard Deviation of the Estimate for the "Control" group was ascertained to be

1.415, while for the "Experiment" group it was discovered to be 1.265. This implies that there is a larger discrepancy between the observed measurements and the anticipated measurements in the control cohort in contrast to the experimental cohort.

Based on the obtained data, it can be observed that the "Experiment" group exhibits higher values for R, R Square, and Adjusted R Square in comparison to the "Control" group. This suggests that the treatment condition implemented in the "Experiment" group exerted a more pronounced impact on the dependent variable when contrasted with the "Control" group.

4.8.1 ANOVA Table

The table show the level of significance of the model in explaining the study variables.

Table 4.13: ANOVA Tests

Model		Sum of Squares	df	Mean Square	F	Sig.
Control	Regression	137.041	5	34.260	208.013	.000[b]
	Residual	80.704	95	.165		
	Total	217.745	90			
Experimental	Regression	143.240	5	28.648	188.023	.000[c]
	Residual	74.506	88	.152		
	Total	217.745	93			

The results indicate that the Control group had a p-value of .000, while the experiment group had a p-value of .000, indicating a statistically significant relationship between the independent and dependent variables in both the groups.

4.8.2 Regression Coefficients

Table 4.14: Regression Coefficients

Group		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
Control	(Constant)	2.204	.031		104.812	.101
	Name of school	**.179**	**.046**	**.213**	**3.882**	**.000**
	Age groupings	.074	.042	.088	1.766	.078
	Gender	.001	.046	.002	.028	.977
	Learner attitude	**.163**	**.048**	**.194**	**3.414**	**.001**
	Controversial learning	.006	.036	.007	.154	.878
	Assimilating cognition	-.022	.032	-.026	-.664	.507
	Declarative knowledge	-.021	.050	-.025	-.419	.675
Experiment	(Constant)	.121	1.246		.017	.986
	Name of school	**.168**	**.047**	**.200**	**3.602**	**.000**
	Age groupings	.048	.042	.057	1.147	.252
	Gender	.001	.305	.000	.022	.878
	Learner attitude	**.191**	**.045**	**.227**	**4.201**	**.000**
	Controversial learning	**.121**	**.047**	**.144**	**2.575**	**.010**
	Assimilating cognition	**.144**	**.043**	**.171**	**3.319**	**.001**
	Declarative knowledge	-.023	.031	-.027	-.743	.458

The constant term for both the "Control" and "Experiment" groups was 2.204 and 0.121, correspondingly, indicating that the estimated value of the dependent variable when all independent variables were zero in both cases. Furthermore, the term did not exhibit statistical significance (Significance = 0.101; 0.986), indicating that the value of the dependent variable when all predictors are at zero did not display a significant deviation from zero in both the control and experimental groups. The results indicate that among the seven variables in the

control group, two demonstrated statistical significance and a positive association. On the contrary, within the experimental cohort, four out of the seven autonomous factors exhibited a favorable correlation with learner attainment.

Within the control group, one of the predictor variables, namely the dimension of learner attitude, exhibited a statistically significant and positive correlation with learner achievement in the field of bookkeeping. This relationship was determined to be significant at a 95% confidence interval, with a regression coefficient (B) of 0.163, a t-value of 3.414, and a p-value of 0.001. Moreover, the standardized coefficient (Beta) of 0.163 suggested that the variable served as a moderately predictive factor, exerting a positive impact on the dependent variable in terms of standard deviation measurements. Furthermore, the factor of educational institution name also demonstrated a noteworthy affirmative correlation with the academic achievements in the field of commerce studies at a confidence interval of 95% (B=.179, t=3.882 & p=.000). The standardized coefficient (Beta) of 0.266 indicated that the variable possessed a moderately robust predictor, exerting a positive influence on the dependent variable in terms of standard deviation units. The remaining five variables pertaining to age groups (B=.074, t=1.766 & P=.078), gender (B=.001, t=.028 & p=.977), Controversial learning (B=.006, t=.154, p=.878), Assimilating cognition (B=-.022, t=-.664, p=.507), and Declarative knowledge (B=-.021, -.419, p=.675) did not exhibit statistically significant associations with the dependent variable (learner achievement in Business studies) within the control group.

The absence of a statistically substantial correlation between different age cohorts and learner performance in the field of Business studies suggested that age alone did not appear to be a

pivotal determinant influencing outcomes in the domain of bookkeeping equations within this particular framework. Furthermore, the data failed to yield substantiation that gender played a noteworthy role in ascertaining learner accomplishment in the realm of bookkeeping equation amidst the learners. The findings additionally demonstrate the absence of a statistically noteworthy correlation between contentious learning, assimilative cognition, and declarative knowledge. Consequently, these factors did not exert a substantial influence on augmenting proficiency in bookkeeping equations through the utilization of contentious learning within the control cohort.

The findings in the experimental group indicated that the variable representing the name of the educational institution exhibited a statistically significant and favorable correlation with the dependent variable. The statistical analysis yielded a coefficient of 0.168, with a t-value of 3.602 and a p-value of .0005. Furthermore, the factor of age cohort did not exhibit a statistically noteworthy correlation with the outcome variable (B=0.048, t=1.147 & p=.252), suggesting that, within the experimental cohort, the distinct age cohorts of participants did not exert a substantial influence on the acquisition of bookkeeping knowledge. Moreover, the factor of sex did not have a substantial impact on the results of the bookkeeping equation (B=0.001, t=0.022, p-value=0.878).

The independent variable of learner attitude, contentious learning, and assimilative cognition demonstrated a slightly significant correlation with learner outcomes in bookkeeping at a 95% confidence interval (B=.191, t=4.201, p=.000; B=.121, t=2.575, p=.010; B=.144, t=3.319, p=.001). This suggests that, while controlling for other predictors, a one-unit increase in learner

attitude significantly enhanced the learner outcome in Business studies by 0.191 units. In a similar vein, an increase of one unit in contentious education within the experimental cohort, while keeping all other factors consistent, exhibits a positive and statistically significant impact on learner achievements in the realm of bookkeeping equations, with an increment of 0.121 units. The variable of cognitive assimilation demonstrated a favorable and noteworthy correlation with learner attainment in accounting equations. Nevertheless, the variable of factual knowledge did not exhibit any noteworthy correlation with learner performance in bookkeeping (B=-.023, t-0.743 & p=0.458).

4.8.3 Qualitative Analysis

The analysis of qualitative data derived from learners' questionnaires, the lesson observation schedule, and key informant interviews with teachers revealed a substantial correlation between the adversary instructional technique and learners' achievement in the field of bookkeeping. The examination demonstrated that learners within the experimental group exhibited a notably reduced time in classifying diverse items as Assets, Capital, and Liabilities by employing color, compared to their counterparts in the control group. In supporting this, a teacher in one of the experiemtal schools said “Learners express readings to utilize AIT and urged that color charts be brought to schools as teaching aids to enhance visualization”. This observation strongly suggests a positive link between cognitive assimilation and learners' success in bookkeeping, as the instructional approach stimulated the integration of ideas, internalization of connections, and refinement of content.

In addition, the classroom observation findings disclosed that the utilization of color ignited learners' interest by enhancing the visualization of concepts pertaining to the constituents of the bookkeeping equation. This, in turn, established a constructive correlation between controvesy learning methods and learners' accomplishments in bookkeeping. This was evident in the notably high scores obtained on the Experimental lesson observation schedule, graded on a scale of 1 to 5, where 1 indicated minimal observation and 5 denoted extensive observance. The assessment of skills, activities, and indicators consistently scored between 4.5 and 5, reinforcing the effectiveness of the approach in promoting active learning and comprehension.

Similarly, the examination of teacher interviews yielded additional insights that reinforced the potential of the adversary instructional technique, specifically the incorporation of color as a dynamic and provocative learning approach. This innovative method demonstrated substantial potential in unraveling the complexities inherent in intricate bookkeeping concepts, thereby making them more accessible to learners. Furthermore, the technique was found to excel in facilitating the creation of vibrant and memorable visual representations of crucial elements within the bookkeeping domain. This synthesis of color-enhanced learning and the visualization of key concepts had a profound impact on learners' comprehension and engagement.

As evidenced through the in-depth interviews with teachers, the employment of color as an integral part of the adversary instructional technique showed remarkable effectiveness in addressing the challenges often associated with complex subjects like bookkeeping. By infusing visual cues through color, teachers observed that learners exhibited a heightened capacity to grasp and retain intricate nuances that were previously perceived as challenging. This

transformative effect was particularly evident in the way learners interacted with and absorbed bookkeeping principles, leading to a tangible improvement in their overall achievement. The study further realized that the strategic use of color in teaching and learning is not solely about aesthetics but rather a deliberate approach to enhance cognitive connections. The application of color enabled learners to mentally categorize, differentiate, and associate distinct elements within the bookkeeping equation. This cognitive process, bolstered by color-driven associations, fostered a deeper understanding of the subject matter and its underlying interrelationships. In conclusion, the findings underscore the pivotal role of adversery instructional method to be an innovative form of teaching-learning pedagogy of bookkeeping, particularly when employing color, in enhancing the cognitive grasp, engagement, and achievement of learners in the intricate domain of bookkeeping as a topic of accounting.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMENDATION

5.1 Introduction

This chapter presents summary of findings drawn from thematic areas of the study which include; background attributes, learner attitude, controversial learning, assimilating cognition and declarative knowledge. Also presented herein are conclusions and recommendations for appropriate interventions.

5.2 Summary of the Study

The primary objective of this study was to investigate the impact of an adversary instructional technique on student achievement in bookkeeping within public secondary schools located in the Komothai zone of Kiambu County. The specific objectives included To examine the influence of adversary instructional technique on learner achievement in bookkeeping in public secondary schools in Komothai Zone Kiambu County; To determine the effect of adopting controversy in learner achievement in book keeping in public secondary schools in Komothai zone, Kiambu County; To assess the impact of assimilating cognition in learner achievement in book keeping in public secondary schools in Komothai zone, Kiambu County and to evaluate the impact of declarative knowledge in learner achievement in book keeping in public secondary schools in Komothai zone, Kiambu County. The study evaluated the effectiveness of the adversary instructional method by assessing learner attitude, controversy learning, cognitive assimilation, and declarative knowledge, while measuring achievement in bookkeeping through test scores.

The study aimed to provide insights that could drive programming and policy interventions targeted at enhancing teacher training, management, and motivation. By enabling educators to effectively employ interactive instructional methods, the study aimed to enhance students' achievement in bookkeeping. Furthermore, the study sought to inform policy discussions at both national and county levels, with the goal of influencing the allocation of additional resources to support teacher training initiatives.

It was anticipated that the research findings would not only serve as a basis for future investigations into the interplay between adversary techniques and student achievement in bookkeeping but also contribute to a deeper understanding of the causal relationships between these aspects across different educational levels and geopolitical contexts.

To address these objectives, a quasi-experimental approach was employed using the Solomon Four-Group Design. Both quantitative and qualitative methodologies were applied to collect and analyze data. Data collection tools encompassed a self-administered questionnaire for students, a corresponding questionnaire for teachers, a key informant interview guide for teachers, and an observation guide. Data collection took place between May and June 2023 and involved 206 learners and 4 teachers. Notably, the experimental group comprised 101 learners (49%), who received training on the correct implementation of the adversary instructional method using color coding, while the remaining 101 learners (51%) constituted the control group.

The analysis of the collected data encompassed a combination of quantitative and qualitative techniques. Quantitative analysis techniques encompassed independent samples t-tests for variance, cross-tabulations with Chi-square tests, and multiple linear regression. Qualitative data

were subjected to thematic analysis. The regression analysis produced two distinct models: one for the experimental group (Model 1) and another for the control group (Model 2). Each model incorporated independent and moderating variables. The findings were organized into sub-sections aligned with the study's objectives.

Regarding the learner's background attributes, the respective educational establishments caused a positive effect on learner achievement in both control and experiemtal groups (Control Model: = 0.179, t = 3.882, p=0.000; Experiemental model: B= 0.168, t=3.602 and p=0.000). This suggests that trained teachers in the experimental group were more effective in activating learners' background knowledge than their untrained colleagues in control group. In addition, the bivariate analysis also showed that there was a significant link between the school identifier (educational establishment) and student performance in the field of book keeping equation through controversial learning color accounting. This implies that the selection of educational establishment could potentially influence the academic achievement of students in the field of bookkeeping equations. Similarly, learner attitude was found to have a significant and positive effect on learner achievement in book keeping in both the assignment groups (Control. B=.163, t=3.414, p=0.001; Experiment: B=.191, t=4.201, p=0.000). In particular, the learners cited convenience, simplicity and usefulness in class settings as main points.

In the context of controversy learning, the analysis found a positive and significant effect on the experimental group and not the control groups (Experiemental: B=0.121, t=2.575 and p=0.010). The results imply that controversy learning promoted critical thinking and explained better the complexities that were encountered in relation to bookkeeping. This underscores the value of

employing innovative instructional approaches, such as controversy learning, to enhance students' cognitive abilities and their understanding of complex topics such as bookkeeping in business studies.

Furthermore, the dimension of assimilating cognition exhibited a positive and substantial impact on learner achievement within the experimental group. This effect was highlighted by the experimental group's coefficient (B) of 0.144, a t-value of 3.319, and a p-value of 0.001. Importantly, the results indicated that assimilating cognition, particularly in the context of color accounting, played a crucial role in enhancing students' overall performance. The analysis further revealed that this cognitive process facilitated the internalization of connections, refinement of content understanding, and aided in comprehending intricate concepts associated with the subject of bookkeeping. The analysis emphasizes the importance of tailored instructional methods that harness assimilative cognition, offering educators insights into optimizing teaching strategies to facilitate deeper comprehension and more effective learning experiences for students in the realm of bookkeeping in business studies subject.

5.3 Conclusion

In conclusion, the findings of the study reveal several significant aspects related to learner achievement in the context of bookkeeping education. Firstly, the educational establishments themselves exhibited a positive influence on learner achievement across both the control and experimental groups. This indicates that trained teachers within the experimental group were notably more effective at activating learners' background knowledge compared to their untrained counterparts in the control group. Additionally, the analysis highlights a significant connection

between the school identifier (educational establishment) and student performance in the realm of bookkeeping through the application of controversial learning and color accounting. This suggests that the choice of educational establishment could potentially impact students' academic achievements in the field of bookkeeping. In view of the above, the study underscores the importance of teacher training and pedagogical approaches. Trained teachers may effectively leverage controversial learning and color accounting methods to enhance learners' background knowledge activation. This emphasizes the significance of ongoing teacher development and the adoption of innovative teaching techniques to promote deeper understanding and academic success among students. Further, the outcomes solidify the importance of considering institutional factors when designing educational programs. Cultivating a positive learning environment, along with addressing learners' perceptions of relevance and convenience, can significantly impact their success in bookkeeping education.

Furthermore, the study's emphasis on learner attitude underscores the need to address students' perceptions of the subject's relevance and applicability. By recognizing the factors that contribute to positive learner attitudes, educators and policymakers can design strategies to engage students more effectively, potentially leading to improved achievement in the field of bookkeeping. As such, the findings offer valuable insights for educators, administrators, and policymakers seeking to enhance learner achievement in bookkeeping education by focusing on teacher training, innovative instructional methods, and the cultivation of positive learning environments.

In addition, the analysis demonstrated a positive and significant impact of controversy learning on the experimental group, underscoring its ability to foster critical thinking and provide better

understanding of the complexities inherent in bookkeeping. This highlights the value of employing innovative instructional approaches like controversy learning to enhance students' cognitive capacities and their grasp of intricate subjects like bookkeeping in business studies.

Additionally, the research revealed a significant positive influence of assimilating cognition, particularly in the context of color accounting, within the experimental group. This cognitive process played a pivotal role in elevating students' overall performance by aiding the internalization of connections, refining content comprehension, and facilitating the understanding of intricate concepts associated with bookkeeping. The analysis reinforces the significance of tailored instructional methods that harness assimilative cognition, providing educators with insights to optimize teaching strategies for more profound comprehension and effective learning experiences in the realm of bookkeeping within the business studies curriculum.

5.4 Recommendation

Based on the conclusions discussed above, the study recommendations targeted the educational policy stakeholders, institutions and actors of business studies in Kiambu County, in view of leading an effective teaching, enhanced student achievement, and a more enriching learning experience in the field of bookkeeping in business studies. The sub-sections covers recommendations for policy action, practice and further research.

5.4.1 Recommendations for Policy

The study recommends the Ministry of Education to develop and disseminate policy guidelines to secondary schools, requiring business studies teachers to access regular professional development opportunities to remain up-to-date with the latest pedagogical approaches such as controversy teaching technique. This will enable the educational institutions to invest in comprehensive teacher training programs with a focus on equipping educators with the necessary skills to effectively activate learners' knowledge and employ innovative teaching methodologies like controversial learning and color accounting.

In addition, the Ministry of education should develop and disseminate policy guidelines aimed at incorporate innovative teaching techniques, such as controversial learning and color accounting, into the curriculum. These approaches may enhance students' critical thinking skills and comprehension of complex subjects like bookkeeping. Providing teachers with guidance on how to effectively integrate these methods can lead to more engaging and productive learning experiences.

Thirdly, the Ministry should design policies that are cognizant of uniqueness among educational institutions. In lieu of this, the diverse institutions institutional factors such as teaching methodologies employed, the learning environment, and the overall culture of the institution, should be considered when designing educational programs for maximum learner outcomes.

5.4.2 Recommendations for Practice

The educational institutions should strive to cultivate a positive learning environment which is crucial for student success. Institutions should prioritize creating classrooms that are conducive to active learning, critical thinking, and student engagement. Addressing students' perceptions of relevance and convenience can contribute to a more positive attitude toward learning, thereby enhancing their achievement in subjects like bookkeeping.

The secondary schools management should consider tailoring teaching methods to accommodate different learning styles can improve students' understanding and retention of complex concepts. Moreover, the educators should consider incorporating strategies that allow for individualized instruction.

5.4.3 Recommendations for further research

The study recommend stronger collaboration between educators and researchers to continuously explore and refine effective teaching strategies. Research-based insights can inform instructional practices and lead to the development of new approaches that further enhance student achievement. The research further call upon scholars to continuously assess the effectiveness of the current instructional methods and educational programs.

Table 5.1: Contribution to Body of Knowledge.

OBJECTIVE	**CONTRIBUTION**
1.Controversial Learning	Controversial learning may be used to promote critical thinking skills as well as unpack complexities in accounting using colours
2.Assimilating Cognition	Assimilating cognition may be beneficial in iternalizing connections, content refinement and making sense of complex concepts in Book keeping for deeper mastery of elements that constitute book keeping equation
3.Declarative Knowledge	Declarative knowledge promote problem solving skills.

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APPENDICES

6.1 Appendix I: Interview Schedule for teachers of Business Studies

Dear Sir/Madam,

My name is Onyogo Seline Awino of registration number E60/36107/2019 persuing Master of Education in Business Education at the University of Nairobi. The focus of my study is Influence of Adversary Instructional Technique on learner achievement in book keeping among Form three learners persuing Business Studies as subject specialization in public secondary schools in Komothai Zone, Kiambu County; to capture effective conceptualization of Book keeping concepts using colour accounting. The purpose of the study is academic.Your response will be treated with highest confidentiality; your biodata will not be revealed. Thank you for accepting to participate in the study.

1. Personal Information

(a) Name and Sub County of your school

_____

(b) Gender: (a) Male (b) Female

_____

(c) Age Categories : Less than thirty years; (b) 31-40 years; (c) 41-50 years; (d) Over 50 years

_____

(d) Level of educational attainment : PhD degree ; Master's degree; Bachelor's degree ; Diploma; Certificate; Others

_____

(e) Length of teaching experience: Over 20 years ; 16-19 years ;11-15 years ; 6-10 years Less than 5 years

(f) Indicate the population of your class desegregated by gender

(i) Girls …….

(ii) Boys ……..

(iii) Total ……..

2. Discuss how often the teacher use an adversary technique in your classroom when teaching bookkeeping, probing for actively engagement of students in critical thinking, creative problem-solving and dialogue by addressing bookkeeping topics including color accounting .

3. Discuss the challenges that are associated with using an adversary technique to teach bookkeeping.

4. Discuss the teacher's perspectives regarding the use of an adversary technique to increase understanding of the color accounting concept.

5. Discuss the use of an adversary technique in facilitating the assimilation of knowledge, in regards to integrate ideas, internalize connections and refining content.

6. Do you think the use of an adversary technique has been successful in helping learners internalize connections and refine content?

9. Discuss teacher's attitude towards the application of an adversary technique in teaching bookkeeping.

10. Discuss other strategies you think teachers can use to enhance learner achievement in bookkeeping.

6.2 Appendix II: Classroom Observation Schedule

Background Information _____

Name of School_____

Name of teacher_____

Class_____

Date_____

Time_____

Number of learners: Girls_____ Boys_____ Total_____

Subject_____

Topic _____

Sub-Topic_____

Observation of Adversary Instructional Technique Utilization

NO.	SKILL	ACTIVITIES	INDICATORS	Score (1 to 5, 1-barely observed, 5 Mostly observed)
1	Controversial Learning	Arousing debate	Participation: Students actively engaging in the debate and expressing their own opinions.	
		Clarifying concept	Color recognition: Can easily identify with colors	
		Unpacking complexity	Critical thinking: Students making reasoned arguments, challenging existing beliefs and exploring different perspectives.	
2	Assimilating Cognition	Integrating ideas	Linking new approach which is specific color to corresponding bookkeeping element	
		Internalizing connections	Comprehension: Students demonstrating an understanding of the material and making connections between concepts.	
		Refining concepts	Clarity of meaning	
3	Declarative knowledge	Utilizing reasoning	Object incorporation of identified colors into actual bookkeeping elements	
		Conceptualizing assertions	proving claims to justify thoughts	
		Storing experience	future access, lasting impact, life impression and content retrieval	

6.3 Appendix III: Learner Questionnaire _KC/KZ/S…/…

Dear Respondent,

You have been identified as a respondent in this study and your contribution will be treated in confidence. My name is Onyogo Seline Awino pursuing Master of Education in Business Education at the University of Nairobi.This questionnaire is designed to establish the influence of adversary instructional technique on learner achievement in book keeping in public secondary schools in Komothai Zone, Kiambu County, to capture effective conceptualization of Book keeping concepts using colour accounting.The purpose of see the study is academic. You are humbly requested to participate in the study by filling in this questionnaire.Therefore, kindly respond to all questionnaire items as they apply to you, by ticking against the appropriate options or filling in the blank spaces provided. You need not to write your name.

SECTION A: Personal Information

1. Name of your school: …….
2. Age: ……....
4. Gender: ……..…….
5. Zone: ……...……
6. County: ……
7. On average, which of the following represent scores you obtained during term one in business studies?

(a) Below 30 % ( )

(b) Below 40 % ( )

(c) Below 50 % ( )

(d) Below 70 % ( )

(e) Above 70% ( )

8. How regularly do your teacher use color in teaching Business Studies?
   a) Once a week ( )
   b) Twice a week( )
   c) Never ( )

9. **Section B: Learner Perception of using Color in Book keeping**

Indicate whether you strongly agree (SA), Agree (A), Neither agree nor disagree (NA), Disagree (D) and Strongly Disagree (SD) with the following statements by ticking [√] against each statement. Use a scale of 1-4 where 1= SA, 2 = A, 3=U, 4=D, 5=SD.

	SD	D	NA	A	SA
1. I am familiar with color accounting and its use in bookkeeping					
2. I am comfortable with using color to solve bookkeeping equations					
3. Color accounting could help me with breaking parts of elements which constitute bookkeeping equation for ease of learning					
4. I do not think I would face any challenges with using color accounting to solve bookkeeping equations					
5. Color accounting has more advantages than traditional bookkeeping methods e.g lecture					
6. UsingColor in Book keeping easens learning for mastering accounting concepts.					
7. My teachers use variety of colours when teaching Book keeping equation.					
8. My knowledge of color accounting for bookkeeping is excellent					
9. Color accounting would be helpful during bookkeeping lesson in a class setting					
Controversial Learning					
1. Controversial learning can help to trigger interest in learning book keeping					
2. Color accounting can help to clarify concepts in learning bookkeeping					
3. Controversial learning can help to increase understanding of bookkeeping concept					
4. Controversial learning can be used to promote critical thinking in learning bookkeeping					
5. Controversial learning encourages pair discussion in learning bookkeeping					
6. Color accounting can help to explain complexities in learning bookkeeping					
Assimilating Cognition					

1. Assimilating cognition can help to integrate ideas and build connections					
2. Controversial learning can help to facilitate the assimilation of knowledge					
3. Assimilating cognition about color accounting can help to internalize connections that exist among bookkeeping elements					
4. Assimilating cognition about color accounting enhances content refinement in bookkeeping					
5. Assimilating cognition can help me to make sense of complex concepts					
6. Assimilating cognition can be used to promote active learning					
Declarative Knowledge					
1. Declarative knowledge can help me to reason and conceptualize assertions					
2. Declarative knowledge can help to utilize color accounting concept to comprehend bookkeeping					
3. Declarative knowledge can help to store experience in bookkeeping					
4. Declarative knowledge can help to develop critical thinking skills					
5. Declarative knowledge can be used to promote creative problem-solving					
6. Declarative knowledge can be used to foster collaboration among students					

10. Do you find color accounting difficult? If yes, please explain

……

……

11.What do you think should be done to make color accounting more exciting?

……

……

6.4 Appendix IV: Achievement Tests

Color Accounting and Bookkeeping

You have been identified to provide data on influence of adversary instructional technique on learner achievement in book keeping in public secondary schools in komothai zone, kiambu county. Your responses will be treated in strict confidence and used specifically for this study. Your input will be greatly appreciated. Thank you

Student Code ……..

Form …….

Date …….

Answer all Questions provided in this paper.

The following information was extracted from the books of Tabibu traders.

On 10th April 2022, Tabibu traders had the following balances:

Premises = 300,000

Motor vehicles = 450,000

KCB bank loan= 1,200,000

Capital = 600,000

Stock = 150,000

Creditors = 70,000

Cash = 100,000

Bank overdraft = 60,000

Debtors = 80,000

Land = 850,000

The following day, he sold stock valued at Ksh10,000 for Ksh9600.

Questions:

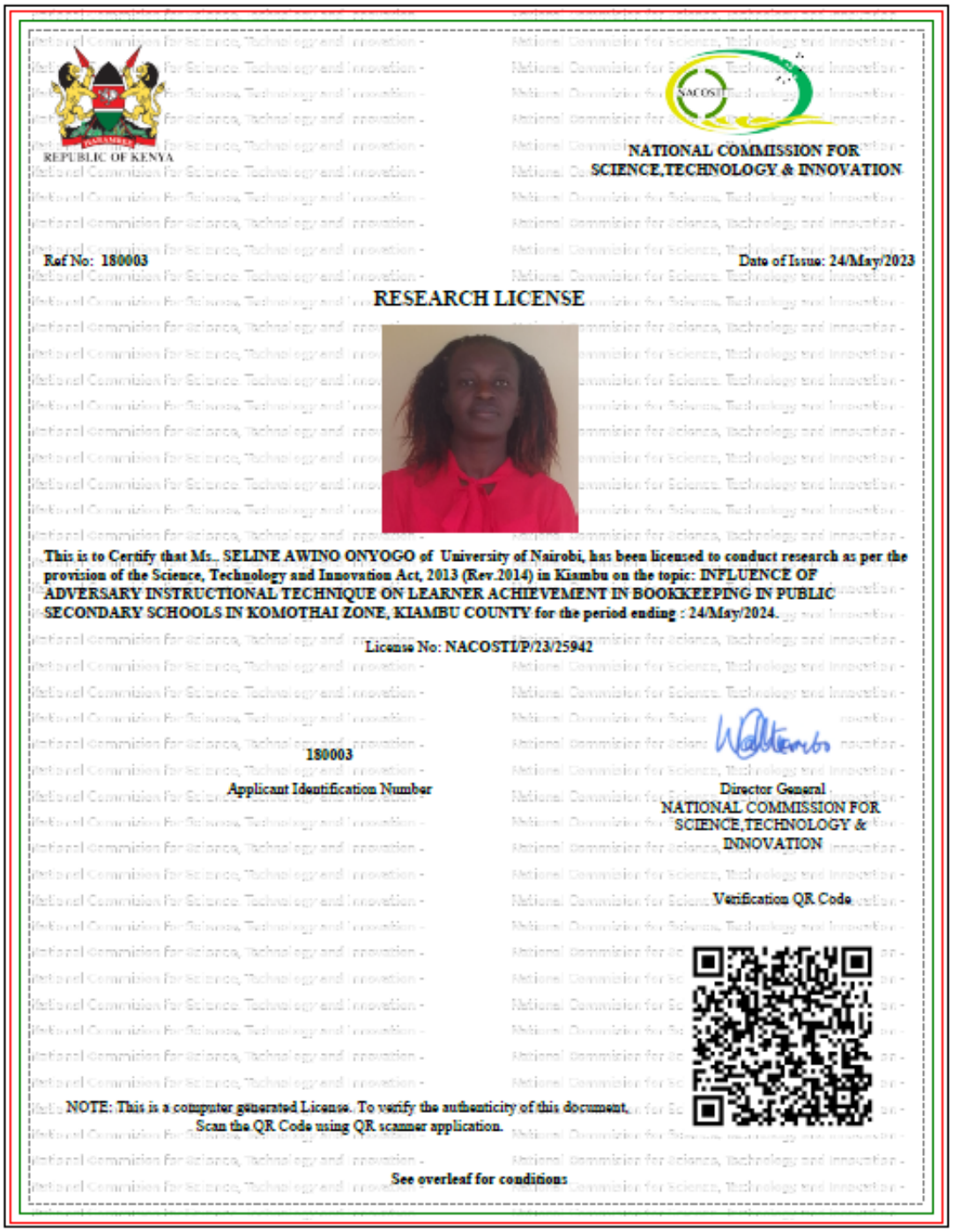
a. Use color coding concept to classify the elements listed above as **Assets**, **Capital** and **Liabilities**

……
……
……
……

b. Use the information above to draw Tabibu's book keeping equation (Assets = Liabilities + Capital) as at 11th April, 2022.

……
……
……
……

6.5 Appendix IV: NACOSTI Permit



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