ADOPTION OF THE ART WORLD DESIGN THINKING PROCESS TO ENHANCE TEACHER PEDAGOGICAL CREATIVITY IN PRE-PRIMARY SCHOOLS IN UGANDA

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DECLARATION

I, Katungi Juma, declare that this dissertation is my original work and has never been presented for a degree in any other University.

Signature: _____ Date: _____

APPROVAL

We as university supervisors confirm the work was done by the candidate under our supervision.

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DEDICATION

I dedicate this work to my children; Imran Katungi, Alim Katungi, Aara Katungi, Twaha Katungi and Usaamah Asiimwe, Special tribute to the Kyakabale Family especially my Mother Hafiswa Kyomugisha Kakuru (RIP) and to my fallen sister Nshemerirwe Zaituni may you rest in peace till we meet in the hereafter.

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To my sisters and brothers, I am always humbled and glad to have you in my life. Looking up to you gives me courage and hope. My supervisors, Associate Professor Godfrey Ejuu and Associate Professor, Rev, Dr. Grace Lubaale you have both been so inspiring and encouraging. Kristine Merete Bugge and Emad Al-Rozz, I am always indebted to the faith and trust you have had in me. Your support and encouragement kept me moving. My Colleagues in the 2017 PhD Class you are so amazing.

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ABBREVIATIONS AND ACRONYMS

AWDTP	Art World Design Thinking Process
CPD	Continuous Professional Development
ECCE	Early Childhood Care and Education
ECD	Early Childhood Education
GUREC	Gulu University Research Ethics Committee
KyU	Kyambogo University
MOES	Ministry of Education and Sports
NCDC	National Curriculum Development Centre
NCST	National Council for Science and Technology
TMC	Teacher Methodological Creativity
TMUC	Teacher Materials Utilization Creativity
TSUC	Teacher Spaces Utilization Creativity
UNICEF	United Nations Children's Fund

ABSTRACT

Creative teaching practices are essential for promoting holistic development in early childhood, with evidence suggesting that young children benefit significantly when educators adopt innovative and engaging approaches (OECD, 2021; Craft et al., 2014). Despite ongoing efforts in Early Childhood Teacher Education in Uganda, many trainee teachers still lack critical creative competencies in the use of learning materials, methodologies, and physical learning environments (MoES, 2018; Nakabugo et al., 2020). This study explored the impact of the *Art World Design Thinking Process (AWDTP)* on enhancing pedagogical creativity among early childhood education (ECE) pre-service teachers. Employing a quasi-experimental design within a *Concurrent Embedded Mixed Methods* framework (Creswell & Plano Clark, 2017), the research was conducted across two teacher training institutions, engaging 64 participants divided into control and experimental groups. The study was guided by four objectives: (1) to assess the relationship between AWDTP and creativity in material utilization; (2) to examine its impact on methodological creativity; (3) to evaluate the influence of AWDTP on spatial creativity in learning environments; and (4) to determine the overall contribution of AWDTP to pedagogical creativity. The intervention involved the integration of AWDTP into the experimental group's teacher training experience. Data collection tools included a structured teacher creativity observation checklist and a focus group interview guide. Quantitative data were analyzed using independent samples t-tests, while qualitative data were subjected to thematic analysis. Findings demonstrated that the AWDTP significantly enhanced participants' pedagogical creativity, aligning with contemporary theories of creative teaching and design-based pedagogy (Beghetto & Kaufman, 2014; Rauth et al., 2010). In conclusion, the Art World Design Thinking Process presents a promising approach for cultivating creativity among early childhood educators. The study contributes to global discourse on improving the quality of early childhood teaching and learning by embedding creative pedagogical frameworks into teacher preparation programs.

CHAPTER ONE

BACKGROUND TO THE STUDY

1.1 Introduction

This chapter presents the background to the study in which the researcher establishes and places the study problem in a historical, contextual and conceptual perspective. It further discusses the statement of the problem, the purpose of the study, objectives, research questions, scope and significance of the study.

1.2 Background

The philosophy of Early Childhood Education (ECE) is grounded in the belief that every child is a unique, capable, and active learner who develops through relationships, play, and exploration within a supportive environment. Rooted in constructivist theories such as those of Jean Piaget and Lev Vygotsky, ECE emphasizes that learning in the early years is most effective when it is child-centered, developmentally appropriate, and socially and culturally responsive (Piaget, 1951; Vygotsky, 1978). It prioritizes holistic development cognitive, physical, emotional, social, and moral over rote academic achievement, recognizing that foundational learning occurs through meaningful interactions and experiences (UNESCO, 2019). The philosophy also upholds the right of every child to a safe, nurturing, and inclusive environment where their identities are respected and their curiosity is cultivated (NAEYC, 2020). Importantly, it views educators not as mere transmitters of knowledge, but as facilitators and co-learners who support children in constructing their own understanding of the world (Copple & Bredekamp, 2009). This approach is vital for fostering

creativity, critical thinking, empathy, and lifelong learning skills from the earliest years of life

Creativity in early childhood education is a critical component of high-quality teaching and learning, particularly as it nurtures cognitive flexibility, emotional expression, and problem-solving from a young age. However, several systemic and contextual barriers continue to hinder early childhood educators from fully embracing creative pedagogical practices. One of the most pressing challenges is the presence of rigid and overly structured curricula mandated by national education systems. While curricular structure is necessary for ensuring consistency and accountability, excessively prescriptive frameworks restrict the autonomy of educators to tailor learning experiences based on children's developmental cues and interests. As a result, teachers often feel compelled to prioritize meeting predetermined learning outcomes over fostering creativity, exploration, and imaginative play as hallmarks of effective early childhood learning (Jeffrey & Craft, 2004).

In addition to curricular constraints, resource limitations present another significant barrier. Many early childhood education settings, particularly those in underserved or informal communities, suffer from a lack of age-appropriate, child-friendly materials such as toys, art supplies, and manipulatives. Furthermore, inadequate infrastructure including cramped, poorly ventilated classrooms or unsafe outdoor play spaces limits the ability of children to move freely and engage in multisensory, experiential learning. These environmental constraints not only diminish the quality of the child's learning experience but also impede the teacher's capacity to implement creative and responsive teaching strategies (Bamford, 2009).

Compounding these structural and material challenges is the low morale and professional disenfranchisement experienced by many early childhood educators. This sector often receives lower remuneration, limited opportunities for career progression, and insufficient recognition, leading to burnout and diminished intrinsic motivation. Such conditions discourage risk-taking and innovation in pedagogical practice. Moreover, the lack of targeted professional development opportunities focused on enhancing creative competencies such as storytelling, play-based learning, or arts integration means that many teachers are ill-equipped to foster creativity in their classrooms, even when they are willing to do so (Day & Gu, 2007).

Despite these challenges, several key enablers can significantly promote teacher creativity. A supportive school culture that values teacher autonomy is among the most critical factors. When educators are given the freedom to shape their own teaching strategies and innovate within their classrooms, they are more likely to engage in creative and responsive practices (Craft, 2005). Such environments encourage risk-taking and foster a shared vision for innovation and improvement.

Continuous professional development (CPD) also plays a pivotal role in fostering teacher creativity. Training programs that incorporate arts-based methods, design thinking, and experiential learning help educators build the skills and confidence necessary to explore creative approaches (Cremin & Chappell, 2019). When CPD is sustained and reflective, it supports the ongoing growth of creative competencies aligned with the needs of young learners.

Collaborative learning environments and professional learning communities also serve as powerful enablers of teacher creativity. Opportunities

for co-planning, idea exchange, and reflective dialogue with peers help teachers build a diverse repertoire of strategies and feel more supported in their innovation efforts (Vygotsky, 1978; Lieberman & Mace, 2010). These networks not only enhance pedagogical creativity but also reinforce a culture of collective learning and shared problem-solving.

The integration of the Art World Design Thinking Process (AWDTP) into early childhood teacher education and practice is also a critical enabler. AWDTP, which blends artistic exploration with structured design thinking principles, provides a dynamic framework for teachers to identify challenges, co-create solutions, prototype ideas, and reflect iteratively (Visscher-Voerman & Gustafson, 2004; Lin, 2008). By engaging in this cyclical process, early childhood educators can develop innovative learning materials, child-centered teaching methods, and flexible use of space—key dimensions of pedagogical creativity. The AWDTP fosters an experimental mindset and encourages teachers to view teaching as a creative act that evolves with the needs and interests of their learners.

Historically, the modern term creativity first used in the 1950's by JP Guilford in his paper creativity, he uses it to replace earlier terms like creative imagination (Engell, 1981; Guilford, 1950). Creativity has contributed to human adaptability and in-turn enhanced employability and economic prosperity of communities (Gauntlett, 2011; Florida, 2002).

The discussion on creativity in education was rooted in the professional development of teachers in the training process whose focus was on the teaching process and the activities involved (Kadirbaeva, 2010; Csikszentmihalyi & Wolfe, 2014). Later we see more details like description of features of

pedagogical creativity (KanKalik & Nikandrov, 1990). But like in many other disciplines, this has evolved to take several dimensions, which include creative activities, teaching and learning materials creativity, curricular creativity, and creativity of learning environments. (Shaheen, 2010)

Teacher Pedagogical Creativity is when teachers are able to poses characteristics of creative people like generating novel and valuable ideas (Boden, 2009). This has been proven to be an important element for children's intellectual, emotional, social and cognitive development (Kupers, 2019). Despite the well-documented impact of Teacher Pedagogical Creativity on learning outcomes and sustainable development, early childhood teacher training institutions have yet to prioritize this crucial element in their curricula (Selkrig, 2017; Ata-Akturk, 2023).

The teacher's ability to be reflective has been proven to positively impact children's reading and numeracy (Lucas, 2019). The SDG 4 Progress Report (2018) affirms that half of children and adolescents worldwide are not meeting minimum proficiency standards in reading and numeracy. Similarly, research by NAPE (2017) confirmed that more than 70% of lower primary school children are unable to master required curriculum concepts by primary three. To fill this gap Teacher Pedagogical Creativity is one of the essential elements that has the potential to boost children's creativity and enhance achievement in learning.

According to Ben-Horin & Boylan (2016), teachers who possess pedagogical creativity are responsive, flexible, and improvisatory. Such teachers are comfortable with ambiguity, think metaphorically and juxtapose seemingly incongruent and novel ideas in new and interesting ways. They acknowledge and use fluid and flexible identities (Abramo & Reynolds, 2015). The Art World

Design Thinking Process provides an opportunity to explore in improving Teacher Pedagogical Creativity.

Improving teacher pedagogical creativity involves focusing on activities that serve as a conduit for creative expression (Baghetto & Dilley, 2016). These activities should nurture the conditions that allow creativity to flourish, including personality traits like openness and flexibility (Uzakbaeva et al., 2013). Among these factors, the teacher's reflective attitude stands out as the most crucial, as it enables educators to critically assess and adapt their teaching methods, fostering an environment where pedagogical creativity can grow (Giglio, 2015). Teacher Pedagogical Creativity is coined out of two terms; teacher creativity, which is the teacher's ability to use imaginative approaches to make learning more interesting for children (Sternberg, 2001) and pedagogy which comes from the study of teaching methods (Shah, 2021). Teacher Pedagogical Creativity refers to the ability of the teacher to use exceptional imagination while using materials, methods and spaces. The teacher can identify and create new ideas for effective teaching, and managing existing and new pedagogical challenges.

There is a global hope and expectation that education has the potential to drive nations toward a brighter future, playing a key role in advancing development and progress (Acemoglu, 2012). To meet this high expectation, we have to re-think our approach to education. Creativity opens prospects to realise this hope (Martiniano, 2016). Focusing our efforts on using creative ideas, materials and activities in education will facilitate the process of realising a strong education for our children (Gregory, 2013 & Ismuratova, 2016).

Craft (2006) asserts that creativity has transitioned from being a peripheral concern to a central focus in contemporary education (Craft, 2006;

Shaheen, 2010). By embedding creativity into the educational framework, we can address quality teaching and foster the development of creative children who possess the competencies needed to navigate the uncertainties of an ever-evolving world (Parkhurst, 1999). This emphasis on creativity not only enhances the learning experience but also prepares students to meet the challenges of the future effectively.

The term "Design Thinking" was first introduced in the 1960s, particularly by design theorists such as Herbert A. Simon, who mentioned it in his book *"The Sciences of the Artificial"* (1969) (Simon, 1969). Simon described design as a way of thinking focused on problem-solving through creating solutions that meet human needs. However, the concept gained broader recognition and was formalized as a methodology in the late 1980s and 1990s through the work of design firms like IDEO (Brown, 2009). Tim Brown, CEO of IDEO, popularized the term in the early 2000s, emphasizing the use of design principles in non-design fields to encourage innovation, creativity, and user-centered approaches to solving complex problems (Brown, 2009). Since then, Design Thinking has evolved into a widely used process across various industries and sectors, helping organizations tackle challenges by focusing on empathy, ideation, prototyping, and iteration (Kelley & Kelley, 2013).

Conceptually, the Art World Design Thinking Process (AWDTP) serves as a conceptual and practical foundation for this study, integrating principles of design thinking into Early Childhood Education (ECE) pedagogy. Rooted in models like ADDIE - Analysis, Design, Development, Implementation, and Evaluation (Visscher-Voerman & Gustafson, 2004), AWDTP is adapted as a flexible, iterative tool for enhancing creativity in teacher education. This

approach enables pre-service teachers to critically analyze classroom challenges, design creative responses, and develop solutions that are contextually relevant. By grounding teacher preparation in design thinking, the study supports a shift from routine, prescriptive methods to more dynamic, learner-centered practices that reflect the needs and interests of young children.

In the study situated in Early Childhood Education settings, design thinking was sensitive to developmental appropriateness, and resource availability. This study tailors AWDTP specifically to the realities of early learning environments by adapting its stages—such as ideation, prototyping, and feedback—to focus on play-based learning, use of local materials, and inclusive classroom design. Teachers learn to design activities and resources through artistic exploration and reflective inquiry, making the design process itself a learning tool. This aligns with Syed-Ikhsan's (2004) assertion that design thinking processes must be context-specific to be effective. As such, AWDTP becomes not just a creative tool, but a pedagogical method that empowers teachers to co-create meaningful learning experiences with and for their learners.

The artistic lens of AWDTP is used to help teachers to explore creativity through material, method, and space. As part of the study, teachers engaged in workshops where they reimagine classroom spaces, repurpose materials into interactive learning tools, and develop flexible teaching strategies grounded in play and imagination. This aligns with Lin's (2008) view that creativity in education flourishes when teachers are given the freedom to innovate using open-ended, art-based processes. Through this experiential learning model, AWDTP promotes teacher agency, reflective thinking, and the confidence to try new approaches for fostering pedagogical creativity in early childhood settings.

A key element of AWDTP used in this study is its iterative nature. Teachers move through cycles of design, implementation, and reflection to refine their practice. This process is supported through peer collaboration, facilitator feedback, and child observations, reinforcing the idea that effective teaching is continuously evolving. The evaluation phase of the design cycle encourages data-informed reflection, allowing teachers to assess the impact of their innovations on children's learning and adjust accordingly. By embedding these reflective habits, the study not only nurtured creativity in the short term but also lays the foundation for sustained innovation in early childhood pedagogy (Visscher-Voerman & Gustafson, 2004).

Bonnardel (2017) suggests that the Art World Design Thinking Process incorporates both convergent and divergent thinking, which underpins its capacity to enhance creativity. Divergent thinking encourages the generation of a wide array of ideas, while convergent thinking focuses on refining and narrowing these ideas into practical solutions. This combination is central to fostering creativity in design. Additionally, Bonnardel (2016) demonstrates that this process has proven effective in industries focused on service and product design, where it significantly boosts innovation and problem-solving efficiency.

The Art World Design Thinking Process revolves around the cognitive process of the designer, blending iterative reflection and action (Brown, 2009; Cross, 2011). Confronted with an initial, often vague problem, the designer engages in cycles of experimentation and manipulation of multiple ideas. Through this exploration, the problem is redefined and adjusted as new insights emerge (Dorst, 2015). This continuous iteration ultimately leads to a suitable

solution, with each stage refining both the problem's understanding and the development of potential solutions (Martin, 2009).

Often the designer thinks in a variety of ways about a problem and this provides options that are likely to meet the client's expectations, as they are refined further in a collaborative way (Kimbell, 2011). In so doing, this process greatly emphasises problem analysis as a basis for decision-making through a series of measured steps. Such a process pertains closely to solving Teacher Pedagogical Creativity challenges in the classroom.

The Art World Design Thinking Process has been effectively applied to foster creativity across various disciplines. In neuroscience, it has helped understand creative cognition (Gabora, 2002; Vandervert et al., 2007), while in Science Education, it has promoted innovative learning approaches (Alashwal, 2020). The process has also found success in Social Science, where it enhances creative problem-solving (Sawyer, 2006), as well as in Technology, where it facilitates innovation (Treffinger & Isaksen, 2005). Additionally, it has been implemented in Early Childhood Education, supporting the development of creative skills in young learners (Bodrova & Leong, 2001).

The Art World Design Thinking Process offers numerous opportunities for enhancing early childhood teacher pedagogical creativity by equipping educators with mindsets to challenge traditional approaches and assumptions that have long shaped how we understand teaching young children (Henriksen et al., 2016). This process promotes an open, iterative way of thinking, allowing teachers to step outside conventional methods and explore new, innovative strategies in the classroom (Scheer et al., 2012). By fostering a mindset of curiosity and experimentation, the Art World Design Thinking approach

empowers educators to reimagine how they engage with children, incorporate different learning styles, and create more dynamic, personalized learning experiences (Razzouk & Shute, 2012). It encourages educators to view challenges as opportunities for creative problem-solving and to continuously refine their teaching practices. Ultimately, this process helps cultivate a more flexible, responsive, and imaginative approach to early childhood education, supporting the development of both teachers and children in meaningful ways (Brown, 2009).

In this study, the Art World Design Thinking Process was used as a metaphoric model to enhance Teacher Pedagogical Creativity. It examined the relationship between the art world design thinking process and indicators of teacher pedagogical creativity that included, Teacher Material Utilization Creativity, Teacher Methodological Creativity and Teacher Spaces Utilization Creativity in early childhood education and care. The art world design thinking process was assumed to induce creativity in the early years of teaching and learning with a focus on developing, creating and stimulating teacher pedagogical creativity skills. It was used to offer a mental framework for pedagogical creativity that can be precisely examined, effectively applied and accurately tested as illustrated hereunder:

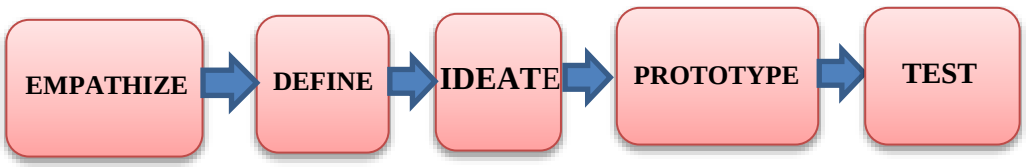

Figure 1. 1

The Art World Design Thinking Process Model

Source: d.school (2019) from Stanford University (adapted)

Figure 1 is the design thinking process model's five levels.

Empathizing is the first stage of the Design Thinking process. The stage helps a designer to gain deeper understanding of general issues from user perspectives without allowing their own assumptions to block their thinking, with the aim of building a user-friendly product in a given context (Baeck & Gremett, 2012). It is basically research into the challenges, advantages, assets, threats and opportunities at hand from the point of view of the user.

Defining is the second stage in the process. It is where a designer compiles all the information collected in the first stage and makes meaning of it before coming up with a concrete issue that the people, they interacted with may have been trying to drive at (Nairman, 2019). At this stage the designer develops a point of view on the specific challenge to address or opportunity to take.

Ideate is the third stage in the design thinking process. In this stage, the designer uses the conclusions arrived at in the defining stage to get tentative solutions to the problem. Thinking big and wide is critical to help build up ideas (Baeck & Gremett, 2012). Thus, thinking here will not necessarily follow the usual patterns as a lot of thinking outside the box is encouraged.

The fourth stage is the prototype stage. In this stage, the different solutions are tried or experimented to see how best they answer the identified problem (Waloszek, 2012). It has a lot of building and breaking to find what fits as desired.

The last stage is the test. It is a stage that allows the designer to try out the best option developed to solve the problem in different contexts that may be available (Waloszek, 2012). During the test, further modification can be made to make things better.

Contextually, the study is placed on early child teacher education in Uganda. Early childhood teacher education is the training attained by teachers who teach in the pre-primary or early childhood centres or schools. This is a crucial stage that lays a bedrock for the quality of learning outcomes for young children. This level of education is still faced with challenges associated with limited learning resources and the quality of teacher training (UNICEF, 2019)

The challenges in the quality of teacher training are often linked to the traditional approaches employed by teacher training institutions, which tend to limit opportunities for fostering creativity and innovation in teaching practices (Darling-Hammond, 2010). In response to these concerns, this study focused on the in-service Early Childhood Diploma in Teacher Education program offered by Kyambogo University, using it as a case study to explore how the program addresses or potentially perpetuates these challenges. By examining the curriculum and pedagogical methods, the study aimed to assess whether the training provided encourages creative teaching approaches, which are essential for improving early childhood education outcomes (Robinson, 2011)

University programs frequently adopt structured curriculum models characterized by traditional teaching methodologies, including lecturing, note-taking, and distributing handouts (Bergmann & Sams, 2012). In this context, instructors often emphasize content-heavy lectures, followed by the provision of summarized handouts that highlight key points for teacher trainees. This approach primarily aims to prepare students for semester examinations, where success is measured by content recall rather than critical thinking or creativity. As a result, teacher trainees may focus predominantly on memorizing theoretical concepts to achieve high scores in these exams, rather than developing practical

skills or innovative teaching strategies (Darling-Hammond, 2006; Hattie, 2009). Consequently, this examination-driven model can restrict the opportunity to cultivate deeper learning and creativity in teacher education, ultimately hindering the development of effective teaching practices that meet the diverse needs of learners in today's classrooms (Niemann, 2018; Zhao, 2012).

This kind of approach hardly engages teacher trainees in creative activities that deliberately target to stimulate their pedagogical creativity. This, in turn, produces teachers who lack the necessary creativity to create engaging and stimulating learning environments for the children. The reproductive model of training ends up being a barrier to developing creativity due to its focus on knowledge acquisition. Other scholars emphasise that under this model, teachers are trained to memorise for standardized tests which limits their sense of creativity (Miller, 2015; Scoff-ham, 2003; Vandeleur et al, 2001). Consequently, this inability to practice creativity in the process of training trickles down to early childhood classes where teachers fail to use creativity in their pedagogical practice.

Conducting research on teacher creativity in early childhood education is essential due to the profound impact that pedagogical creativity has on children's learning outcomes. Research indicates that creative teaching strategies can significantly enhance children's engagement and motivation, leading to improved academic performance (Craft, 2006; Beghetto & Kaufman, 2014). Furthermore, early childhood is a critical period for cognitive and emotional development, where teachers play a pivotal role in shaping a child's ability to think creatively and solve problems (Vygotsky, 1978). Thus, investigating the

factors that foster or hinder teacher creativity can provide valuable insights for enhancing educational practices in this foundational stage.

Understanding teacher creativity in early childhood education is crucial for developing a curriculum that supports innovative teaching methods. As education continues to evolve, there is an increasing demand for teaching approaches that prepare children for a rapidly changing world (Shaheen, 2010). By prioritizing creativity in teacher training and professional development, educational institutions can equip educators with the skills needed to cultivate creativity in their students, promoting a more dynamic learning environment (Parker & Lejeune, 2019). Research in this area can inform policy decisions and lead to the development of resources and frameworks that empower teachers to integrate creative practices into their classrooms effectively.

Investigating teacher creativity can also shed light on the personal and professional factors that influence educators' creative capacities. Factors such as teacher beliefs, experiences, and classroom environments significantly impact their willingness and ability to engage in creative practices (Fisher, 2004; Craft et al., 2014). By exploring these aspects, researchers can identify barriers to creative teaching and recommend strategies for overcoming them, ultimately contributing to a more enriching educational experience for both teachers and students. The findings from such research can inform targeted interventions and support systems aimed at enhancing teacher creativity, which is vital for fostering the next generation of innovative thinkers.

Early childhood education plays a foundational role in shaping children's cognitive, emotional, and social development. To effectively nurture these domains, teachers must adopt creative pedagogical approaches that foster

curiosity, imagination, and active engagement (Craft et al., 2014). However, many teacher education programs, especially in low-resource settings, often emphasize rote learning and standardized methods, which do not encourage creative thinking (Nakabugo et al., 2020). As a result, pre-service teachers may struggle to design stimulating learning experiences that promote holistic development. The Art World Design Thinking Process (AWDTP) offers a structured, experiential approach that helps educators embrace innovation, artistic expression, and problem-solving all of which are crucial for fostering creativity in young learners.

Design thinking is a human-centered, iterative process used to solve complex problems creatively. It promotes empathy, ideation, prototyping, and testing skills that align well with the needs of early childhood education (Rauth et al., 2010; Brown, 2009). AWDTP applies these principles within an artistic framework, encouraging teachers to explore learning challenges through the lens of visual arts, storytelling, and improvisation. This process helps educators move beyond traditional didactic methods, equipping them with the ability to co-create materials and experiences that reflect children’s interests, cultural contexts, and developmental needs (Henriksen et al., 2018). When applied in teacher training, AWDTP empowers educators to reimagine their role not just as instructors, but as facilitators of playful, exploratory learning environments.

A core strength of AWDTP lies in its ability to enhance creativity across three pedagogical dimensions: material use, teaching methods, and learning space design. Teachers trained in AWDTP learn to repurpose locally available materials into interactive learning tools, develop flexible teaching strategies that adapt to children's needs, and creatively reorganize physical spaces to promote

movement, collaboration, and sensory engagement (Beghetto & Kaufman, 2014). This is particularly valuable in under-resourced ECE settings, where access to commercial educational materials may be limited. Studies show that creative spatial and material arrangements in classrooms significantly impact children's engagement and learning outcomes (OECD, 2021)

Emerging evidence suggests that integrating artistic design thinking processes into teacher education improves both teacher confidence and classroom innovation (Sawyer, 2011). AWDTP's participatory, reflective nature makes it especially suitable for diverse cultural contexts, where localized knowledge and community values play a vital role in education. By engaging teachers in a creative, iterative process, AWDTP promotes self-efficacy and encourages culturally responsive pedagogy. This not only enriches children's learning experiences but also aligns with broader goals of inclusive, high-quality early childhood education as advocated by UNESCO (2022). Ultimately, AWDTP serves as a transformative tool that nurtures creative capacities in educators, laying a strong foundation for lifelong learning in both teachers and children.

1.3 Statement of the Problem

Teachers who possess pedagogical creativity demonstrate a high level of cognitive flexibility they are quick thinkers, adaptive in their approaches, accurate in delivery, and possess a vivid imagination (Ehsonova, 2016). These qualities enable them to effectively utilize available materials, teaching methods, and learning spaces in ways that enhance engagement and support meaningful learning experiences. Pedagogically creative teachers are also reflective

practitioners, constantly evaluating and refining their methods to enrich learning experiences (Lucas, 2019).

However, despite the well-documented benefits of creative teaching, many early childhood educators still lack these crucial attributes. This often leads to rigid, teacher-centered instruction where the emphasis is placed on content delivery and rote memorization, rather than nurturing creativity and problem-solving skills in learners (Vandeleur, 2001; Craft, 2006). As a result, children are often denied opportunities to explore, imagine, and think critically which key competencies in early development are. The absence of imaginative play, storytelling, and child-led exploration in the classroom reflects a deficit in the creative engagement needed for holistic child development (Burnard, 2012; Ritchhart, 2002; Mullen & Machi, 2014).

One of the root causes of this creativity gap lies in teacher training programs that do not adequately emphasize the development of pedagogical creativity (Ata-Akturk, 2023). These programs often focus on theoretical knowledge and standardized teaching techniques, with limited opportunities for experiential learning, reflection, or risk-taking. As Selkrig (2017) emphasizes, it is not sufficient to instruct teachers to support children's creativity; their own creative capacities must also be nurtured and developed. The long-term success of early childhood education programs is thus contingent upon the ability of teacher training institutions to embed creativity as a core pedagogical value (Nolan, 2024).

In response to this critical need, the current study sought to foster creativity within teacher education by contextualizing and applying the Art World Design Thinking Process. This innovative framework was employed to

enhance pedagogical creativity among early childhood education trainees at Kyambogo University as aligned with the Education Agenda 2030, teacher education programs must be comprehensive, equipping ECD educators with the knowledge, skills, and attitudes needed to support diverse learners. Continuous professional development is essential to keep teachers abreast of emerging research, innovations, and practices in early childhood education (UNESCO, 2015; OECD, 2020). The research addresses a significant gap in teacher education and contributes to the development of more dynamic, learner-centered teaching practices.

1.4 Purpose of the Study

The purpose of this study was to examine the impact of the Art World Design Thinking Process on enhancing Teacher pedagogical creativity among early childhood teacher trainees, with the goal of fostering innovative teaching practices within early childhood teacher education.

1.5 Objectives of the Study

1.5.1 To assess the impact of the Art World Design Thinking Process on Teachers' Creativity in Material Utilization.

1.5.2 To determine the effect of the Art World Design Thinking Process on Teachers' Methodological Creativity.

1.5.3 To evaluate the effect of the Art World Design Thinking Process on Teachers' Creativity in Spaces Utilization.

1.5.4 To describe the extent to which the Art World Design Thinking Process contributes to teachers' creativity in material utilization, methodology, and space utilization.

1.6.0 Research Hypotheses

To achieve the objectives, the study was guided by the following hypotheses;

1.6.0.1 Ha: There is a significant effect of the Art World Design Thinking Process on Teacher Material Utilization Creativity.

1.6.0.2 Ha: There is a significant effect of the Art World Design Thinking Process on Teacher Methodological Creativity.

1.6.0.3 Ha: There is a significant effect of the Art World Design Thinking Process on Teacher Spaces Utilization Creativity?

1.6.1 Research Question

1.6.1.1 What is the contribution of the Art World Design Thinking Process to; Teacher Material Utilization Creativity, Methodological Creativity and Spaces Utilization Creativity?

1.7 Scope of the Study

1.7.1 Geographical Scope

The study was conducted at two affiliated colleges under the Department of Early Childhood Education at Kyambogo University in Uganda. The first institution, referred to as College A, is located in Yumbe District in the northwestern region of the country and served as the control group site. The second institution, referred to as College B, is situated in Kabale District in the southwestern region and was designated for the experimental group. These colleges were purposefully selected based on their historical significance and relevance to the study. Both are among the oldest institutions offering the Diploma in Early Childhood Education, which indicates a long-standing commitment to teacher preparation and a rich institutional memory. Their established structures, experienced faculty, and diverse student populations

provided a reliable foundation for implementing and assessing the intervention. Furthermore, the geographical spread of the two colleges allowed the study to account for regional variation, increasing the contextual robustness and potential generalizability of the findings across different educational settings in Uganda.

This study is situated within the context of early childhood teacher education in Uganda, focusing on the professional preparation of educators who work in pre-primary or early learning centers. Early childhood education is recognized as a critical phase in a child's development, laying the foundation for future academic achievement and holistic growth. However, in Uganda, this sector faces persistent challenges, including limited access to teaching and learning resources, inconsistencies in curriculum implementation, and gaps in the quality of teacher training programs (UNICEF, 2019).

To ensure the relevance and generalizability of the study findings, it is essential to account for the diverse contextual settings in which early childhood education is delivered. Uganda comprises urban, semi-urban, and rural environments, each presenting unique conditions that influence the training, deployment, and effectiveness of early childhood educators. Urban areas may benefit from proximity to teacher training institutions and relatively better infrastructure, while semi-urban and rural regions often grapple with resource scarcity and limited professional development opportunities. By acknowledging and integrating these contextual differences, the study adopts a context-sensitive approach in the way the Art World Design Thinking Process is adapted, which enhances the applicability of its findings to various educational settings across the country. This approach aligns with the need for evidence-based policy and

practice that addresses both national and localized challenges in early childhood education.

1.7.2 Content Scope

The content scope of this study focused specifically on the key variables: The Art World Design Thinking Process as the independent variable, characterized by five indicators: empathy, ideation, making, prototyping, and testing. The dependent variable, Teacher Pedagogical Creativity, was examined through three indicators: Teacher Material Utilization Creativity, Teacher Methodological Creativity, and Teacher Spaces Utilization Creativity. By narrowing the focus to these specific elements, the study aimed to provide a clear understanding of the relationship between the design thinking process and its impact on teacher creativity in early childhood education.

1.7.3 Time Scope

The time scope for this study spanned from 2017 to 2023 and included several key phases. It began with a comprehensive review of the literature to identify existing knowledge gaps (Mertens, 2015). This was followed by the phases of data collection, data analysis, and interpretation of findings (Trochim, 2006). The final phase involved compiling and reporting the results. However, the study presents data that was collected in 2020 due to two main factors: first, the widespread disruption of educational institutions caused by the COVID-19 pandemic (UNESCO, 2021) and delays in the publication post covid process.

1.8 Significance of the Study

This study holds significant value for a wide range of stakeholders involved in early childhood education and teacher preparation. The findings underscore the urgent need for reforms in early childhood teacher education

programs, particularly in enhancing the use of creative approaches and resource-based learning. These insights are especially relevant for higher education institutions and colleges of education, such as Kyambogo University, which are directly responsible for pre-service teacher training. Such institutions can use the evidence generated by this study to revise and enrich their curricula to foster teacher pedagogical creativity more effectively.

The Ministry of Education and Sports (MoES) stands to benefit from this study by utilizing its findings to inform national strategies on teacher training and professional development. This includes policy-level decisions aimed at strengthening creativity and innovation within early childhood care and education (ECCE) frameworks.

Additionally, the National Curriculum Development Centre (NCDC) can draw on the study's classroom-based evidence to support the review and development of the ECCE curriculum, as well as the creation of teacher guides and learning materials that align with creative pedagogical practices.

School administrators and ECD center managers will also find the results useful, particularly in addressing the gaps in continuous professional development (CPD)**.** The Art World Design Thinking Process model, explored in this study, provides a practical and replicable tool for training teachers in creative use of materials, methodologies, and learning spaces core areas critical to effective early learning environments.

Non-governmental organizations (NGOs) and development partners involved in early childhood education programming can adapt the findings in their capacity-building efforts and teacher support initiatives across Uganda and the region.

Finally, the study contributes to the broader academic discourse on teacher pedagogical creativity, adding to the existing body of scholarship in Uganda, regionally across Sub-Saharan Africa, and globally. It offers a conceptual and empirical foundation for future research and experimentation in creative pedagogies and early childhood teacher education.

1.9 Limitation and Delimitation

1.9.1 Limitations

The empirical results reported herein should be considered in the light of some limitations;

This study faced the limitation of an insufficient sample size for reliable statistical measurement. In quantitative research, the validity of statistical results is generally supported by large datasets, which enable generalization to the wider population (Creswell & Creswell, 2017). However, this study, which adopted a mixed-methods approach with a quantitative design as the primary focus, utilized a relatively small sample size, reducing the potential to generalize its findings (Johnson & Onwuegbuzie, 2004). This limitation was influenced by the study design, which required two groups—a control group and an experimental group—further constraining the sample size available for analysis. This was justified by the fact that the group was homogenous which reduced variability and made findings more reliable (Cohen, 1988).

The study also faced the limitations of limited previous studies in a similar context. Most of the available literature was from studies conducted in the developed world and this could not sufficiently inform the local context. However, the researcher, used a mixed-methods approaches to compensate for the lack of context-specific research to gather new data and generate original

insights (Creswell & Creswell, 2017) and also relied on models from similar but not identical contexts, by adapting them to the local environment (Maxwell, 2013).

The limitation of timings due to the COVID-19 pandemic. The study which was scheduled for three years has been extended to more time and this could have time factors overriding the findings of this study.

1.9.2 Delimitations

In this study in early childhood education, the following delimitations were used.

The study focused on in-service early childhood teacher educators. Irrespective of their age differences, they were all taking a training to become ECCE teachers at a diploma level. This was to ensure that the findings are relevant to the targeted age group (Creswell & Creswell, 2017).

The other delimitation factor that the study considered was the type of education settings in which the study was conducted. This was conducted in public institutions that were using a similar curriculum in the course of training the teachers. (Montessori, Reggio Emilia, etc.). This delimitation was to ensure that there are no significant variations in the particular teaching methods, and resources used by the program (Mertens, 2015).

The limitation of a small sample size, the study intentionally focused on a homogeneous group of early childhood education teacher trainees, drawn from two comparable teacher training institutions. This homogeneity reduced participant variability, thereby enhancing the internal consistency of the findings despite the limited size (Cohen, 1988). The quasi-experimental design with control and experimental groups was purposefully selected to allow for

comparative analysis and to strengthen the reliability of the observed outcomes within the specific context of teacher education.

Regarding the limitation of scarce literature in similar local contexts, the study was deliberately designed to contribute original knowledge to an under-researched area. While international literature offered foundational insights, the researcher contextualized models and frameworks through localized adaptation and iterative engagement with participants. This approach ensured cultural and contextual relevance while also aiming to fill a critical gap in regional early childhood education research (Maxwell, 2013).

In response to the timing disruptions caused by the COVID-19 pandemic, the study employed a flexible data collection timeline and modified certain research activities, such as using smaller group sessions and virtual check-ins where necessary. While the timeline extension may have influenced some dynamics, this adaptability ensured the safety of participants and preserved the integrity of the data. Moreover, this adjustment aligns with emerging best practices in conducting educational research under public health constraints.

1.10 Theoretical and Conceptual Framework

1.10.1 Theoretical Framework

The study was guided by Thorndike and Woodworth's theory of identical elements (Thorndike, 1906; Woodworth, 1938) which states that the transfer of learning between tasks occurs when the two tasks share common or "identical" elements. In other words, if two situations involve similar stimuli or responses, learning in one context will likely transfer to the other. Which implies that previously acquired features or elements like skills, values, attitudes, experiences

and knowledge systems can be applied to a new situation that has related features or elements.

Despite being over a century old, the theory remains pertinent in guiding the design of instructional strategies that foster meaningful learning connections. Its principles have been adapted and extended by contemporary scholars and still influence curriculum design, especially in areas like problem-solving, critical thinking, and creativity (Thorndike & Woodworth, 1901; Schunk, 2012). Therefore, referencing these early theorists provides a strong theoretical foundation and demonstrates continuity in the evolution of educational thought.

The theory was suitable for this study because the study sought to transfer features in the thought process used by the art world design thinking process creativity to be used in the thought process for developing teacher pedagogical creativity in early childhood teacher education.

Teacher pedagogical creativity like the art world design thinking process creativity is a cognitive process. The mind plays a central role in both situations in a way that success depends on the ability of the mind to process and deal with information in a given way (Marchetti, 2018). This similarity supports the argument that the theory of identical elements is suitable for framing this study.

In addition to cognitive abilities, several key features are shared between the Art World Design Thinking Process and Teacher Pedagogical Creativity. These features include reflective capacity, a rich imagination, logical and adaptive thinking, research-driven approaches, and the ability to analyze situations. Both processes rely on the mind's capacity to adapt and transfer knowledge. This adaptability mirrors the process of learning transfer, where

previous knowledge is applied to new situations through creative and critical thinking (Royer, 2009; Bayles, 1903).

On the premise that previously, acquired knowledge and skills can be transferred and be used in new situations, this theory is valid for a study that seeks to transfer assumptions of a creativity model used in the Art World Design Thinking Process to teacher pedagogy creativity in early childhood teacher education.

1.10.2 Conceptual Framework

In this section, the researcher presents a diagrammatical illustration of the conceptual framework. The illustration shows the relationship between the independent variable -the Art World Design Thinking Process and the dependent Variable-Teacher Pedagogical Creativity.

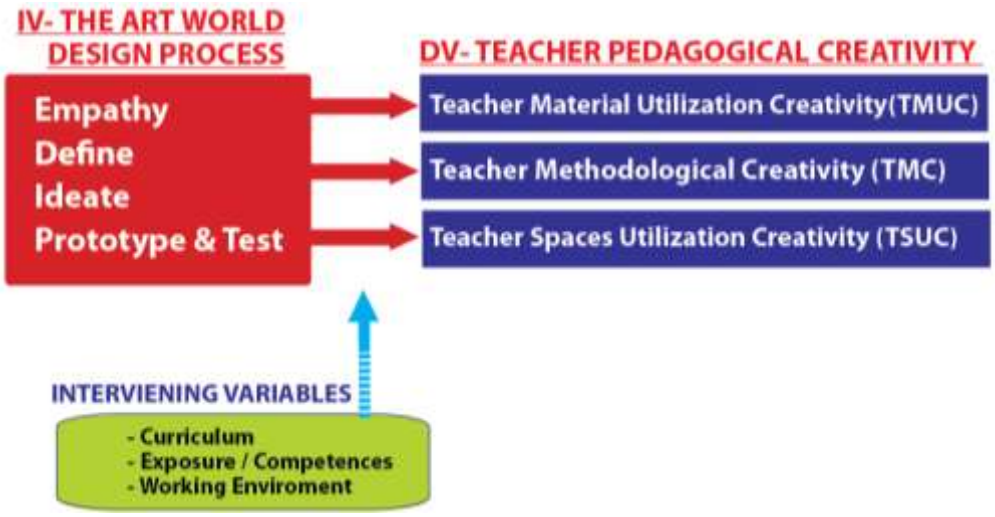

Figure 1. 2

The Conceptual Framework of the Study.

Source: Researcher, 2019; d.school, 2019, Jager, 2008 and Learning Framework, 2007

The independent variable is the Art World Design Thinking process which is made up of five stage process that is; empathy, define, ideate, prototype

and test and the dependent variable which is teacher pedagogical creativity had three indicators that is Teacher Material Utilization creativity (TMUC), Teacher Methodological creativity (TMC) and Teacher Spaces Utilization Creativity (TSUC).

1.10.3 Operational Definition of Terms;

The Art World Design Thinking Process; Design thinking is a non-linear, iterative process that teams use to understand users, challenge assumptions, redefine problems and create innovative solutions to prototype and test. It is most useful to tackle ill-defined or unknown problems and involves five phases: Empathize, Define, Ideate, Prototype and Test (IxDF, 2016). It is used in this study as an adapted model from the design world to teacher education as a set of structured steps that supports the thought process behind creative practices in teaching. This process is made up 5 stages defined below;

Empathy: This phase involves deeply understanding the needs, feelings, and experiences of the people for whom the solution is being designed. By observing, engaging, and immersing oneself in the users' world, designers gather insights into their challenges and motivations, allowing for human-centered solutions (Brown, 2009).

Define: After gathering insights during the Empathy stage, the Define phase focuses on synthesizing this information to create a clear problem statement. This step involves organizing the findings to define the core problem that the design will address, ensuring that the project remains focused on solving the right issue (Plattner, 2010).

Ideate: Ideation is the brainstorming phase where designers generate a broad range of creative ideas to solve the problem defined earlier. This process

encourages out-of-the-box thinking, leveraging techniques like brainstorming, mind mapping, or role-playing to explore as many potential solutions as possible (Kelley & Littman, 2005).

Prototype: During the Prototype stage, selected ideas are transformed into tangible models or representations, which could be sketches, physical models, or digital simulations. This step allows designers to test and refine their ideas by building something concrete that can be evaluated and improved upon (Cross, 2011).

Make (Test): The final step involves testing the prototypes with users to gather feedback and refine the solution. The focus here is on understanding how the prototype works in real-world scenarios and identifying areas for improvement. Iteration is key at this stage, as testing often leads back to refining the design and creating new prototypes (Kelley, 2001).

Teacher Pedagogical Creativity: Teacher Pedagogical Creativity refers to a teacher's ability to imaginatively and flexibly design, adapt, and implement instructional strategies that foster meaningful and engaging learning experiences. In the context of early childhood education (ECE), this concept is especially crucial, as it aligns with the developmental needs of young learners who thrive through exploration, play, and sensory engagement.

At its core, pedagogical creativity involves the use of innovative teaching methods, the creative design of learning materials, and the ability to transform everyday classroom environments into stimulating and inclusive learning spaces. It enables educators to move beyond routine instruction to respond dynamically to children's interests, cultural backgrounds, and developmental stages (Craft, 2005). For instance, a creative early childhood teacher might turn a simple

storybook into a full-day learning experience involving role play, art, movement, and music.

Pedagogical creativity also encompasses problem-solving and adaptive thinking skills teachers employ to meet challenges such as limited resources, diverse learner needs, or policy constraints. It encourages experimentation and risk-taking within the teaching process, often drawing from interdisciplinary approaches like the arts, storytelling, and design thinking (Cremin & Chappell, 2019). This creativity is not just innate but can be nurtured through professional development, reflection, and collaborative practice.

Furthermore, teacher pedagogical creativity supports child-centered learning by encouraging teachers to co-create knowledge with learners, rather than delivering it top-down. It promotes a playful pedagogy where curiosity, autonomy, and imagination are valued as central to early learning (Jeffrey & Craft, 2004).

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter presents an analysis of the available scholarly knowledge and trends on the current study. Particularly, the analysis is structured into subtitles aligned to the study objectives; the Art World Design Thinking Process and Teacher Material Utilization Creativity, the Art World Design Thinking Process and Teacher Methodological Creativity and finally the Art World Design Thinking Process and Teacher Spaces Utilization Creativity. The focus of the discussion in the literature hinges on the purpose of this study as a way to address the problem identified. This analysis reveals the knowledge gaps and focuses on the study direction

2.1 The Art World Design Thinking Process and Teacher Material Utilization Creativity.

Children crave teachers who pay personalised attention to the details of their needs. Well as these needs range from emotional, social and physical needs, for a classroom experience material utilization is a central advantage point from which to cater for most of these needs. This means that the way a teacher approaches the use of materials can harness the child's needs or frustrate them. The way a teacher uses materials should be able to meet the child's needs (Harris, 2011; Stinnett, 2018; Toros, 2013). For a teacher to effectively use materials to meet the child's needs there is a need for harmony between the skills, activities and attitudes. To address this, we can anchor ourselves on established and tested frameworks that give guidance on improving creativity (Bulte, Westbroek, De Jong & Pilot, 2006). The Art World Design Thinking Process is one of such

frameworks that provide participatory ways, which can improve teacher materials utilization creativity (Dominiguez, 2012). The art world design thinking process uses an iterative process that orients, models and engages. All the phases have an inbuilt reflection process, which gives the participant a chance to learn and be able to use it.

The language in which materials are is the conveyor for the ideas and concepts (Garvin, 1964) which makes it of central importance in improving the quality of learning outcomes (Pageni, 2017). The aspect of language plays a critical role in developing concepts in our early years. It is therefore important that while developing materials for children attention is paid to children's language. This improves relevance and ease in the use of the materials. Like in The Art World Design Thinking Process, research helps the developer to understand the real experiences of the user which helps in producing user-friendly products or services. In a similar fold, developing Teacher Material Utilization Creativity requires research into understanding children's experiences. Understanding user experiences is very vital but in early childhood education where reading is so basic language may not be a priority user experience to put focus on.

When Teacher educators embrace transformative cultures it improves the creativity of their trainees (Caaleja, 2018). This approach ensures there is a mutual collaboration between the trainer and the trainee to foster better development of skills. The mutual collaboration gives the young teacher a chance for mentorship through observations and teamwork. Similarly, mutual respect is an essential element in developing Teacher Material Utilization Creativity. The process of engaging with the Art World Design Thinking Process requires a

collaborative approach. This enables the expert in the use of this process to model for the novice.

All children are not necessarily auditory learners and therefore, there is a need to provide materials that allow children to find what suits their interests (Marzano, 2001; Dian, 2010). To meet this unique requirement, the Art World Design Thinking Process provides an opportunity in the ideate phase. In this part of the process, the designer is compelled to propose as many ideas as possible as a way of creating a chance to meet several needs. In a similar fold, Teacher Material Utilization Creativity needs to offer children a variety of materials to meet their unique interests.

The availability of engaging materials enhances the interaction between the teachers and the children. Teachers should, therefore, carefully select materials with specific study points that match with activities. This creates personal points of connection to enhance teacher-learner interaction (Grainger,2004; Phan, 2020; Saragih, 2017). The Art World Design Thinking Process uses "how might we questions" in the define phase to generate possible ideas for a challenge. This offers insights into Teacher Materials Utilization Creativity by way of creating possibilities for the teacher to carefully explore the materials and activities to draw on fresh perspectives. This has the potential to breed materials and activities that are more engaging.

Material modifications enable the teacher to re-imagine materials to match context, learner interests and selected methods (Sendur, 2018). It also gives the materials instructiveness abilities according to Gjalt (2018). A teacher with the potential to re-imagine materials through modifications has limitless possibilities. The Art World Design Thinking Process through its ideate phase

one is capable of developing new ideas through challenging commonly held beliefs, encouraging curiosity and exercising free thought. The possibility to modify materials to make new meanings and new ideas gives this study on Teacher Materials Utilization Creativity a lot of hope.

The environment of the child plays a pivotal role in constructing meanings of their immediate surrounding. Using such objects that are common in the eyes of the child to develop new concepts comes with a lot of value for the child. These materials are usually readily available, and free and offer limitless material possibilities (Gago, 2020; Kapur, 2018; Smith, 2011). The Art World Design Thinking Process is interested in the experiences of the client as a starting point for creating a practical solution. Given this context of developing Teacher Material Utilization Creativity, this process would be handy in trying to explore and understand children's environments and the objects therein as potential material sources.

Most teachers still confirm to structured lessons in which the principle is adherence to strict rules (OECD, 2012). The challenge is that teachers follow the learning framework in an orthodox manner without any deviations (Tyler, 2010) yet it is simply a guide. This challenge gives this study a gap to fill. The Art World Design Thinking Process has the potential to offer insights for teachers in developing Teacher Materials Utilization Creativity. Using the how might we questions can lead to several solutions. If well adapted for the teaching situation, this has the potential to equip teachers with the needed skills to approach teaching and material Utilization with a lot of flexibility.

Using divergent thinking in the process of searching and identifying learning materials opens up many possibilities. By challenging the existing ideas,

new ones are brought to life (Goodman, 2014; Runco, 2011). Divergence allows the teacher to explore many ideas. This exploration allows the teacher to discover unique ways of material utilization, which enrich children's experiences. To achieve this, the Art World Design Thinking Process has numerous possibilities for this study.

Convergent approaches are important as a framework for mapping out the most suitable ideas. The designer can evaluate the divergent ideas or their elements and arrive at a final solution (Cropley, 2006; Gregory, 2019). The prototype and testing phase of the Art World Design Thinking Process has a carefully well-thought-out process to develop how to use convergent thinking. Understanding how it works and adapting it for Teacher Materials Utilization Creativity has limitless possibilities in developing how to use convergence.

The conversation on assessment information has for so long taken the position of reporting on children's weaknesses and strengths (Timpereley, 2014). There is a need for a shift from this conversation to using children's assessment information to evaluate the teaching and learning processes. Benegas (2016) argues that assessment information should include previous performances in the way materials, methods and approaches are used. The entire teaching and learning process needs records of assessment information. This conversation gives the study that seeks to improve Teacher Materials Utilization Creativity an opportunity to use assessment information on a different front. Using the ideate phase of the Design Thinking Process we can generate several ideas in which we can use assessment information.

With the rate at which our social landscape is changing because of technology and its effects, it is important to embrace a multidisciplinary

approach to materials for learning (Miller, 2017). Such an approach requires teachers to be able to re-imagine and use knowledge, processes and artefacts from other disciplines to create a rich and familiar learning environment (Li, 2020). This challenges the study that is concerned with improving Teacher Material Utilization Creativity. The Art World Design Thinking Process has the potential to ignite the desired creativity in countering this challenge.

The quality of interaction is influenced by how we behave while making a communication. These reciprocal process skills are important in establishing a stable and meaningful relationship with the children (ParkRogers, 2020). It is equally important for the teacher to develop an understanding of using reciprocal process skills to improve the materials utilization interactions with the children. The prototype and test phase in the Art World Design Thinking Process offers an opportunity to develop a process of mutual respect. The process compels the designer to engage the client in a meaningful and respectful conversation to produce a satisfying solution.

Material Utilization is not merely using materials with children but a process that requires creative imagination and analytical reasoning. The teacher should be concerned with the assessment of the learner's suitability for a given material among other things (Jogan, 2020). The mismatch that often goes unnoticed leads to boredom and this affects the quality of learning experiences for children. There is a need to develop teacher skills that can enable them to manipulate available ideas to match learners (Selvi, 2010). The Art World Design Thinking Process offers us an opportunity to address this challenge. Adapting and using the thought process behind prototype and test offers clues to rethink how materials relate with the users. It develops insights into

understanding the usability aspect of a given material like (Courson's 2010) argument on materials meeting children's emerging abilities according to developmental stage.

Early childhood pedagogy concerns itself with the 'how' of adults and developing quality child interaction (Wall, 2015). Ignoring the 'what' questions implies that the view on adult-child interaction is viewed from a narrow perspective. The focus is on the process rather than the content and media within which the interaction takes place. The how requires to continuously reflect on better ways of interacting with the children. As well as engaging the "what" brings on board reflecting on content and media within which the interaction takes place (Mcwilliam, 2003). The gap is in the 'how'. Adapting the Art World Design Thinking Process for early childhood teacher education provides possibilities to the 'how' question.

In supporting teacher quality, training needs carefully designed approaches (Hruska, 2017). The Art World Design Thinking Process has a vital role to play in designing teacher-training programs and activities. The thought process involved in design thinking enables teacher educators to model carefully studied ways and approaches for the trainees. Its engaging and practical approach helps in overlooking assumptions. This helps the teacher educator and the trainee to focus on understanding the real experiences of children.

Early childhood curricula recognize age appropriateness (Learning Framework, 2007) by stressing the relevance of playfulness and flexibility (Wall, 2015). To achieve this important aspect of early childhood learning, teachers require quality training (Atmore et al, 2012) there is a need to focus on specialised skills in material use. Placed in this context, adapting the art world

design thinking process that encourages exploration, developing playfulness and flexibility gets within easier reach. This opens space for creativity in how materials are used hence creating opportunities for Teacher Material Utilization Creativity.

Teacher training is centred on the acquisition of skills and competencies for providing effective teaching (Siima, 2018). The question would be ‘What kind of skills are our teachers being equipped with?’ The current classroom practices used in early childhood teacher education do not focus on teacher competencies (Ejuu, 2012). To prepare a teacher with competencies relevant to the current educational challenges, Kyambogo University's Department of Early Childhood Education has to focus on teacher skills in material utilization creativity. The Art World Design Thinking Process provides a starting point to solutions for Teacher Material Utilization Creativity. This process provides a framework for a thought process that seeks knowledge by asking questions that lead to exploration (Garrette, 2018). If this kind of approach is adapted for early childhood teacher training, it has enormous possibilities.

Early childhood teachers require skills that enable them to translate curriculum knowledge into appropriate learning experiences (Gafurov, 2019). This involves clarifying and articulating performance outcomes into learner activities and instructions. The Department of Early Childhood Education training given to trainees focuses on lecture room theoretical approaches. With little attention to activities and learning materials, yet they are central to performance outcomes. As a result, teachers end up reproducing how rather than adapting approaches to child-friendly ones (Scheuer, 2018). The Art World Design Thinking Process using the prototyping process creates a carefully

developed thought process for adaptation that has the potential to address a gap in Teacher Material Utilization Creativity skills.

Early childhood programs emphasized grounded experience and high qualification as enablers in developing strategies for supporting children (De Leon-Abao, 2014). The kind of grounded experience De Leon-Abao refers to here involves practical and hands-on activities that engage teachers in critical and creative thinking. The major challenges in our teacher training programs lie in material utilization (Henriken, 2016). This study sought to explore the Art World Design Thinking Process in a bid to offer some solutions to the challenge of material utilization. The Art World Design Thinking Process is a testing phase in a product life cycle which engages the final use as a way to a better understanding of user experiences. If this thought process is adapted to teacher training it offers insights into new possibilities for materials utilization.

Basco (2017) and UNEB (2017) attribute the poor quality of learning outcomes in Uganda to a lack of desired competencies and skills among teachers. This indicates that despite the knowledge and skills acquired during training, teachers are still unable to effectively deliver learning outcomes as required. While there may be numerous solutions to this issue, ensuring that teachers possess material utilization creativity is among the most desired ones. One way of enhancing teacher material creativity is through exploiting the Art World Design Thinking Process.

The child should be the central focus of all curricular plans so that all the benefits that accrue to this go directly to the child (Cutter-Mackenzie et al, 2014). The implication of this is that we should be able to train a teacher with competencies that put the child at the centre of the teaching-learning process.

The learning framework (2007) rightfully envisages childhood through the provision of activities that cater for a holistic approach. However, teachers lack the required competencies to conceptualize materials and curricular activities that offer a rich experience for children under their care (Massey, 2019). The Art World Design Thinking Process has interesting features that improve imagination, which is good for adaptation. Developing teacher imagination could potentially improve teacher material utilization through improving conceptualization and adaptation.

Three critical issues challenge teacher education today; conformity, compliance and predictability (Robinson, 2012; Miller, 2015). Teacher education is struggling to conform to both local and international standards as a way to ensure predictable and measurable outcomes. Subsequently, because of this pressure, the training institutions train teachers who are conformists, which cannot help them to meet market expectations. This is because the market requires flexibility and creativity rather than mere conformity, compliance and predictability (Shkitina, 2019). To harmonize this situation teacher training must put focus on creativity. The Art World Design Thinking Process offers interesting possibilities when it comes to material utilization creativity. If adapted for teacher training in early childhood education, it will lead to a teacher capable of making unique connections when it comes to Teacher Material Utilization Creativity.

2.2 The Art World Design Thinking Process and Teacher Methodological Creativity

There are several discourses on early childhood pedagogy concerned with supporting young children to flourish in different contexts (Murray, 2015).

To address these concerns, we should be concerned with what, where and how teachers use teaching methods. The Department of early childhood education is currently concerned with teachers learning the types of methods, which address the "what" factor only. Teachers need skills in planning for appropriate use of methods (Zaynab & Hamid, 2020). Appropriate planning helps the teacher to address the three critical concerns of what methods, where to apply and most importantly how to employ these methods. Fitting in different contexts requires skills to develop a variety of methodological ideas and approaches. The Art World Design Thinking Process offers opportunities to develop an individual's ability to think out a variety of possible solutions. Using this with teacher education is capable of providing a variety of methodological solutions and ideas. Equipping the teacher with the understanding of how the Art World Design Thinking Process could potentially enhance teacher methodological creativity. Thus, this study is ideal for the Department of Early Childhood at Kyambogo University.

Increasingly schools are under pressure to cater for differences in children's abilities (Education for All Global Monitoring Report 2007). To be able to meet such expectations and more, teacher-training programs must develop programs with specialized methodological approaches that cater for the increasing expectations. This challenges the one-size-fits-all norm practised in early childhood education and care (Robinson, 2012). Government and other stakeholders are increasingly in favour of inclusive classrooms (UNESCO, 2014; UNICEF, 2016). The challenge is we lack teachers with the competencies to manage an inclusive classroom competently. To succeed in this direction requires a teacher who can act spontaneously with creativity to meet children's

needs (Akerson, 2004). The Art World Design Thinking Process offers opportunities to develop spontaneity while working on possible solutions. The individual can develop a flexible mind through the iterative process. This could potentially boost teacher methodological creativity if used for teacher training.

According to the International Society for Technology in Education, (2008) the teacher needs to have diverse teaching strategies with the understanding that children come to school with different educational preparedness. This article brings an interesting issue of diversity into the conversation of teacher education and training. Any effective early childhood program should indeed put diversity at its heart because the children we handle go through different home and societal experiences. As a teacher training institution, Kyambogo University needs to look at this challenge as an opportunity to challenge how we approach the use of methods in our teacher training. This study seeks to interrogate the Art World Design Thinking Process for solutions and insights into improving teacher creativity in material use, methods and using spaces while teaching young children. Adapting processes like prototyping could potentially equip teachers with the mental ability to approach methods creatively.

Lev Vygotsky's zone of proximal development challenges the fundamental principles on which our current education is premised (Miller, 2015). Despite the opportunities this theory sets forth for teachers, teachers are still unable to exploit these opportunities. The major challenge lies in how teachers approach methods used in the teaching process. Teachers need two fundamental skills to pull this off, which are modified role-play and learner-centeredness (Ramdan & Rahmat, 2018). Modifying the roles of a teacher and

putting children at the centre of their learning holds vital importance. This study seeks to offer some possibilities by exploring the Art World Design Thinking Process. For the ZPD, the Art World Design Thinking Process offers a mental process that encourages divergent thinking. This thought process challenges the individual to evolve new ideas continuously. Equipped with this, teachers have a possible potential to challenge their methodological approaches continuously.

Wood (2010) as cited by Cutter-Mackenzie et al, (2014) interestingly relates the early childhood study setting of 100 years ago with our current system. The description of the Pingelly Pre-Primary School of the 1900s in Western Australia is of small chairs, paper, pencils and dolls. This is a true reflection of the early childhood settings today. The question is if the Pre-Primary School of over 100 years ago is the same as that of today have we made any progress in this area? Any progress would start with teacher training and development. Encouraging teachers to engage in active exploration leads to new ways of doing things (Kosslyn, 2012). The Art World Design Thinking Process offers some insights through the ideate phase. It prepares the mind to make insightful connections. This leads to multiple idea possibilities. Adapting such a process has the potential to improve early childhood teacher education approaches to methodological usage.

Quality education is responsible for children's cognitive, emotional and social development without which the potential for full growth is compromised (Wall, 2015; Heckman, 2006). Proficiency in the use of methods is a major quality indicator in the learning of young children. Early childhood education programs should be more concerned with how to use the teaching methods rather than their theory. There is a need to focus on the centrality of methods in teacher

training (Shengji, 2009). Adapting the Art World Design Thinking Process offers teacher training programs new possibilities. Ideate and prototyping create a mental state of defining and redefining ideas until the ideas suit the required solution. Given the opportunity, it has the potential to enhance teacher methodological creativity.

Vandeleur, (2001) argue that well as reproductive learning is still important in some instances, it does not help the teacher trainee to develop the expected competencies. Because reproductive learning is based on memorization and reproduction of existing knowledge, it yields a teacher void of the required methodological creativity. It is important to use an approach that nurtures curiosity by encouraging learners to explore (Honig, 2002). To meet this knowledge gap, the researcher wants to interrogate the Art World Design Thinking Process. The process is rich with a manipulative approach that develops exploration skills through the manipulation of possible ideas. By adapting this process and using the modelling approach to model its processes for teachers, training has the potential to develop teacher methodological creativity (Magno & Sebrano, 2009).

The four stages criterion for a creative process of preparation, incubation, illumination, and verification help in evaluating a creative process (Tsai, 2012). This explains the need for a guiding criterion for the evaluation of any creative process. It builds a robust and collective understanding of what creativity is and is not. In a similar approach, this study seeks to explore the Art World Design Thinking Process to develop an approach for understanding methodological creativity. The process has a rigorous process for incubating and evaluating ideas until they are fully developed. This kind of thought process if adapted to early

childhood teacher education has the potential to produce a teacher with creative approaches to teaching methods.

To be able to nurture creativity individuals should develop skills in posing unfamiliar questions. This conjures fresh ways of thinking, and unexpected answers, and initiates multiple view angles. This leads to a shift in frameworks, which causes uncertainty, surprises and unique interpretive skills (Miller, 2015). The issues raised are important for the study, which seeks to explore the Art World Design Thinking Process for methodological creativity. This process offers a framework for insightful use of ideas. If adapted for teacher education, we are sure that the results will be good news for teachers working with children in the area of methodological creativity.

The teachers should possess skills that enable them to understand the scene and the emotional attachments that come along (CAO, 2017). This argument raises an important issue of the interaction between the methods and the many scenes in which learning takes place. The teacher should possess skills that enable him to appropriately adapt the selected method to the many unintentional scenes that occur during a lesson. This requires a person who is proficient in the use of a selected method(s) (Vaughn & Baker, 2001). To solve this puzzle, this study seeks to explore the Art World Design Thinking process for clues. This process uses an iterative process that develops the ability for multiple views and insightfulness, which is essential for an activity that requires creativity. Adapting such a process to teacher education can offer opportunities for better methodological approaches. This study addresses the gap in how teachers use methods.

2.3 The Art World Design Thinking Process and Teacher Spaces Utilization Creativity

There is a growing shift in the research community towards programs with specific pedagogical approaches, such as Montessori and Steiner. However, these programs have not necessarily been shown to lead to better child outcomes (OECD, 2015). Such approaches often adhere to strict methodological frameworks, prescribing specific tools, materials, and spatial arrangements. These rigid structures can stifle creativity, yet Kyambogo University's early childhood teacher training programs still promote them as models for early childhood education. Environments that encourage such strict pedagogies require teachers equipped with the skills to creatively utilize space and offer a variety of possibilities. The art world design process provides valuable insights for teachers working in these systems. For example, the prototyping phase fosters mental skills necessary for replicating and adapting ideas. By incorporating these creative strategies, teacher training institutions can equip educators with the ability to transform early childhood spaces into more dynamic, creative learning environments. This study fills that gap that compliments existing methodologies through improving teacher creativity.

Most school systems today are built on the premise that learners must follow a scripted curriculum according to Goodlad as cited by Miller, (2015). Kyambogo is also following a similar model where teaching follows strict rules as laid down in a program book. Such a system cannot allow space utilization creativity to thrive since the content pre-determines the spaces. Therefore, what you can expect are teachers with inadequate competencies in space utilization. This study, which seeks to explore the art world design process intends to exploit

the gaps that this kind of system has in teacher space utilization creativity. Like in the design world, the duplicating and altering process offers interesting avenues for teacher space utilization creativity. Given this mind process in the course of training the teacher will be able to develop creative approaches to the use of spaces while teaching a scripted curriculum to meet the needs of individual children.

De Leon-Abao, (2014) stresses that teacher instructional competence is a key cornerstone for effective learning. This argument challenges teacher educators today to use spaces that harness creativity. However, training institutions for early childhood teacher education do not focus on developing competencies in the use of spaces yet it's one of the keys to desired outcomes. To ensure that teachers acquire the necessary space utilization competencies in these changing contexts, this study will explore the art world design process for crews that emanate therein. The prototype presents a unique process feature revolving around a given idea making slight changes which result in multiple ideas. This mind process has the potential to equip the teacher for early childhood with space utilization creativity competencies that not only improve his or her instructional competence skills but will also plant a seed for space utilization creativity that will never stop growing.

According to Winniccot (1971) as cited by Kaufman, (2003) a creative process involves asking new questions, imagination, exploitation and experimentation. For teaching to possess the desired creativity such questions should preoccupy a teacher's thoughts on space utilization. Without creative spaces, teachers asking new questions or even experimenting with materials and methods will continue to be a myth for our early childhood educators. To arrest

this situation, we need to do more to improve our teacher space utilization in early childhood teacher education programs. This study seeks to offer possibilities by exploring the art world design process which offers mental training that allows one to question and experiment with ideas, materials, methods and spaces. Given this ability, the teachers will be able to exhibit space utilization creativity that offers quality learning experiences for early childhood education and care.

Early childhood teachers complete their training and meet all the requirements to attain their qualifications, which implies they should know what to teach and how to deliver it effectively (Basco, 2017). However, despite this, many children in schools are not learning as expected (NAPE, 2017). This issue may arise from various factors, but one critical aspect is how teachers utilize learning spaces. When teachers rely on a traditional classroom setup, with seats arranged in a fixed order, they often develop only theoretical knowledge of space utilization. Yet, effective teaching requires practical skills that allow for flexibility and creativity in using learning environments. The Art World Design Process offers solutions to address this challenge. This process engages the teacher's mind in a cycle of creating, modifying, and refining ideas until the desired outcomes are achieved. With such mental preparation, teachers can better apply c9reativity in their teaching spaces, moving beyond rigid setups to foster more dynamic learning experiences for children.

Creativity is habitual and can be cultivated through providing a rich platform of experiences tailored to harness creativity (Miller, 2015). If creativity can be cultivated, then it's also possible that teacher training can use the art world

design thinking process as a framework to cultivate space utilization creativity in early childhood education and care.

CHAPTER THREE

METHODOLOGY

3.0 Introduction

This chapter presents the methodology employed to establish the relationship between the art world design thinking process and teacher pedagogical creativity. It describes; the research approach, the research strategy, the research design, the philosophical stance, the research methods, the location of the study, the target population, sample size, sampling techniques, research instruments, measurements, validity and reliability, data collection procedures, data analysis and ethical considerations.

3.1 Research Approach

The study adopted a mixed method approach as suitable for the study that collected both quantitative and qualitative data (Sanders et al, 2012). This was a suitable approach because of its flexibility in allowing the use of a pluralistic stand.

3.2 Research Strategy

The study used a quasi-experimental strategy because of its flexibility in conducting experimental studies in social science settings (Creswell, 2017; Bhattacherjee, 2012).

3.3 Research Design

This study adopted an embedded mixed methods design**,** integrating both quantitative and qualitative approaches to provide a comprehensive understanding of the research problem. The primary strand of the study used a matched pair in pre-test/post-test quasi-experimental design (Creswell, 2018), while the qualitative strand involved focus group interviews with participants.

This design enabled the collection of both data types, allowing for parallel but distinct analysis processes. The qualitative findings were subsequently integrated during the interpretation and discussion phases to enrich and contextualize the quantitative results.

Mixed methods design offers the advantage of triangulating findings, thereby increasing the depth and validity of conclusions. Furthermore, this approach is well supported in social science research for capturing the multifaceted nature of educational dynamics and evaluating the effectiveness of teaching interventions (Tashakkori & Teddlie, 2003; Johnson & Onwuegbuzie, 2004).

By combining numerical data with the rich, contextual perspectives of participants, this approach reinforces the validity and reliability of the results, offering a holistic view of the research questions posed.

3.4 Philosophical Stance

This study was guided by a pragmatist philosophical stance, which focuses on finding practical solutions to real-world problems using the most suitable methods. Pragmatism supports the use of both qualitative and quantitative approaches, making it ideal for studies that seek to understand complex issues from multiple angles (Creswell, 2003; Halcomb, 2015).

In this research, pragmatism provided the flexibility to combine numerical data with personal insights from participants, allowing for a more complete picture of teacher pedagogical creativity. This approach is especially useful in educational research, where diverse methods help capture the full scope of teaching and learning practices (Feilzer, 2010; Andrew & Halcoecmb, 2006; Creswell & Plano Clark, 2011). By choosing this stance, the researcher was able to use the

strengths of both data types to better explore the impact of the Art World Design Thinking Process in early childhood teacher education (Bakkabulindi, 2015).

3.5 Methods of Data Collection

The study used two methods of data collection the Observation method to collect quantitative data and the focus group interviews to collect the qualitative data.

3.5.1 Pre and Post Classroom Observation

The researcher carried out classroom observations of the participants in both the control and experimental groups to observe teacher pedagogical creativity indicators. This was done at pre and post-test. Using the pre-test scores, the participants in the control and experimental groups were matched after which the treatment/intervention was introduced to the experimental group. Both groups were again observed for the post-test on teacher pedagogical creativity.

3.5.1.1 Experimental Procedure

Preparation Phase

Sixty early childhood education teacher trainees were selected from Kyambogo University using cohort sampling. Two cohorts were identified: one for the experimental group (n = 30) and another for the control group (n = 30). The inclusion/exclusion criteria was based on trainees who had completed foundational ECD courses and were available for the entire duration of the study program.

Pre-Test Administration

All participants were given a standardized pre-test measuring pedagogical creativity in three domains: material utilization, methodological creativity, and space utilization creativity. This provided baseline data to assess prior

competence and allowed for paired comparisons post-intervention. Groups were matched based on pre-test scores, and academic standing to minimize baseline differences.

Intervention Phase

The Experimental Group received training in the Art World Design Thinking Process for three months (3 sessions per week, 3 hours per session). Training included hands-on workshops, collaborative projects, iterations and classroom simulation activities focused on developing teacher pedagogical creativity. Sessions were facilitated by trained experts with advanced degrees in art education, early childhood pedagogy, and instructional design. On the side of the Control Group continued with the traditional teacher education curriculum without exposure to the Art World Design Thinking Process.

Post-Test Administration

After the intervention, both groups were subjected to the same post-test as in the pre-test. The post-test measured any gains or changes in pedagogical creativity.

3.5.2 Focus Group Discussion

To be able to collect data to answer the qualitative research question on the contributions of the art world design thinking process to teacher materials utilization creativity, teacher methodological creativity and teacher spaces utilization creativity, the researcher used a focus group discussion method, which was suitable for collecting qualitative data for a wide range of views, ideas and opinions from the participant on a pre-defined topic (Krueger & Casey, 2015. The focus was on the participants' experience of the art world design thinking process and how it influenced their approach and pedagogical practices.

3.6 Research Instruments

In line with the data collection methods employed in this study, the researcher used two data collection instruments. The observation guide was used during the pre-test and post-test data collection to take scores on teacher pedagogical creativity and the focus group interview/discussion guide was used for the collection of qualitative data on the influence of design thinking on teacher pedagogical creativity. Robson (1993) cited in Nyenje, (2017) suggests that it is important to engage a variety of data collection instruments as a way of cross-validation of data. This way of using a variety of instruments to target data collection enhances confidence in the study findings (Gay, 1996 in Nyenje, 2017)

3.6.1 Observation Guide

The observation guide (Appendix One) was used to observe the participants in both the control and experimental groups during the pre-test and post-test phases. The researcher developed a creativity observation tool, which consisted of items that were indicators for teacher pedagogical creativity. The tool had items distributed to represent the three different areas that are material utilization creativity, methodological creativity and space utilization creativity. The tool had a rating scale of 1-5 in which 1 was the lowest score showing low teacher pedagogical creativity and five the highest score showing the highest teacher pedagogical creativity.

3.6.2 Focus Group Interview Guide

A focus group interview guide consisting of 12–15 questions per section was developed to guide the qualitative data collection process. The guide comprised mainly open-ended and semi-structured questions, designed to

encourage participants to express a wide range of opinions and experiences related to the adaptation of the Art World Design Thinking Process in their teaching. To ensure the flow and depth of discussions, the researcher employed a range of question types, including introductory questions to set the stage, transitional questions to shift between topics, and concluding questions to wrap up discussions effectively (Krueger, 2002).

Each Focus Group Discussion (FGD) was composed of six participants, making the group size manageable and conducive to active participation (Morgan, 1997). The participants were purposively selected from the experimental group to ensure that they had undergone the intervention and had relevant experiences to share regarding the use of the design thinking process in teaching.

The following procedure was followed in conducting the FGDs:

Preparation: The researcher secured a quiet, comfortable, and neutral location to host the FGDs, ensuring minimal distractions. Participants were briefed on the purpose of the study, the voluntary nature of participation, and ethical considerations such as confidentiality and consent. Written informed consent was obtained from all participants

Group Composition: Participants were divided into five groups, each consisting of six members, to promote effective group dynamics and allow every participant a chance to contribute. Care was taken to ensure diversity within each group in terms of gender, performance levels, and background to elicit a range of perspectives

Moderation: The researcher acted as the moderator, using the semi-structured guide to facilitate discussions while allowing flexibility for participants to raise

new ideas. A research assistant served as a note-taker and operated the audio recorder to ensure no critical information was missed.

Conduct of the FGDs: Each FGD session lasted approximately 45 minutes. The moderator began with icebreaker questions to build rapport and ease participants into the discussion. Open-ended questions encouraged storytelling, personal reflections, and discussions on how the Art World Design Thinking Process influenced their creativity in material use, methodology, and space utilization.

Data Management: All discussions were audio-recorded (with permission) and supplemented with field notes. Immediately after each session, audio files were securely stored and later transcribed verbatim for analysis.

Data Analysis: Thematic analysis was used to process the qualitative data. Transcripts were first read multiple times to ensure familiarity. Codes were generated based on recurring ideas and then grouped into broader themes related to teacher creativity development, challenges faced, and perceived impacts of the intervention.

Trustworthiness Measures: To enhance credibility, member checking was conducted by sharing summaries of the discussions with participants to verify the accuracy of interpretations. Triangulation was achieved by comparing focus group data with quantitative findings and classroom observations. An audit trail was maintained, documenting decisions made during data collection and analysis.

Through this systematic and rigorous process, the FGDs provided rich, context-specific insights that complemented and deepened the interpretation of the quantitative findings of the study.

3.7 Location of the Study

The study was conducted at two colleges affiliated with Kyambogo University in Uganda, strategically selected to control for contamination during the intervention. The first college, 'coded A,' is located in the North-western district of Yumbe, near the border with South Sudan, and hosted the control group. Yumbe is approximately 500 kilometers from the capital, Kampala, and its geographical isolation helped reduce any potential contact with the experimental site. The second college, 'coded B,' is situated in the South-western district of Kabale, close to the border with Rwanda. This district lies about 400 kilometers from Kampala and was selected to host the experimental group. These two colleges were chosen not only for their geographical distance over 700 kilometers apart but also because they are key institutions offering the in-service diploma in Early Childhood Education. This physical separation allowed the researcher to effectively minimize contamination risks during the study intervention (Shadish, Cook, & Campbell, 2002).

3.8 Target Population

Those who experience the phenomena are the most suitable candidates to form the study population for a given study (Bbuye, 2012; DePoy & Gitlin, 1998). On this basis, the researcher used the in-service Diploma in early childhood education teachers as it was the most suitable population for this study on teacher pedagogical creativity in early childhood teacher Education. The parent population was 156 teachers in four affiliated colleges. A total of 62 participants including the in-service teachers were involved as the accessible population (Trochim, 2020). The control group had 32 participants; the experimental group had 30 participants.

Establishing clear inclusion and exclusion criteria was critical for maintaining the validity, reliability, and ethical standards of the study. These criteria ensured that all participants had comparable backgrounds and experiences pertinent to early childhood teacher education, thereby minimizing potential confounding variables. This consistency strengthened the ability of the researcher to accurately assess the impact of the Art World Design Thinking Process on the development of teacher pedagogical creativity. Additionally, setting clear criteria enhanced the transparency of the participant selection process, promoted fairness, safeguarded the welfare of participants by ensuring voluntary and informed participation, and supported the replicability of the study in future research endeavors. The following inclusion and exclusion criteria were applied:

3.8.1 Inclusion and Exclusion Criteria for Study Participants

Inclusion: Enrolled in the Diploma in Early Childhood Education at College A and B under Kyambogo University, successfully completed the pre-test, available and committed for the full duration of the study (pre-test, intervention, post-test, FGDs), provided informed consent to participate, and proficient in english (language of instruction and data collection).

Exclusion: Did not complete the pre-test, withdrew or missed significant parts of the intervention or post-test, declined or withdrew informed consent, and had prior extensive training or certification in the Art World Design Thinking Process.

3.9 Sample Size and Sampling Techniques

According to Creswell (2014), cohort sampling is particularly valuable in educational research because it enables researchers to observe changes over time

and compare outcomes across groups with shared characteristics. In this study, cohort sampling was used to select participants from two affiliated colleges offering Early Childhood Teacher Education programs.

The target population 160 were all student-teachers enrolled in the Diploma in Early Childhood Education programs across Uganda. From this, the accessible population included 62 student-teachers from two specific colleges affiliated with the Department of Early Childhood Education at Kyambogo University one located in Yumbe District (Cohort A) and the other in Kabale District (Cohort B).

The sample population consisted of 60 student-teachers, with 30 participants selected from each college. These two cohorts were purposely selected to reflect regional diversity and were assigned as control and experimental groups, respectively. The sample allowed for meaningful comparison of the impact of the Art World Design Thinking Process on teacher pedagogical creativity across the two settings.

3.10 Measurement

To be able to measure like (Bhattacherjee, 2012) asserts that measurement in research is the careful and deliberate observation of the real world to make sense of it as a researcher. The researcher conceptualized the constructs by developing indicators and developing a scale to measure these indicators accordingly.

The first variable was the independent variable, which was the Art World Design Thinking Process. To be able to measure this construct, the five steps of the art world design thinking process were used as indicators. The steps/indicators that we measured were “empathize, define, ideate, prototype and

Test". They were scored on a scale of 1-5 on which scoring 1-2 was considered "Basic", 3 was considered "Intermediate", 4 was "Proficient" and 5 was considered "Advanced" A teacher who scored the highest level at the various stages was considered to possess higher teacher pedagogical creativity than the one who scored less.

The second construct was teacher pedagogical creativity (TPC) and to be able to measure this it was broken down into three indicators that are; teacher material utilization creativity (TMUC), teacher methodological creativity (TMC) and teacher spaces utilization creativity (TSUC). TMUC had 14 constructs each of 5 points, which totalled 70 points, TMC had 10 constructs of 5 points each totalling 50 points and TSUC had 6 constructs each of 5 points totalling 30 points, with the overall total of 150 points for the three indicators of TPC. The resulting fraction calculated as a percentage was the measure of teacher pedagogical creativity. For this study, a score of a teacher who scored between 50% and 64% was representative of "basic teacher pedagogical creativity" This was the average score of the in-service teachers at the pilot level of the instrument. It was considered to be the level at which the participants were since they were already in service. The study was interested in developing teacher pedagogical creativity from "basic" to "intermediate" whose score was between 65% - 75% and then "proficiency" was 75% - 85% after which the teacher would be considered advanced if the score above 85% in teacher pedagogical creativity.

3.11 Validity, Reliability and Truth Value and Consistency

For any study to be respected and accepted there is a need to ensure validity, reliability and credibility. These are the psychometric properties of measurement scales on which the adequacy and accuracy of our measurement

procedures in scientific research are validated (Smith, 2015; Bhattacherjee, 2012) Validity is achieved when the scales used can measure the constructs that the researcher intended to measure while reliability is achieved when the scales measure consistently and precisely. In qualitative data validity and reliability are achieved through ensuring truth value and consistency in the research process (Smith, 2015). Creswell, (2013) stresses the need for a researcher to clearly express to the reader how the credibility and accuracy of the findings will be ensured. The following section discusses how we ensured validity and reliability for both qualitative and quantitative data:

3.11.1 Validity

To ensure the validity of the research instruments, the study employed both expert judgment and procedural standardization. First, the instruments were subjected to rigorous content validation by a panel of five content experts specializing in early childhood education and research methodology. The experts evaluated each of the 24 items across three sections of the instrument, using a rating scale of 1 to 5 based on relevance and clarity. This evaluation process was repeated five times to allow for item refinement and improvement until all items met acceptable standards. The Content Validity Index (CVI) was calculated using the formula:

$$\text{Content Validity Index} = \frac{\text{Total number of items rated as valid}}{\text{out of the Total number of items on the instrument}} \times 100$$

Only items that yielded an average CVI of 0.70 or higher were retained for use in the final instrument. Items falling below this threshold were revised based on expert feedback and re-evaluated until they met the required validity standards.

Beyond instrument validation, the researcher maintained procedural validity by ensuring that all participants received uniform instructions and were assessed under comparable conditions. This approach minimized variability due to external factors and helped preserve the integrity of the data collected.

For the qualitative component, which involved focus group discussions, the researcher employed triangulation and peer debriefing to enhance credibility and trustworthiness. Triangulation was achieved by comparing themes from different participant groups and aligning them with the quantitative findings. This cross-validation helped to confirm the consistency of responses and insights across data sources.

Furthermore, the researcher used member checking**,** where selected participants reviewed transcripts or summaries of their contributions to confirm accuracy and authenticity. Rich, thick descriptions were also employed to capture the context and depth of participants' experiences, enhancing the transferability of the findings.

By combining expert validation, methodological consistency, and interpretive rigor, the study ensured a high degree of validity for both its quantitative measurements and qualitative insights.

3.11.2 Reliability:

To strengthen the trustworthiness and consistency of the research findings, the study employed rigorous strategies to ensure reliability for both quantitative and qualitative data collection tools. For the quantitative instruments, the study utilized the inter-rater reliability approach. Six independent raters were given the complete instrument containing 24 items to assess multiple times over six rounds. Each item was evaluated for consistency in rating, and the resulting

scores were used to compute the average level of agreement across raters. The inter-rater reliability index was established at 0.70, which is generally considered an acceptable threshold for reliability in educational research (Cohen et al., 2007).

For the qualitative component, reliability was ensured through the use of systematic data coding, clear documentation, and consistency in data handling procedures**.** The researcher maintained a well-structured audit trail, which documented all coding decisions, emerging themes, and analytic processes. This transparency allowed for the study to be replicated or reviewed for accuracy. To reduce interpretation bias and strengthen consistency, a peer examination process was applied. A colleague familiar with qualitative analysis independently reviewed the codes and themes to verify their alignment with the raw data. Code-recode procedures were also employed, where initial codes were compared with recoded data at a later time to assess stability and consistency. Together, these strategies ensured that both the quantitative and qualitative components of the study produced dependable and replicable findings, enhancing the overall reliability of the research.

3.11.3 Credibility

To ensure that the qualitative data was valid and reliable the researcher, ensured truth value in which all participants' views were represented accurately. This was made possible through revisiting the recordings of participants' responses. This was further confirmed with the use of verbatim from the participants in the process of reporting the findings.

Secondly, the researcher also ensured consistency and neutrality for the data to be reliable by ensuring transparency in all the methodological procedures,

which allows similar or closely related results at different times. This was strengthened by the availability of tools that were used to consistently give clear descriptions of procedures and the use of the researcher's diary to keep a detailed record that was used throughout the presentation of findings (Nobel, 2012; Rolfe, 2006; Slevin, 2002)

Controlling observer bias is essential in ensuring the credibility and validity of research findings, particularly in studies involving human subjects such as teachers in early stajustification childhood education. In this study, several strategies were implemented to minimize these forms of bias.

Standardized observation tools were used to ensure consistency in how data was collected across both the control and experimental groups. The use of structured observation protocols reduced the likelihood of the observer interpreting events subjectively or selectively recording data that aligned with preconceived expectations (Creswell & Creswell, 2017).

Observer training and inter-rater reliability checks were conducted. Before data collection, observers were thoroughly trained to use the observation instruments uniformly. Inter-rater reliability was tested by having multiple observers rate the same sessions independently, and any discrepancies were resolved through discussion and recalibration of the tools, thereby improving objectivity (Mertens, 2015).

Triangulation of data sources helped mitigate both observer and participant bias. Data was collected through multiple methods observations, and interviews, which allowed cross-validation of findings. If the results aligned across different sources, this added to the credibility and trustworthiness of the findings, regardless of potential individual biases (Patton, 2002). By applying

these measures, the study sought to ensure that both participation and observation were as neutral and objective as possible, thereby enhancing the rigor and reliability of the research outcomes.

3.12 Data Collection Procedure

The data collection procedure was in four stages, the pre-test observation, the experiment, the post-test observation and qualitative data collection as discussed below;

3.12.1 Pre-test Observation Procedure

This process was preceded by the development of the observation tool and identification of research sites. After identifying the participants and undertaking all the necessary ethical procedures, the participants were briefed about their involvement in the research process. This was followed by time to allow the participants to prepare their lessons after which the researcher observed the different participants and rated them using the teacher creativity observation tool.

3.12.2 Experiment Procedure

3.12.2.1 Control Group:

The control group was engaged in their regular coursework for a period of eight weeks without any intervention related to the Art World Design Thinking Process. Their training followed the standard curriculum as prescribed by the Department of Early Childhood Education at Kyambogo University. This period was equivalent to the time the experimental group spent receiving the intervention, ensuring a balanced comparison.

The experts involved in the study were carefully selected based on their academic qualifications, professional experience, and specialization in early childhood education and creative pedagogies. The team comprised five experts:

one a masters' degree holder in Early Childhood Education, and two senior tutors with over ten years of experience in Early Childhood. All the experts had previous experience in curriculum evaluation, creative arts, and teacher development programs. Their involvement in validating the research instruments, and supervising the intervention process added rigor, credibility, and depth to the study outcomes.

3.12.2.2 Experimental Group:

After the pre-test, the next phase was to introduce the treatment to the experimental group. To be able to approach this systematically an experiment schedule was developed using the Art World design thinking process steps that are empathy, define, ideate, prototype and test. Activities were developed in line with the different steps of the design thinking process that would develop material utilization creativity, methodological creativity and space utilization creativity. In each of the creativity areas participants were involved in guided practical demonstrations, personal individual trials and trial classroom experimentation. In the classroom trials, participants were given classroom challenges to adopt the same thought process as used in the art world design thinking process experiments in preparation for learning material, use of methods and spaces. All this involved an iterative process of presentations, discussions and improvements.

3.12.3 Post-test Observation Procedure

After the experiment, the participants in both the experimental and control groups were briefed about the next phase, which was the post-test observation. All participants were requested to prepare a lesson from the same learning area as was prepared in the pre-test. This was followed by the participant's lesson

observation. Starting with the pre-observation conference, the lesson step by step and then the post-observation conference as it was in the pre-test.

3.12.4 Qualitative Data Procedure

Following the post-test observation, qualitative data were collected through focus group interviews with the experimental group to gain deeper insights into their experiences with the Art World Design Thinking Process. The participants were purposively divided into five focus groups, each consisting of six participants, allowing for rich, interactive discussions in a manageable setting. The interviews were conducted in a round-table format, which fostered an open and inclusive atmosphere. Each session lasted approximately 45 minutes and was guided by a semi-structured interview protocol. This format provided consistency across interviews while also allowing for flexibility, enabling participants to freely express their perspectives and share personal experiences relevant to the intervention.

The focus group discussions were audio-recorded with participants' consent to ensure accuracy and completeness of data capture. Field notes were also taken to document non-verbal cues and group dynamics during the interviews.

3.13 Data Processing and Analysis

3.13.1 Data Processing

After collecting the data from the field, the data was checked for any duplicated tools and those, which were incomplete, all were removed. This was followed by coding for the qualitative data, then the quantitative data was classified according to the different sets and this was followed by entering it into the computer as raw data.

3.13.2 Data Analysis

The data analysis was done in two methods one for qualitative and the other for quantitative data as shown below;

3.13.3 Qualitative Data

In the research objective that was interested in answering the question "What is the contribution of the Art World Design Thinking Process to Teacher Material Utilization Creativity, Teacher Methodological Creativity and Teacher Spaces Utilization creativity?" The study used thematic Content Analysis (TCA) is a qualitative research data analysis to identify, analyze, and interpret patterns or themes within qualitative data. The process involved several key steps: familiarizing oneself with the data, generating initial codes by categorizing segments of text, searching for broader themes by grouping related codes, reviewing and refining these themes for coherence and relevance, and finally defining and naming each. This systematic approach allowed the researcher to extract meaningful insights from qualitative data, it also provided a structured framework for reporting findings, ensuring transparency and rigor in the analysis process (Braun & Clarke, 2006).

3.13.4 Quantitative Data

In objectives one to three, it was hypothesised that there was a significant relationship between the independent variable and the dependent variable indicators, the resulting data was analysed as follows;

In the first hypothesis, $\mathbf{H_a}$: where we took the assumption that there was a significant effect of the Art World Design Thinking Process on Teacher Material Utilization Creativity. We used a paired t-test to establish if there was a difference between the data from the pre-test and post-test phases.

In the second hypothesis, **H_a:** where we took the assumption that **t**here is a significant effect of the Art World Design Thinking Process on Teacher Methodological Creativity. We also used a paired t-test to establish if there was a difference between the data from the pre-test and post-test phases.

In the third hypothesis, **H_a:** where we also took the assumption that there is a significant effect of the Art World Design Thinking Process on Teacher space utilisation Creativity and to establish if there was a difference between the data from the pre-test and post-test phases, a paired t-test was used to analyse the data.

3.14 Ethical Considerations

Ethics in research concerns itself with providing guiding principles to researchers and ensuring that participants are protected (Ichendu, 2020; Creswell, 2014). This study ensured that the following ethical guidelines were adhered to.

Having taken the proposal through all the levels of presentation and being approved by all the relevant authorities at the university level like the Departmental and Faculty level, the researcher received a clearance from the graduate board which was used to submit the work to the research ethical committee of Gulu University. The work was able to meet expectations which led to an approval. Using the university introductory letter, the researcher also sought permission from the research sites. The GUREC clearance, the site clearances and the proposal were submitted to the Uganda National Council of Science and Technology (UNCST) for final review and approval. After meeting all the requirements, the proposal was given the final approval.

On the issue of consenting, all the participants were briefed about the research project and were given the chance to ask questions for further clearance. After this, all the participants were given consent forms to sign as evidence for voluntary participation in the study.

To ensure confidentiality, all the participants' observations, lesson plans and documents were coded. Which could not allow anybody to identify the participation. All the audio and video recordings of the activities were destroyed after decoding all the necessary data.

Since the participants were committing valuable time to participate in this research work, the researcher provided compensation in terms of transport facilitation and feeding during the research activities.

CHAPTER FOUR

PRESENTATION OF FINDINGS, ANALYSIS AND INTERPRETATION

4.0 Introduction

This chapter presents findings, analyses of the data and interprets findings about the study problem. Starting with the demographic characteristics of the study participants followed by findings that are presented according to the study objectives; To measure the effect of the Art World Design Thinking Process on Teacher Material Utilization Creativity, to measure the effect of the Art World Design Thinking Process on Teacher Methodological Creativity, and to measure the effect of the Art World Design Thinking Process on Teacher Spaces Utilization Creativity.

4.1 Demographic Characteristics of the Study Participants

The participants were both male and female with the experimental group constituting of 50% (n=30) and the control group with 50% (n=30) too. The majority of the participants were female, with the experimental group having 90% (n=27) females and 10% (n=3) males and the control group had 81.2% (n=26) females and 18.7% (n=6) males. Which made the overall 85.5% (n=53) females and males 14.5%n(n=9).

4.2 The effect of the Art World Design Thinking Process on Teacher Material Utilization Creativity

In objective one, the study sought to establish how the Art World Design Thinking Process affected the teacher's material utilization creativity. It was assumed that when the participants in the experimental group were introduced to the art world design thinking process, they would develop a design thinking

mindset that would enhance their material utilization creativity in the process of working with children.

To be able to measure the competencies that accrued to this interaction, a set of fourteen indicators subcategorized under the four stages of the art world design thinking process (empathize, define, ideate, prototype and test) were used at pre-test and post-test. The resulting scores are presented as follows;

4.2.1 Scores on Teacher Material Utilization Creativity Constructs for Empathy

In Table 4.2.1 below, the data is presented on three creativity indicators that were measured that is; Material for individual children, relating context to selection and associating selection to planning. For these three the study was interested in establishing how the art world design process would influence the thought process of the participants on these indicators while using materials. The data sets presented in tables 4.2.1 and 4.2.2 below are for the pretest and post-test observation;

Table 4.2. 1

Pretest scores from teacher material utilization creativity constructs for Empathy

Creativity Material for Individual Child	Control Group Pre-test Scores			Experimental Group Pre-test Scores		
	Score	Freq	%	Score	Freq	%
	1	25	83.3	1	24	80
	2	05	16.7	2	6	20
	3			3		
	4			4		
	5			5		
Associating	1	9	30	1	13	43.3
Selection with	2	21	70	2	17	56.7
Planning	3			3		
	4			4		
	5			5		
Relating context to	1	3	10	1	4	43.3
selection	2	26	86.7	2	26	53.3
	3	1	3.3	3		
	4			4		
	5			5		

Source: Primary Data, 2020

Below is the pretest data presentation from Table 4.2.1 above;

Pretest observation: Both groups were subjected to a pretest observation on the concept of empathizing. To establish their level of competence in empathizing, three creativity indicators associated with teacher material utilization creativity were scored. From Table 4.2.1 above, in the ability to prepare materials that were responsive to the individual child 83.3% of the participants scored 1 and 16.7% scored 2 for the control group well as in the experimental group the scores were 80% with 1 and 20% scoring 2.

This was followed by the indicator of being able to relate selection to planning in which the control group had 30% scoring 1 and 70% scored 2 well as the experimental group participants had 43.3 scoring 1 and 56.7% scored 2 and lastly, the indicator of the ability to relate context to selection, the control group had 10% scoring 1, 86.7% scored 2 and 3.3% scored 3 well as in the experimental group 43.3% scored 1 and 53.3% scored 2. Below is a bar graph

with the statistical presentation of the relationship between the art world design process and teacher material utilization creativity at the empathizing level.

Figure 4.2. 1

Comparing Control and Experimental Groups at Pre-test in Empathizing

Source: Primary Data, 2020

In Figure 4.2.1 above the control group has scores between 1 and 3 with an average of 41.1 % of the participants scoring 1 out of 5 yet in the experimental group the scores were between 1 and 2 with 55.5% of the participants scoring 1 out of 5 which means that the experimental group had more participants attaining a lower score as compared to those in the control group. This implied that generally, the control group participants were better than those of the experimental group in expressing the creativity indicators for empathizing at the pretest level.

The following Table 4.2.2 presents posttest data.

Table 4.2. 2

Posttest scores from Teacher Material Utilization Creativity Constructs for Empathy

Creativity Material for Individual Child	Control Group Post-Test scores			Experimental Group Post-Test scores		
	Score	Freq	%	Score	Freq	%
	1	2	43.7	1	-	-
	2	18	50	2	2	6.7
	3	10	9.3	3	11	36.7
	4			4	11	36.7
	5			5	6	20
Associating Selection with Planning	1	2	6.7	1	-	-
	2	13	43.3	2	2	6.7
	3	12	40	3	17	56.6
	4	3	10	4	8	26.7
	5			5	3	10
Relating context to selection	1	0	-	1	-	-
	2	6	20	2	2	6.7
	3	21	70	3	14	46.6
	4	3	10	4	8	26.7
	5			5	6	20

Source: Primary Data, 2020

Below is a presentation of the posttest data from Table 4.2.2 above;

Posttest observation: After introducing the intervention to the experimental group a post-test observation was done on both the control and experimental group on the same creativity indicators that were measured at the pretest and the data showed that in the indicator of teacher's ability to respond to individual differences of children, the control group had 43.7% scoring 1, 50% scored 2 and 9.3% scored 3 well as the experimental group had 6.7% score 2, 36.7% scored 3, 36.7% scoring 4 and 20% scored 5. In the indicator of being able to relate selection to planning 6.7% scored 1, 43.3% scored 2, 40% scored 3 and 10% scored 4 in the control group well as 6.7% scored 2, 56.6% scored 3, 26.7% scored 4 and 10% scoring 5 in the experimental group. Well as in the indicator teacher's ability to relate context to selection, the control group had 20% scoring 1, 70% scored 2 and 10% scored 3 as the experimental group participants had

6.7% scored 2, 46.6% scored 3, 26.7% scored 4 and 20% scoring 5. Figure 4.2.2 below, is the statistical analysis of the data in Table 4.2.2.

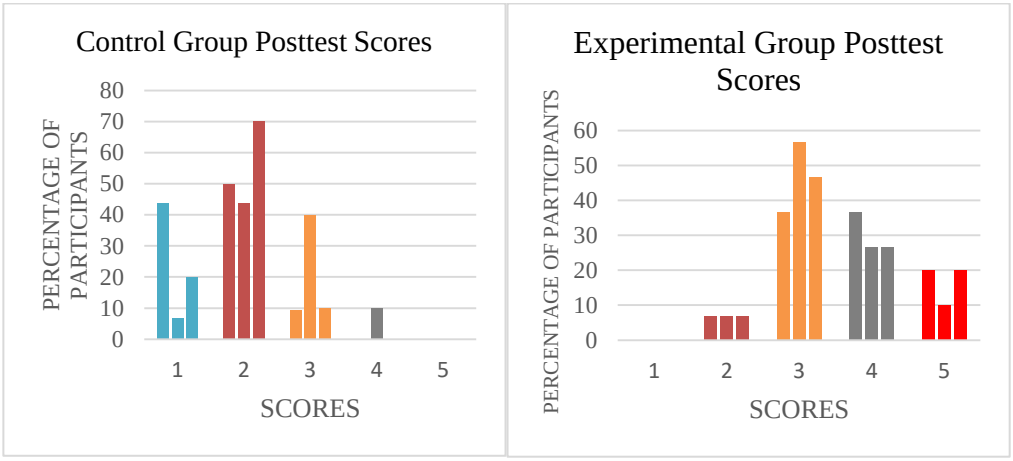

Figure 4.2. 2

Comparing Control and Experimental Groups at Post-test in Empathizing

Source: Primary Data, 2020

In Figure 4.2.2 above the scores show that the participants in the control group scored between 1 and 4 though more participants shifted to 2 and 3 scores when compared with their pretest where the majority scored 1well as participants in the experimental group scored between 2 and 5 with most of the participants scoring 3 to 5 which shows that generally, the experimental group was scoring much better than the control group as compared to the pretest scores where they scored in the range of 1 to 3 with majority scoring 1. With such a significant difference in the results, there is justification for a statistically significant difference between the two groups at the posttest.

4.2.2 Scores on Teacher Material Utilization Creativity Constructs for Define

In the following Table 4.2.3 data is presented on the influence of define on teacher material utilization creativity. This was generated through the

measurement of three creativity parameters for define. In Table 4.2.3 data is presented below.

Table 4.2. 3

Pretest Scores from Teacher Material Utilization Creativity-related Constructs for Define

Creativity Attribute	Control Group			Experimental Group		
Contextualizing Materials	Pre-test Scores			Pre-test Scores		
	Score	Freq	%	Score	Freq	%
	1	11	36.7	1	15	50
	2	18	60	2	12	40
	3	1	3.3	3	3	10
	4			4		
	5			5		
Using available Sources	1	3	10	1	4	13.3
	2	22	73.3	2	24	80
	3	5	16.7	3	2	6.7
	4			4		
	5			5		
Availability of selection	1	1	3.3	1	2	6.7
	2	13	43.3	2	21	70
	3	16	53.3	3	7	23.3
	4			4		
	5			5		

Source: Primary Data, 2020

In Table 4.2.3 above, two data sets are presented with one another on the left is the control group data and on the right is the experimental group data for pretest scores;

Pretest observation: When observed at the pretest the participant's responses to the creativity indicators at the define level and the scores were as follows. In the ability to contextualize materials the participants in the control group had 36.7% score 1, 60% scored 2 and 3.3% scored 3 well as the experimental group had 50% score 1, 40% score 2 and 10% scored 3. In the ability to detect and use available sources in material utilization creativity, the control group participants had a 10% score of 1, 73.3% scored 2 and 16.7% scored 3 well as their counterparts in the experimental group 13.3% scored 1, 80% scored 2 and 6.7%

scored 3. In the third creativity indicator of the availability of selection, the control group participants had 3.3% scored 1, 43.3% scored 2 and 53.3% scored 3 well as the participants in the experimental group 6.7% scored 1. 70% scored 2 and 23.3% scored 3. Figure 4.2.3 below shows how the two groups fared when their data was analyzed and presented statistically.

Figure 4.2. 3

Comparing Control and Experimental Groups at Pre-Test in Define

Source: Primary Data, 2020

In Figure 4.2.3 above the control group had scores between 1 and 3 with an average of 16.7% scoring 1 out of 5 yet the experimental group also had scores between 1 and 3 but with an average score of 1 at 24.3% of the participants which meant that the experimental group had more participants attaining a lower score as compared to those in the control group. This generally eluded to the fact that the control group participants were relatively better than those of the experimental group in teacher material utilization creativity at a defined level but comparable. Below is the data from the post-test observation;

Table 4.2. 4

Posttest scores from teacher material utilization creativity constructs for Define

Creativity Attribute	Control Group			Experimental Group		
Contextualizing Materials	Post-Test scores			Post-Test scores		
	Score	Freq	%	Score	Freq	%
	1	4	13.3	1	-	-
	2	14	46.7	2	-	-
	3	12	40	3	13	43.3
	4			4	16	53.3
	5			5	1	3.3
Using available Sources	1	2	6.7	1		
	2	10	33.3	2	1	3.3
	3	18	60	3	9	30
	4			4	13	43.3
	5			5	7	23.3
Availability of selection	1	1	3.3	1		
	2	8	26.7	2	2	6.7
	3	21	70	3	7	23.3
	4			4	15	50
	5			5	6	20

Source: Primary Data, 2020

Table 4.2.4 above, contains post-test data which is analyzed below;

Post-test observation: After introducing the art world design process a posttest observation was carried out on both groups and the scores were as follows; starting with the control group's ability to contextualize materials in which it had 13.3% participants scoring 1, 46.7% score 2 and 40% scored 3 well as participants the experimental group had 43.3% with 3, 53.3% with 4 and 3.3% with 5 followed by the ability to use available sources, in which the control group had 6.7% of the participants scoring 1, 33.3% scored 2 and 60% scored 3 well as in the experimental group participants had 3.3% with 2, 30% with 3 followed by 43.3% with 4 and 3.3% with 5 and in the ability to determine the availability of a given selection, the participants in the control group were 3.3% with 1, 26.7% with 2 followed by 70% with 3 well as those in the experimental group had 6.7%

with 2, 23.3% scoring 3, 50% scored 4 and 20% scored 5. In Figure 4.2.3 below a statistical representation of the relationship between the two groups at posttest.

Figure 4.2. 4

Comparing Control and Experimental Groups at Post-Test in Define

Source: Primary Data, 2020

In Figure 4.2.3 above the scores show that the participants in the control group continued to score between 1 and 3 though with more participants scoring 2 and 3 which was not the case at the pretest where the majority scored 1 meanwhile the participants in the experimental group scored between 2 and 5, majority of the participants having 3 to 5 which shows that generally, the experimental group was scored much higher than the control group as compared to the pretest scores in which its scores range of 1 to 3. The results show that the experiment group had a statistically significant difference from the control group.

4.2.3 Scores on Teacher Material Creativity Constructs for Ideation

In Table 4.2.5 the data presented shows how participants in the control and experimental group scored in the pretest. In both categories, each score is seen from how frequently it appeared in the score sheets. The percentage of the frequencies represents the portion of participants in either the control or

experimental group that had a given score. The scores for the control group are presented against those of the experimental group in each of the creativity constructs that were measured at the pre-test.

Table 4.2. 5

Pretest scores from teacher material utilization creativity constructs for Ideation

Creativity Attribute	Control Group			Experimental Group		
Divergent material thoughts	Pre-test Scores			Pre-test Scores		
	Score	Freq	%	Score	Freq	%
	1	19	63.3	1	20	66.7
	2	6	20	2	9	30
	3	5	16.7	3	1	3.3
	4			4		
	5			5		
Convergent Material thoughts	1	20	66.7	1	21	70
	2	7	23.3	2	8	26.7
	3	3	10	3	1	3.3
	4			4		
	5			5		
Sensitive to Environment	1	9	30	1	15	50
	2	21	70	2	14	46.7
	3			3	1	3.3
	4			4		
	5			5		
Availability of Available Information	1	2	6.7	1	8	26.7
	2	28	93.3	2	17	56.6
	3			3	5	16.7
	4			4		
	5			5		
Convenient ideas	1	2	6.7	1	6	20
	2	24	80	2	21	70
	3	4	13.3	3	3	10
	4			4		
	5			5		

Source: Primary Data, 2020

In Table 4.2.5 above two data sets are presented that is the pretest data for the control group and the pretest data for the experimental group. The pretest scores of both groups are presented as a baseline picture of how the participants were performing in teacher material utilization creativity.

Pretest Observation: Before introducing the intervention, in the creativity indicator divergent material thoughts the control group participants had 63.3%, 20% and 16.7% of the participants scoring 1 to 3 respectively well as for the experimental group participants 66.7% followed by 30% and 3.3% of the participants also scored 1 to 3 respectively as well. In convergent material thoughts, 66.7% scored 1, 23.3% scored 2 and 10% of the participants scored 3 respectively while in the experimental group, 70% of the participants scored 1, 26.7% scored 2 and 3.3% scored 3. Then in being sensitive to the environment while developing ideas for materials, the control group participants had 30% score 1 and 70% scored well as in the experimental group 50% of the participants scored 1, 46.7% scored 2 and 3.3% scored 3.

This is followed by the use of available information to develop ideas in which the control group had 6.7% of the participants score 1 and 93.3% scored 2 well as in the experimental group 26.7%, 56.6% and 16.7% of the participants scored 1 to 3 respectively and being able to identify convenient ideas, 6.7 % of the participants scored 1, 80% scored 2 and 13.3% scored 3 in the control group well as those in the experimental group 20% scored 1, 70% scored 2 and 10% scored 3 respectively. From the data presented above the two groups exhibit scores that generally range from 1-3 in which the majority of the participants in both groups scored implying that the groups were comparable.

Figure 4.2.4 below presents the analyzed data

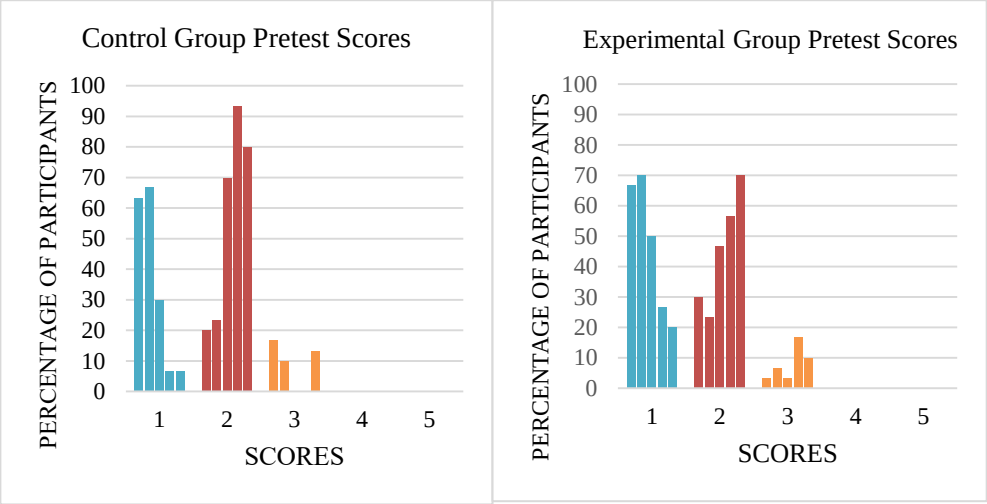

Figure 4.2. 5

Comparing Control and Experimental Groups at Pre-Test in Ideation

Source: Primary Data, 2020

The Figure 4.2.4 above, the analysis shows that the participants in the control group had a better performance as compared to those in the experimental group. Looking at those who scored 1, we have the control group with 66.7 % of participants as the overall highest score as compared to the 70% for the experimental group. This implies that the participants in the control group had better scores in teacher material utilization at ideation as compared to those in the experimental group. Below is data from the post-test observation;

Table 4.2. 6

Posttest scores from teacher material utilization creativity constructs for Ideation

Creativity Attribute	Control Group			Experimental Group		
Divergent material thoughts	Post-Test scores			Post-Test scores		
	Score	Freq	%	Score	Freq	%
	1	2	6.7	1	-	-
	2	23	76.6	2	-	-
	3	5	16.7	3	14	46.7
	4			4	13	43.3
	5			5	3	10
Convergent Material Thoughts	1	4	13.3	1	-	-
	2	21	70	2		
	3	5	16.7	3	14	46.7
	4			4	13	43.3
	5			5	3	10
Sensitive to Environment	1	5	16.7	1	-	-
	2	12	40	2	2	6.6
	3	13	43.3	3	18	60
	4			4	5	16.7
	5			5	5	16.7
Availability of Available Information	1	4	13.3	1	-	-
	2	16	53.3	2	1	3.3
	3	10	33.3	3	18	60
	4			4	11	36.7
	5			5	2	6.7
Convenient ideas	1	-		1		
	2	21	70	2	2	6.7
	3	9	30	3	17	56.6
	4			4	9	30
	5			5	2	6.7

Source: Primary Data, 2020

Post Test: After introducing the intervention 6.7% of the participants in the control group scored 1, 76.6 % scored 2 and 16.7% scored 3 in divergent material thoughts well as in the same construct, the experimental group had 46.7% scored 3, 43.3% scored 4 and 10% scored 5. In convergent material thoughts, the control group had 13.3% scoring 1, 70% scored 2 and 16.7% scored 3 well as the experimental group participants had 46.7% scoring 3, 43.3% scored 4 and 10% scored 5. In sensitive to environment, the control group had 16.7% of the participants score 1, 40% scored 2 and 43.3% scored 3 while in the experimental group, 6.6% scored 2, 60% scored 3, 16.7% scored 4 and 16.7%

scored 5. In the ability to use available information to develop ideas, the control group participants had 13.3% scoring 1, 53.3% scored 2 and 33.3% scored 3 well as in the experimental group 3.3% scored 2, 60% scored 3, 36.7% scored 4 and 6.7% scored 5 and in the ability to use convenient ideas, the control group participants had 70% scoring 2 and 30% scoring 3 yet in the experimental group 6.7% scored 2, 56.6% scored 3, 30% scored 4 and 6.7% scored 5.

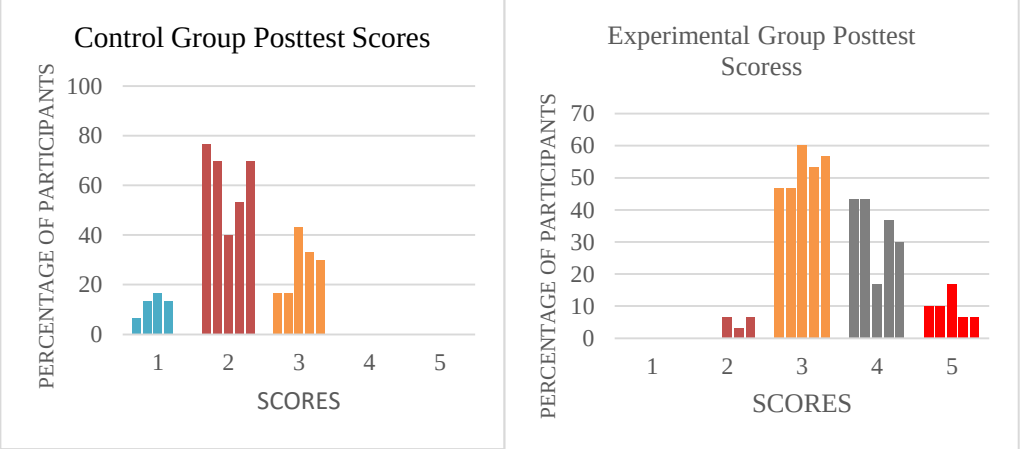

Figure 4.2. 6

Comparing Control and Experimental Groups at Post-Test in Ideation

Source: Primary Data, 2020

From Figure 4.2.5 above the control group has the majority of the participants scoring 2 and 3 with numbers much lower in category 1 as compared to its pretest scores where 1 had a relatively much bigger percentage well as the experimental group participants scored between 2 and 5 with the majority scoring 3 and 4. This shows that as compared to the pretest scores which were between 1 and 3, the experimental group has far much better scores which can be largely attributed to the impact of the ideation process. Thus, the hypothetical explanation is that there is a statistically significant relationship between the ideation stage and teacher material utilization creativity.

4.2.4 Scores on Teacher Material Utilization Creativity Constructs for Prototype and Testing

In Table 4.2.7 below data is presented on how the control and experimental groups scored at the pretest. Prototyping and testing were measured using the same constructs because they often occur concurrently in an iterative manner which makes it hard to separate them.

Table 4.2. 7

Pretest scores from teacher material utilization creativity constructs in Prototype and Testing

Creativity Attribute	Control Group			Experimental Group		
Multi-disciplinary	Pre-test Scores			Pre-test Scores		
	Score	Freq	%	Score	Freq	%
	1	21	70	1	24	80
	2	9	30	2	6	20
	3			3		
	4			4		
	5			5		
Material Competence	1	11	36.7	1	17	56.7
Assessment	2	19	63.3	2	13	43.3
	3			3		
	4			4		
	5			5		
Appropriate for	1	1	3.3	1	6	20
Age/level	2	29	96.7	2	21	70
	3			3	3	10
	4			4		
	5			5		

Source: Primary Data, 2020

Table 4.2.7 above presents the scores that participants obtained for both the control and experimental groups at the pretest. The table presents frequencies and the percentage of participants that obtained a given score on three different indicators that were used to measure competencies related to prototyping and testing for teacher material utilization creativity. The data presented hereafter is for the pretest scores.

Pretest Data: Before introducing the intervention, the control group participants had 70% of the participants scoring 1 and 30% scored 2 well as in the experimental group 80% scored 1 and 20% scored 2 in multi-disciplinary competencies of material utilization creativity. In the ability to access material competencies, 36.7% of the participants scored 1, followed by 63.3% who scored 2 in the control group, well as 56.7% scored 1 and 43.3% scored 2 in the experimental group. In the ability to select material that was age and level-appropriate, the control group participants had 3.3% scored 1 and 96.7% scored while the experimental group had 20% scored 1, 70% scored 2 and 10% scored 3 respectively. The two data sets were analyzed and presented using the statistical Figure 4.2.6 below

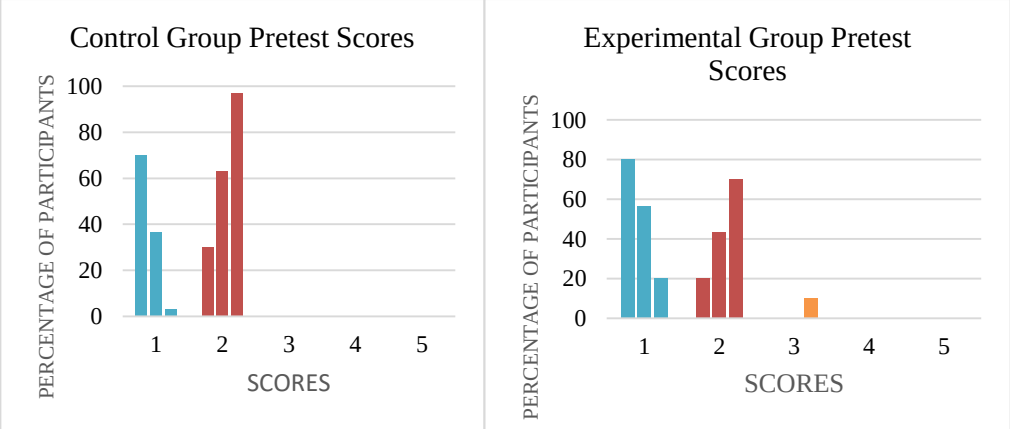

Figure 4.2. 7

Comparing Control and Experimental Groups at Post-Test in Prototype and Testing

Source: Primary Data, 2020

In Figure 4.2.6 above, the percentage scores in the control group showed that on average 35.9% of the participants scored 1 while in the experimental group, the average score of 1 was 52.2% of the total participants which gives the impression that the majority of the participants in the experimental group were scoring lower points as compared to those in the control group. Similarly, in

scores 2 and 3 the average percentage of the scores were generally of lower quality in the experimental group however, the difference cannot affect comparing the two groups. The following table presents the post-test data of prototyping and testing.

Table 4.2. 8

Posttest scores from Teacher material utilization creativity constructs for Prototype and Testing

Creativity Attribute	Control Group			Experimental Group		
Multi-disciplinary	Post-Test scores			Post-Test scores		
	Score	Freq	%	Score	Freq	%
	1	18	60	1	-	-
	2	9	30	2	6	20
	3	3	10	3	18	60
	4			4	5	16.7
	5			5	1	3.3
Material Competence	1	5	16.7	1	-	-
Assessment	2	22	73.3	2	9	30
	3	3	10	3	13	43.3
	4			4	7	23.3
	5			5	1	3.3
Appropriate for	1	-	-	1	-	
Age/level	2	15	50	2	7	23.3
	3	15	50	3	17	56.7
	4			4	4	13.3
	5			5	2	6.7

Source: Primary Data, 2020

Post-Test: After introducing the intervention, the participants were subjected to a post-test observation and had scores as presented below. In multi-disciplinary competencies, the control group had 60% scored 1, followed by 30% scored 2 and 10% scored 3 while in the experimental group, 20% scored 2, 60% scored 3, 16.7% scored 4 and 3.3% scored 5. In the material competence assessment, the control group participants had 16.7% scoring 1, 73.3% scored 2, and 10% scored 3 while in the experimental group, 30% scored 2 followed by 43.3% with 3 then 23.3% with 4 and 3.3% of the participants with 5 and in the ability to meet age and level appropriately, the control group participants had

50% score 2 and again 50% scored 3 well as in the experimental group had 23.3% score 2, 56.7% scored 3, followed by 13.3% with 4 and 6.7% scored 5. The statistical relationship between the two data sets is analyzed and presented using Figure 4.2.7 below.

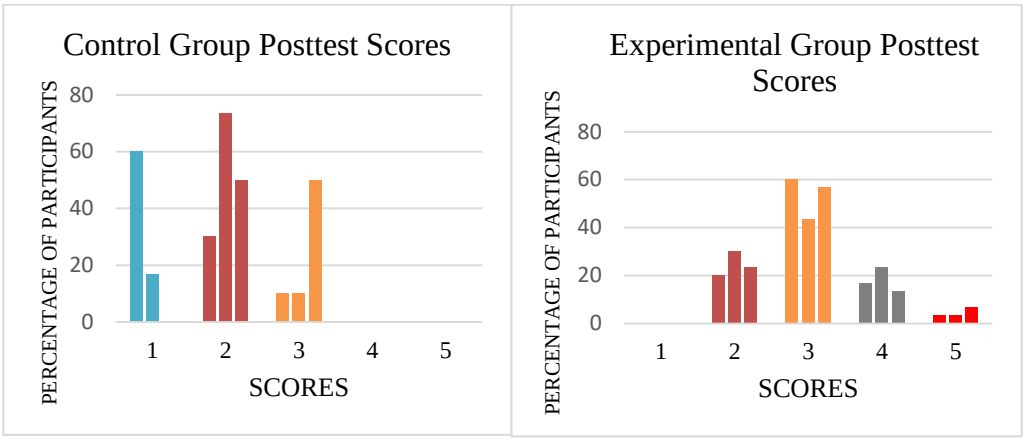

Figure 4.2. 8

Comparing Control and Experimental Groups at Post-Test in Prototype and Testing

Source: Primary Data, 2020

The analysis in Figure 4.2.7 shows a drop in the percentage of participants that scored 1 in the control group at the pretest with now the majority of the participants in scores 2 and 3 which means that there was an improvement in the quality of grades for the control group as well but when compared to the experimental group the scores are seen to have a much bigger difference with zero scores in 1 and most of the participants scoring between 3 and 5. This shows that the participants in the experimental group performed much better than those of the control group after the intervention was introduced. On the whole, we can say that the ideation level had an impact on the quality of teacher material utilization creativity in the experimental group.

4.3 The effect of the Art World Design Thinking Process on Teacher Methodological Creativity

The second objective was concerned with establishing if there was an effect on Teacher Methodological Creativity from the Art World Design Thinking Process. With the argument that the Art World Design Thinking Process would boost Teacher Methodological Creativity in the way the teachers approach the application of teaching methods. To understand this, a pretest and posttest observation was subjected to the participants to measure the level of methodological creativity at different points.

The experimental group was to receive the treatment on top of the ongoing university program and the control group was to continue on the program without any special treatment after which a posttest would be given to determine the difference in the effect of the intervention. The measure was done on the five stages of the art world design process with the understanding that these are capable of improving a teacher's creativity through design thinking. To measure these steps, ten creativity indicators were identified and measured. The data presented below is how participants faired at the pretest and posttest respectively.

4.3.1 Scores on Teacher Methodological Creativity Constructs for Empathizing

Table 4.3.1 below presents data on constructs that were used to measure participants' level of methodological creativity. A pretest observation was carried out on both the control and experimental groups. This data is presented alongside the post-test observation data that was collected after introducing the intervention. The two sets of data are presented in the table below against each

other to draw a comparison between the scores. Frequencies and percentages are used.

Table 4.3. 1

Pretest Scores from Teacher Methodological Creativity Constructs for Empathizing.

Creativity Attribute	Control Group			Experimental Group		
Ability to Act Situational	Pre-test Scores			Pre-test Scores		
	Score	Freq	%	Score	Freq	%
	1	6	20	1	26	86.7
	2	21	70	2	4	13.3
	3	3	10	3		
	4			4		
	5			5		
Teachers' ability to envisage methods applicability.	1	1	3.3	1	19	63.3
	2	17	56.7	2	11	36.7
	3	12	40	3		
	4			4		
	5			5		

Source: Primary Data, 2020

Table 4.3.1 above presents both pretest and post-test scores for the experimental and control groups. The number of frequencies for a given score is tabulated as a percentage to represent a fraction of the participants that had that particular score.

Pretest: Before administering the intervention, a baseline was conducted in a pretest to get a picture of the level of competence at which the participants were. In the ability to act situational, among the control group participants 20% scored 1, 70% scored 2, and 10% scored 3 at the pretest well as the experimental group had 86.7% and 13.3% scored 1 and 2 respectively and in the ability to envisage methods applicability, 3.3% of the control group participants scored 1, 56.7% scored 2 and 40% scored 3 well as in the experimental group 63.3% scored 1and 36.7% scored 2 before the intervention. The two data sets at the pretest were compared to establish the relationship using Figure 4.3.1 below

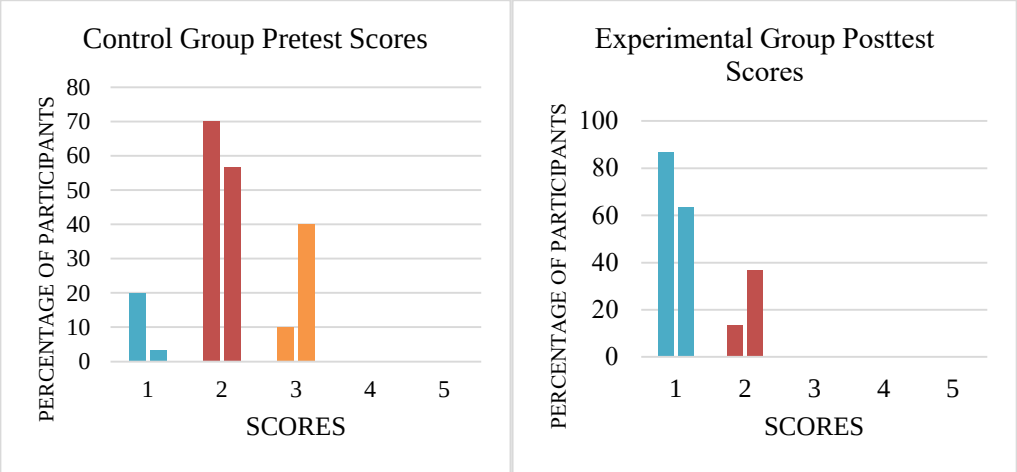

Figure 4.3. 1

Comparing Control and Experimental Groups at Pre-Test in Empathizing.

Source: Primary Data, 2020

Figure 4.3.1 shows the majority of the participants in both the control and experimental groups scored between 1 and 3 which shows that they are generally weaker in the two creativity indicators for empathizing. Well as they are both generally weak, the experimental group is 20.4% weaker than the control group. This shows that at the pretest the control group was performing better than the experimental group. Below is Table 4.3.2 with post-test data on empathizing

Table 4.3. 2

Posttest Scores from Methodological Creativity Construct for Empathizing.

Creativity Attribute	Control Group Post-Test scores			Experimental Group Post-Test scores		
	Score	Freq	%	Score	Freq	%
Ability to Act Situational	1	-	-	1	-	-
	2	25	83.3	2	2	6.7
	3	5	16.7	3	9	30
	4			4	12	40
	5			5	7	23.3
Teachers' ability to envisage methods applicability.	1	2	6.7	1	-	-
	2	13	43.3	2	5	16.7
	3	15	50	3	8	26.7
	4			4	14	46.6
	5			5	3	10

Source: Primary Data, 2020

Posttest: After introducing the intervention, a post-test observation was done on both the control and experiment groups and in the ability to act

situational, 83.3% of the control group scored 2 and 16.7% scored 3 well as the experimental group had 23.3% of the participants score 2, 56.7% scored 3, 13.3% scored 4 and 6.7% scored 5. In the teacher's ability to envisage methods applicability, we noticed that the control group had 6.7% of the participants score 1, 43.3% scored 2 while 50% scored 3 and those in the experimental group had 16.7% of the participants scored 2, 26.7% scored 3, 46.6% scored 4 and 10% scored 5. The results showed a notable contrast between the two groups. While the control group exhibited only a slight change in scores between the pretest and posttest, the experimental group demonstrated a significant improvement in posttest scores compared to their pretest performance. This suggests that the intervention had a considerable impact on the participants in the experimental group, highlighting the effectiveness of the treatment applied in the study. See Figure 4.3.2 below for analysis.

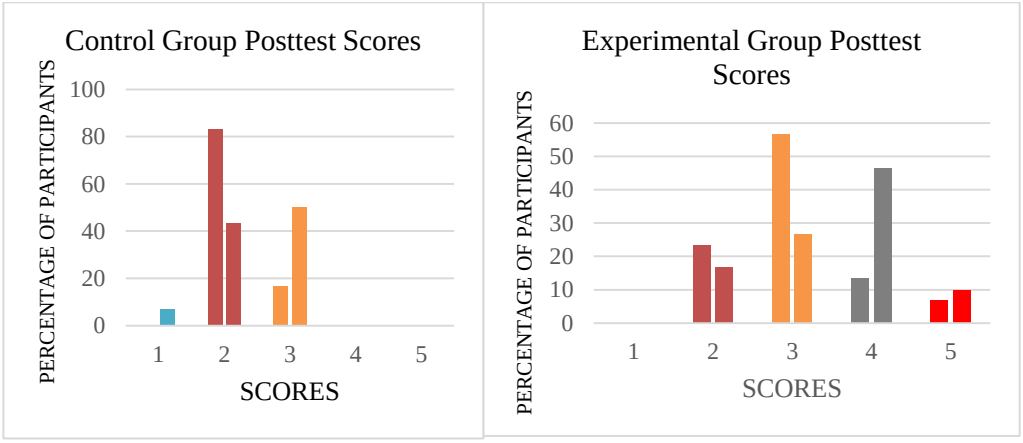

Figure 4.3. 2

Comparing Control and Experimental Groups at Post-Test in Empathizing

Source: Primary Data, 2020

In Figure 4.3.2 above, the scores in the control group showed a slight improvement where we see a rise in the participants who scored 2 and those who scored 1 reduced slightly, the participants in the experimental group had a

significant rise of participant scores from the majority scoring 1 and 2 in the pretest to majority scoring 3 to 5 at posttest. The significance of the difference in the scores is attributed to the introduction of the intervention to the experimental group.

4.3.2 Scores on Teacher Methodological Creativity Constructs for Define

The table below 4.3.2 presents data on the define stage of the design process. The data was obtained using the observation true which was developed to measure the teacher's fluency in employing thoughts related to how define is used in the art world design process. Data is in two sets one for the control group and the other for the experimental group both before and after the intervention.

Table 4.3. 3

Pretest Scores from Teacher Methodological Creativity Constructs for Define.

Creativity Attribute	Control Group Pre-test Scores			Experimental Group Pre-test Scores		
How close is the delivery to the plan	Score	Freq	%	Score	Freq	%
	1	4	13.3	1	12	40
	2	23	76.7	2	18	60
	3	3	10	3		
	4			4		
	5			5		
Opportunity for learners to demonstrate ideas	1	2	6.7	1	5	16.7
	2	17	56.7	2	23	76.7
	3	11	36.6	3	2	6.7
	4			4		
	5			5		

Source: Primary Data, 2020

From the table above 4.3.3, the scores were obtained from two creativity constructs that were used to observe the define abilities of the participants at the pretest as presented here under;

Pretest: For purposes of attaining the baseline information that would be used to measure the extent of the treatment has an effect, a pretest was conducted on the ability to assess how close the delivery was to the plan and we had 13.3%

of the control group participants score 1, 76.7% scored 2 and 10 scored 3 well as those in the experimental group had 40% scoring 1 and 60% scored 2. In the ability to offer learners an opportunity to demonstrate ideas, the control group participants had 6.7% score 1, 56.7% scored 2 while 36.6% of the participants scored 3 well as in the experimental group we had 16.7% of the participants scored 1, 76.7% scored 2 while 6.6% scored 3. The figures at the pretest were able to give us a picture that the two groups were comparable and that the control group was performing slightly better than the experimental group. Below is Figure 4.3.3 showing how data was analyzed using percentages of participants against scores.

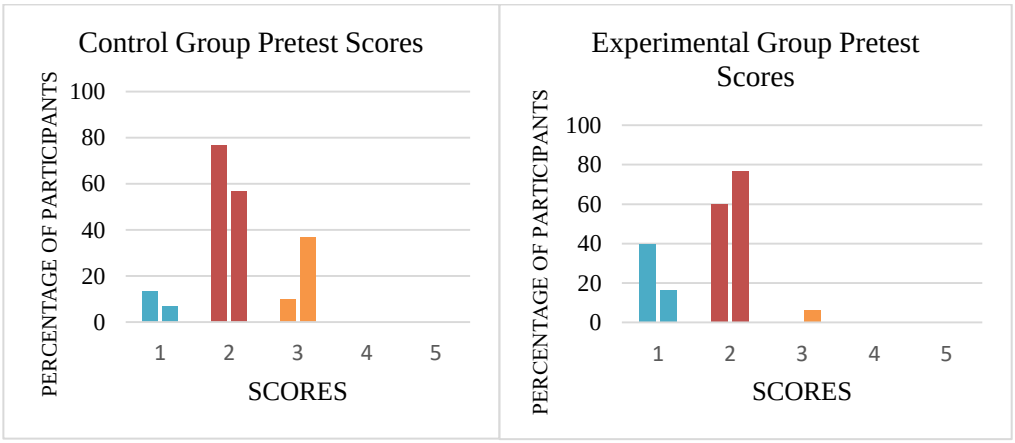

Figure 4.3. 3

Comparing Control and Experimental Groups at Pre-Test in Define

Source: Primary Data, 2020

In Figure 4.3.3 above, the percentages of the participants show that well as majority of the participants in the two groups scored between 1 and 2. There is a slight difference between the performance of the control and experimental group. With the majority of the participants in the experimental group scoring 1 this eludes to the fact that generally, the control group participants were better than those of the experimental group in define at pretest.

Table 4.3. 4

Posttest Sores from Teacher Methodological Creativity Constructs for Define

Creativity Attribute	Control Group Post-Test scores			Experimental Group Post-Test scores		
	Score	Freq	%	Score	Freq	%
How close is the delivery to the plan	1	5	16.7	1	-	-
	2	16	53.3	2	2	6.7
	3	9	30	3	8	26.7
	4			4	13	43.3
	5			5	7	23.3
Opportunity for learners to demonstrate ideas	1	2	6.7	1	-	-
	2	19	63.3	2	4	13.3
	3	9	30	3	4	13.3
	4			4	20	66.7
	5			5	2	6.7

Source: Primary Data, 2020

Posttest: After introducing the intervention there was a need to observe and compare how participants were performing. It is in this vein that we observed the ability to assess the closeness of the delivery to the plan and participants in the control group had 16.7% scoring 1, 53.3% scored 2 and 30% scored 3 well as in the experimental group 6.7% of the participants scored 2 followed by 26.7% that scored 3 then 43.3% with 4 and 23.3% scored 5. In the ability to to offer learners an opportunity to demonstrate ideas the control group had 6.7% of the participants score 1, followed by 63.3 % scoring 2 and 30% scoring 3 well as the experimental group had 13.3% of the participants scoring 2, 13.3% scored 3, 66.7% scored 4 and 6.7% scored 5. The control group displayed scores ranging between 1 and 3 throughout the study. However, at the posttest phase, a significant shift was observed in the experimental group, with most participants scoring between 3 and 5. This considerable improvement, as illustrated in Figure 4.3.4 below, highlights the impact of the intervention applied to the experimental group, indicating that it led to a higher level of performance compared to the control group.

Figure 4.3. 4

Comparing Control and Experimental Groups at Post-Test in Define

Source: Primary Data, 2020

In the above Figure 4.3.4, the scores at posttest show that as compared to the pretest the participants in the control group had a slight rise with the number of participants shifting from majority scoring one to re-distributing between 1 and 3. In the experimental group scores significantly rose from between 1 and 3 to a significant percentage of participants scoring between 3 and 5. This significant difference can be attributed to several factors but considering the baseline scores we can arguably attribute this to the intervention of the art world design process.

4.3.3 Scores on Teacher Methodological Creativity Constructs for Ideate

The table below presents data scores for the control and experiment groups on the creativity construct that were used to measure how ideate was used by the participants before the intervention. Table 4.3.5 used frequencies of scores and participant percentages to compare the scores from the two groups.

Table 4.3. 5

Pretest scores from Teacher Methodological Creativity Constructs for Ideate.

Creativity Attribute	Control Group Pre-test Scores			Experimental Group Pre-test Scores		
	Score	Freq	%	Score	Freq	%
Dynamic Use of Methods	1	19	63.3	1	26	86.7
	2	11	36.7	2	4	13.3
	3			3		
	4			4		
	5			5		
A variety of ideas from learners used	1	10	33.3	1	15	50
	2	20	66.7	2	15	50
	3			3		
	4			4		
	5			5		
Engaging learners to model planned activities	1	1	3.3	1	8	26.7
	2	24	80	2	21	70
	3	5	16.7	3	1	3.3
	4			4		
	5			5		

Source: Primary Data, 2020

In Table 4.3.5, percentages are presented against scores for the control and experimental groups. The table compares scores at pretest as presented below;

Pretest: Before introducing the intervention, a baseline was conducted in the form of a pretest to get a picture of the level of competence at which the participants were before the intervention. In the ability to use methods dynamically, the control group participants 63.3% score 1 and 36.7% scored 2 at the pretest well as the experimental group had 86.7% score 1 and 13.3% scored 2. In the ability to use a variety of ideas from learners, 33.3% of the control group participants scored 1 and 66.7% scored 2 while in the experimental group, 50% scored 1 and another 50% of the participants scored 2 and in the ability to engage learners to model planned activities 3.3% of the participants in the control group scored 1 followed by 80% with 2 and 16.7% with score 2 well as the experimental group had 26.7% of its participants score 1, followed by 70% who

scored 2 and 3.3% scored 3. The two data sets at the pretest were analyzed to establish the difference between the two groups and Figure 4.3.5 below presents this;

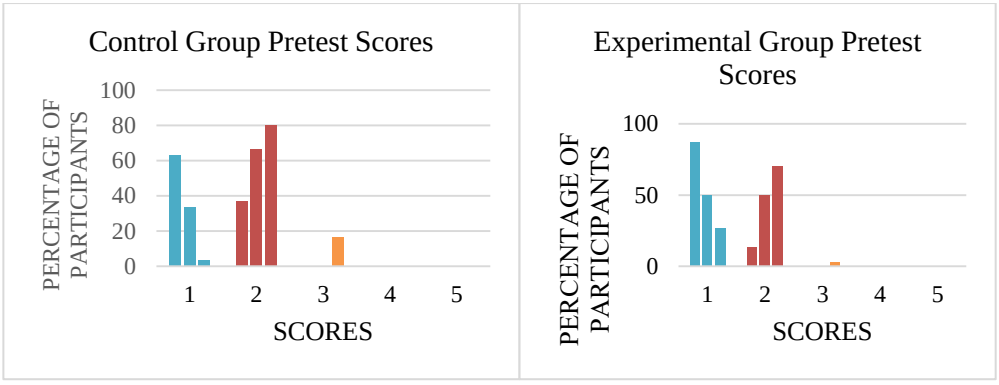

Figure 4.3. 5

Comparing Control and Experimental Groups at Pre-Test in Ideate

Source: Primary Data, 2020

In Figure 4.3.5 above the comparison of the graphs shows that well as both groups scored between 1 and 3, the experimental group had the majority of the participants in category score 1 yet the control group has a fairer distribution between 1,2 and 3. This implies that despite the scores being in the same range, the participants in the control group were generally better at the pretest. However, the two groups were found to be comparable.

Table 4.3. 6

Posttest Scores from Teacher Methodological Creativity Constructs for Ideate.

Creativity Attribute	Control Group			Experimental Group		
Dynamic Use of Methods	Post-Test scores			Post-Test scores		
	Score	Freq	%	Score	Freq	%
	1	16	53.3	1	-	-
	2	12	40	2	1	3.3
	3	2	6.7	3	21	70
	4			4	7	23.3
	5			5	1	3.3
A variety of ideas from learners used	1	2	6.7	1	-	-
	2	15	50	2	5	16.7
	3	13	43.3	3	9	30
	4			4	15	50
	5			5	1	3.3
Engaging learners to model planned activities	1	8	26.7	1	-	-
	2	14	46.6	2	6	20
	3	8	26.7	3	9	30
	4			4	11	36.7
	5			5	4	13.3

Source: Primary Data, 2020

Posttest: After introducing the intervention a second observation as a posttest was done to observe and compare how participants were performing. Here we observed that in the ability to use methods dynamically, participants in the control group had 53.3% scoring 1, 40% scored 2 and 6.7% scored 3 well as in the experimental group 3.3% of the participants scored 2 followed by 70% that scored 3, 23.3% scored 4 and 3.3% scored 5. In the ability to use a variety of ideas from learners the control group had 6.7% of the participants score 1, followed by 50 % scoring 2 and 43.3% scoring 3 well as the experimental group had 16% scored 2, 30% of the participants scoring 3, 50% scored 4 and 3.3% scored 5 and in the ability to engage learners to model planned activities the control group participants had 26.7% scoring 1, 46.6% scored 2 and 26.7% scored 3 well as the experimental participants had 20% scoring 2, 30% scored 3, 36.7% scored 4 and 13.3% scored 5. Well as the scores in the control group

continued to range from 1 to 3, we noticed that of the experimental group significantly increasing to most of the participants scoring between 3 to 5 as presented in Figure 4.3.6 below;

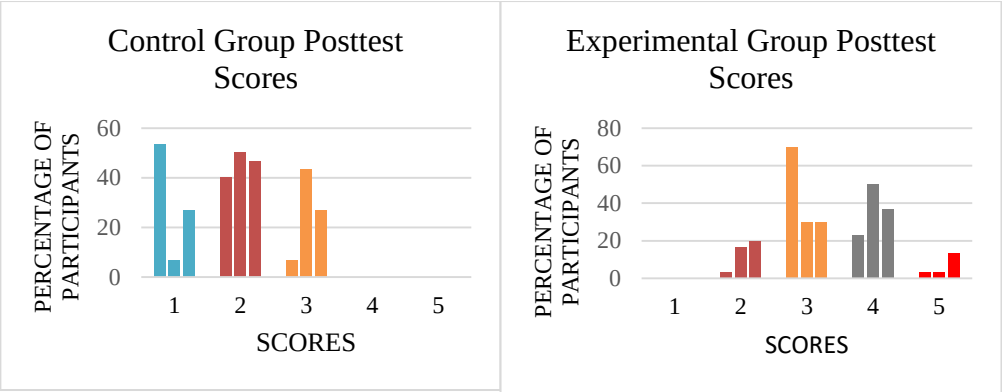

Figure 4.3. 6

Comparing Control and Experimental Groups at Post-Test in Ideate

Source: Primary Data, 2020

In above Figure 4.3.6, the scores at posttest show that as compared to the pretest the participants in the control group had a slight rise with the number of participants shifting from majority scoring one to redistribution between 1 and 3 well as in the experimental group scores significantly rose from between 1 and 3 to a significant percentage of participants scoring between 3 and 5. This significant difference can be attributed to several factors but considering the baseline scores we can arguably attribute this to the intervention of the art world design process.

4.3.4 Data on Teacher Methodological Creativity Constructs for Prototyping and Testing

The table below presents data scores for the control and experiment groups on the creativity construct that were used to measure how prototyping and testing were used by the participants in methods before and after the intervention. Three constructs were used to measure competencies related to prototyping and testing.

The table used frequencies of scores and participant percentages to illustrate how the scores at the pretest relate to those at the posttest.

Table 4.3. 7

Pretest scores from methodological creativity constructs for Prototyping and Testing

Creativity Attribute	Control Group			Experimental Group		
Variety of methodological	Pre-test Scores			Pre-test Scores		
Connections	Score	Freq	%	Score	Freq	%
	1	18	60	1	30	100
	2	12	40	2		
	3			3		
	4			4		
	5			5		
Flexible with learners'	1	10	33.3	1	21	70
options or Alternatives	2	20	66.7	2	9	30
	3			3		
	4			4		
	5			5		
Learners can take over to	1	4	13.3	1	13	43.3
display skills	2	24	80	2	17	56.7
	3	2	6.7	3		
	4			4		
	5			5		

Source: Primary Data, 2020

In Table 4.3.4 Prototyping and testing data is presented. Three constructs were used to measure the extent to which teachers were able to exhibit prototype and test tendencies. They included the ability to exhibit a variety of methodological connections, flexibility with learner options and provisions to allow learners to take over and display skills. The analysis below is a comparison between the pretest observations.

Pretest: Before introducing the intervention, it was necessary to capture the level at which the participants were as a basis for comparison between before and after as this would show if the intervention had an effect. The control participants when observed in the ability to exhibit a variety of methodological connections at the pretest had 60% of the participants score 1 and 40% scored 2 well as the experimental group participants had 100% score 1. In the flexibility

with learner's options, the control group participants had 33.3% scored 1 and 66.7% scored 2 well as the experimental group participants had 70% scored 1 and 30% scored 2. In the flexibility to allow learners to take over lessons and display skills, the control group participants had 13.3% of their participants scored 1, 80% of them scored 2 and 6.7% scored 3 well as in the experimental group, 43.3% of the participants scored 1 and 56.7% scored 2. Figure 4.3.7 compares the two data sets statistically

Figure 4.3. 7

Comparing Control and Experimental Groups at Pre-Test in Prototype and Test

Source: Primary Data, 2020

From Figure 4.3.7 above, the analysis showed that the scores were between 1 and 3 for both groups which generally makes these groups comparable despite their minimal differences in the range of scores, the control group had the participants scoring 1 to 3 on average well as majority of the experimental group participants scored 1 and 2 which implied that the control group participants were relatively better as compared to the experimental group. This is followed by the data set obtained at post-test observation.

Table 4.3. 8

Posttest Scores from Teacher Methodological Creativity Constructs for Prototyping and Testing

Creativity Attribute	Control Group			Experimental Group		
Variety of methodological Connections	Post-Test scores			Post-Test scores		
	Score	Freq	%	Score	Freq	%
	1	22	73.3	1	1	3.3
	2	8	26.7	2	2	6.7
	3			3	14	46.7
	4			4	9	30
	5			5	4	13.3
Flexible with learners' options or Alternatives	1	11	36.7	1	1	3.3
	2	13	43.3	2	5	16.7
	3	6	20	3	11	36.7
	4			4	10	33.3
	5			5	3	10
Learners can take over to display skills	1	5	16.7	1	1	3.3
	2	21	70	2	1	3.3
	3	4	13.3	3	17	56.7
	4			4	9	30
	5			5	2	6.7

Source: Primary Data, 2020

Posttest: After introducing the art world design thinking process to the participants in the experimental group, a second set of observations was done on both the control and experimental groups. Three creativity constructs were observed and the scores showed that; in the ability to exhibit a variety of methodological connections, the control group participants had 73.3% of the participants score 1 and 26.7% scored 2 well as those in the experimental group 3.3% of the participants score 1, 3.3% scored 2, 46.7% scored 3, 30% scored 4 and 13.3% scored 5. In the flexibility with learners options, the control group had 36.7% of participants scored 1, 43.3% scored 2 and 20% scored 3 well as those in the experimental group 3.3% of the participants scored 1, followed by 16.7% scored 2, then 36.7% with 3, 33.3% scored 4 and 10% scored 5 and in the flexibility with learners taking over the lesson to display skills, the control group

had 16.7% of the participants score 1, 70% scored 2 and 13.3 scored 3 well as the experimental group had 3.3% score 1, 3.3% score 2, 56.7% scored 3 followed by 30% who scored 4 and 6.7% scored 5. The figure below compares the two data sets statistically;

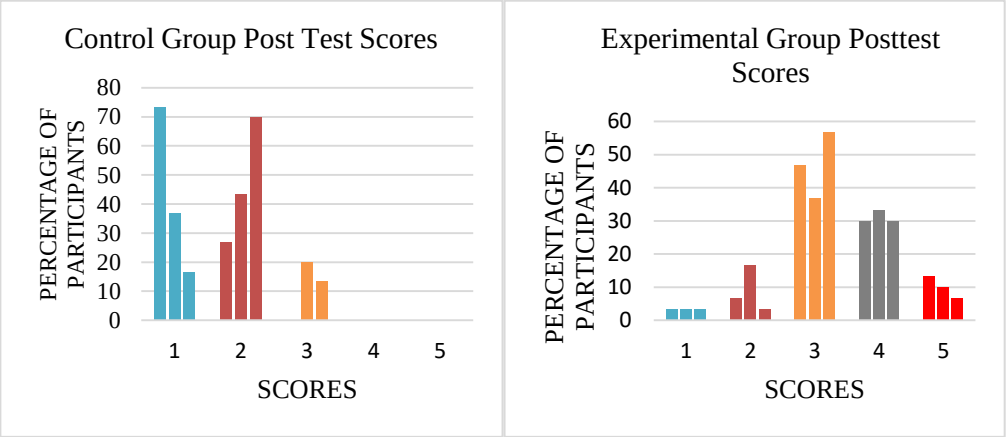

Figure 4.3. 8

Comparing Control and Experimental Groups at Post-Test in Prototype and Test

Source: Primary Data, 2020

The analysis in Figure 4.3.8 shows that as the control group had continued to generally score between the range of 1 to 3, a drift is observed where more of the participants scored 2 as compared to those of the pretest where the majority were scoring 1 well as in the experimental group we observed that the participants scores ranged between 1 to 5 with the majority of the participants scoring 3 to 5. When compared, the difference in the experimental group was stronger than that of the control group. This can be attributed to the art world design process.

4.4 The effect of the Art World Design Thinking Process on Teacher Spaces Utilization Creativity

In objective four we were interested in studying the effect of the Art World Design Thinking Process on Teacher Space Utilization Creativity. The focus

was on how creative were the teachers would be different after the intervention on space planning and use.

4.4.1 Score on Teacher Spaces Utilization Creativity-related constructs in Empathizing

To measure empathizing at prototyping and testing, one construct was measured against teacher space utilization creativity that would reflect empathy. From which two data sets were obtained and presented as pretest observations data. Below in table 4.4.1 pretest data is presented;

Table 4.4. 1

Pretest scores from Teacher Spaces Utilization Creativity Constructs for Empathizing.

Creativity Attribute Flexibility	Control Group Pre-test Scores			Experimental Group Pre-test Scores		
	Score	Freq	%	Score	Freq	%
	1	-	-	1	16	53.3
	2	20	66.6	2	13	43.3
	3	10	33.3	3	1	0.33
	4			4		
	5			5		

Source: Primary Data, 2020

Pretest: Before introducing the concepts of prototyping and testing, an observation was done on both the control and experimental group and as in table 4.4.1, in the flexibility as an indicator of empathy 66.7% of the participants scored 2, and 33.3% with 3 in the control group well as in the experimental group, 53.3% scored 1, 43.3% scored 2 and 3.3% scored 3. The figures showed that well as the range for both groups was between 1 to 3, the experimental group significantly had more participants scoring 1 an indication that they had weaker scores. Below is a statistical figure 4.4.1 was used to compare the two groups;

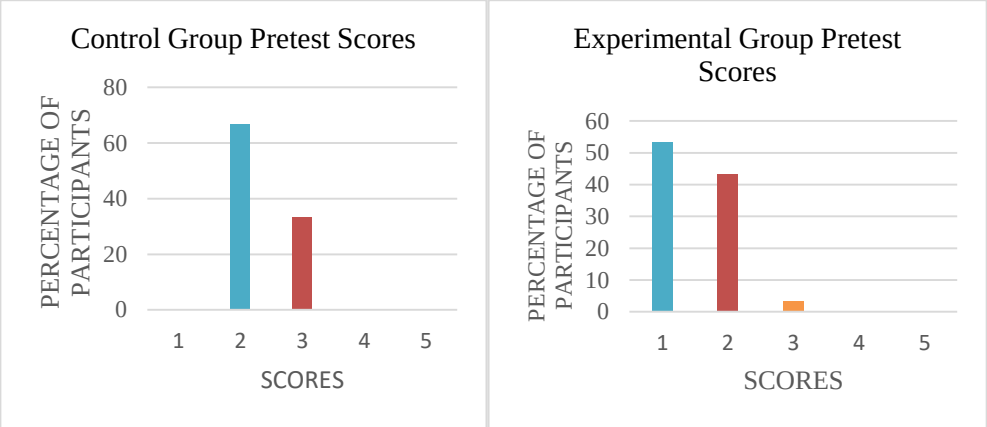

Figure 4.4. 1

Comparing Control and Experimental Groups at Pre-Test in Empathizing

Source: Primary Data, 2020

The statistical graph 4.4.1 shows that more participants scored 1 in the experimental group as compared to the control group. Having a majority score of 1 showed that the participants were at a relatively similar level. The control group was better in the constructs of flexibility as used by the teachers in space utilization creativity. The following table 4.4.2 presents data from the post-test observation.

Table 4.4. 2

Posttest Scores from Teacher Spaces Utilization Creativity Constructs for Empathizing.

Creativity Attribute Flexibility	Control Group Post-Test scores			Experimental Group Post-Test scores		
	Score	Freq	%	Score	Freq	%
	1	19	63.3	1	-	-
	2	10	33.3	2	-	-
	3	1	3.3	3	16	53.3
	4			4	12	40
	5			5	2	6.7

Source: Primary Data, 2020

Posttest: After the pretest, the art world design process was introduced to the experimental group and after some time a posttest observation was done on the two groups with 63.3% of the participants in the control group scoring 2, followed by 33.3% who scored 3 and 3.3% scored 4 in the ability to be flexible

with space utilization constructs well as in the experimental group had 53.3% of the participants scoring 3, 40% scored 4 and 6.7% scored 5. The two data sets were compared using the statistical graph below;

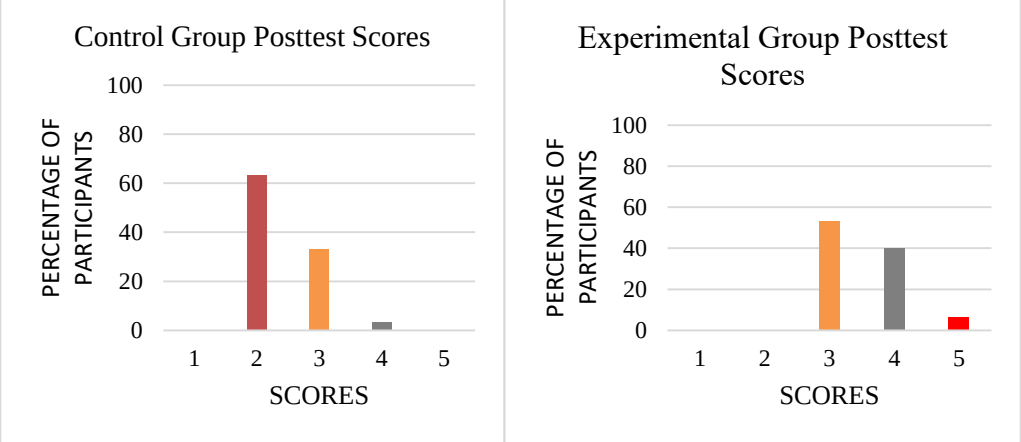

Figure 4.4. 2

Comparing Control and Experimental Groups at Post-Test in Empathizing

Source: Primary Data, 2020

The analysis in Figure 4.4.2 showed that the control group participants scored in a range of 2 to 4though more of its participants made a slight improvement with more scores in 2 as compared to the pretest level where the majority were scoring 1, the participants in the experimental group exhibited a drastic improvement from scores in a range of 1 to 3 to score between 3 to 5 with 40% scoring 4. The analysis shows that there was a statistically significant difference in scores at the posttest.

4.4.2 Pretest scores from Teacher Spaces Utilization Creativity constructs for Define

To be able to understand the difference define would make in the aspect of space utilization creativity there was a need for a pretest which would give us the level of competence the participants had in this form of creativity while working with children. Table 4.4.3 presents pretest data on define.

Table 4.4. 3

Pretest scores from Teacher Spaces Utilization Creativity constructs for Define.

Creativity Attribute	Control Group			Experimental Group		
Engaging Learners in conception approval	Pre-test Scores			Pre-test Scores		
	Score	Freq	%	Score	Freq	%
	1	17	56.7	1	21	70
	2	13	43.3	2	9	30
	3			3		
	4			4		
	5			5		

Source: Primary Data, 2020

Pretest: Before introducing the intervention there was a need to understand how the two groups were fairing in the concepts of define as it applies to teacher space utilization creativity. Engaging learners in conception approval of spaces was used to measure define and from the observations made the control group participants had 56.7% out of the total scored 1 and the remaining 43.3% scored 2 well as the experimental group had 70% and 30% of the participants score 1 and 2 respectively. The statistical graph 4.4.3 below was used to analyze the differences

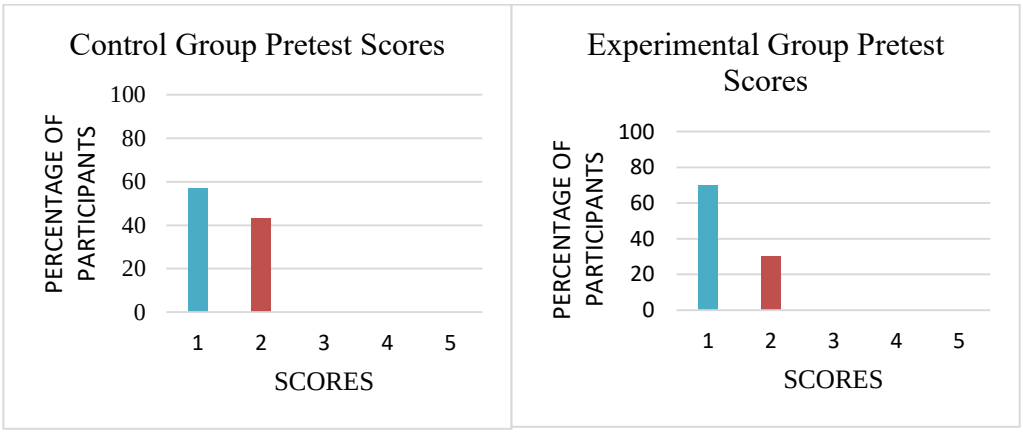

Figure 4.4. 3
Comparing Control and Experimental Groups at Pre-Test in Define
Source: Primary Data, 2020

The statistical Figure 4.4.3 shows that well as both groups have a score range of 1 to 2, the control group participants got 56.7% scoring 1 while the

experimental group shows a 70% score of 1 which shows that the majority of its participants were relatively weaker as compared to those in the control group. Below is the posttest data in Table 4.4.4;

Table 4.4. 4

Posttest scores from Teacher Spaces Utilization Creativity constructs for Define.

Creativity Attribute	Control Group			Experimental Group		
Engaging Learners in conception approval	Post-Test scores			Post-Test scores		
	Score	Freq	%	Score	Freq	%
	1	9	30	1	-	-
	2	16	53.3	2	-	-
	3	5	16.7	3	22	73.3
	4			4	8	26.7
	5			5		

Source: Primary Data, 2020

Posttest: After introducing the art world design process there was a need to re-observe the participants to establish if this had made a significant difference. Engaging learners in space conception approval was re-observed and from the control group, participants 30% obtained 1 followed by 53.3% who scored 2 and 16.7% scored 3 while in the experimental group, 73.3% of the participants scored 3 and 26.7% scored 4. This was analyzed to show the difference using a statistical graph 4.4.4 below

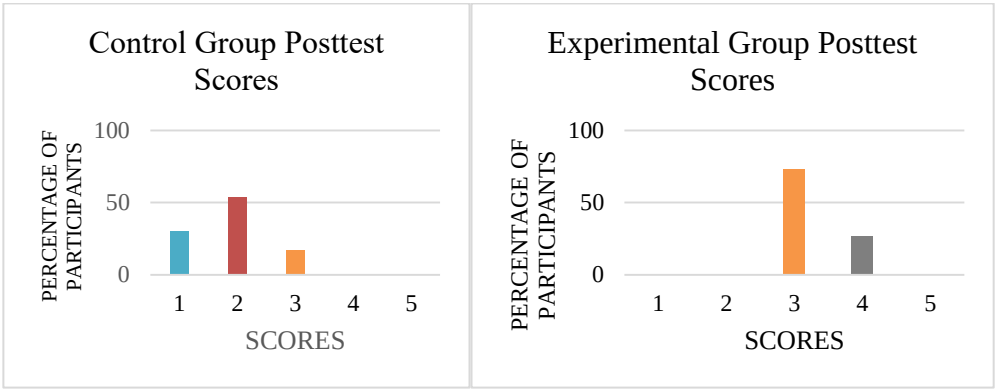

Figure 4.4. 4

Comparing Control and Experimental Groups at Post-Test in Define

Source: Primary Data, 2020

From the statistical Figure 4.4.4 above the control group participants scored between 1 and 3 though with a slight improvement where majority still scored 2 well as in the experimental group the scores are between 3 and 4 with no participants with scores below 3 as earlier scored in the pretest. This explains the level of difference.

4.4.3 Pretest scores from Teacher Spaces Utilization Creativity Constructs for Ideate

Before the intervention, a pretest observation was done on both the control and experimental groups as a basis for drawing on the differences between the two groups and to ascertain if the two groups were comparable below is the presentation of the data from Ideate;

Table 4.4. 5

Pretest Scores from Teacher Spaces Utilization Creativity Constructs for Ideate.

Creativity Attribute	Control Group			Experimental Group		
Space Conception	Pre-test Scores			Pre-test Scores		
	Score	Freq	%	Score	Freq	%
	1	29	96.7	1	30	100
	2	1	3.3	2		
	3			3		
	4			4		
	5			5		
Variety of Space Plans	1	22	73.3	1	20	66.7
	2	8	26.7	2	10	33.3
	3			3		
	4			4		
	5			5		

Source: Primary Data, 2020

Pretest: After the pretest observation the control group participants had 96.7% with a score of 1 and 3.3% scored 2 respectively in space conception well as in the same construct, the experimental group participants had 100% 1. In a variety of space plans for a given space the control group participants 73.3% scored 1 followed by 26.7% who scored 2 while the experimental group 66.7%

scored 1 followed by 33.3% who scored 2. This was analyzed using the statistical graph 4.4.5 below;

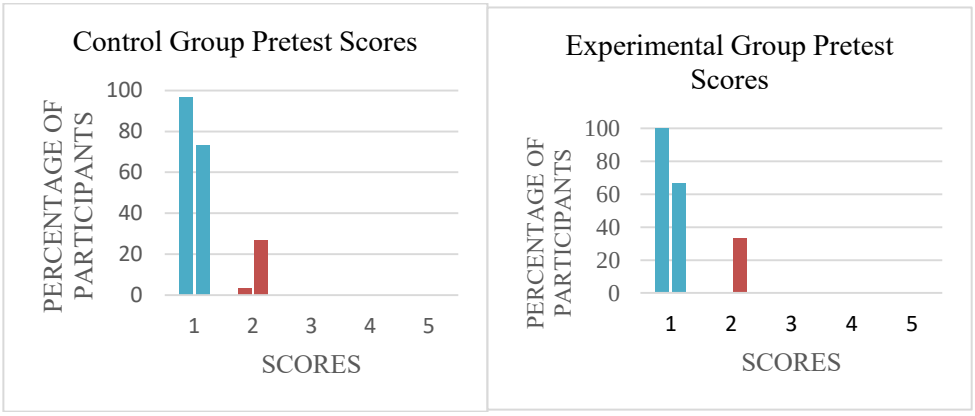

Figure 4.4. 5

Comparing Control and Experimental Groups at Pre-Test in Ideate

Source: Primary Data, 2020

Statistical figure 4.4.5 shows that well as both the control and the experimental group scored in a range of 1 to 2, the experimental group had a higher percentage of participants that scored 1. Despite this difference, both groups were relatively weak in space ideation as compared to other creativity indicators. Below is the post-test data

Table 4.4. 6

Posttest Scores from Teacher Spaces Utilization Creativity Constructs for Ideate.

Creativity Attribute	Control Group			Experimental Group		
Space Conception	Post-Test scores			Post-Test scores		
	Score	Freq	%	Score	Freq	%
	1	27	90	1	3	10
	2	3	10	2	21	70
	3			3	6	20
	4			4		
	5			5	4	13.3
Variety of Space Plans	1	25	83.3	1	8	26.7
	2	5	16.7	2	21	70
	3			3	1	3.3
	4			4		
	5			5		

Source: Primary Data, 2020

Posttest: After introducing the art world design process, a second observation was done on both the control and the experimental group. In the

second set of scores, the control group participants were 90% who scored 1 followed by 10% with 2 while in the experimental group, observations showed that 10% scored 1, 70% scored 1 and 20% scored 3 in space conception and variety of space plans the control group participants were 83.3% and 16.7% scoring 1 and 2 respectively well as the experimental group participants were 26.7% who scored 1, followed by 70% with 2 and 3.3% scored 3. This was analyzed and presented in a statistical figure below;

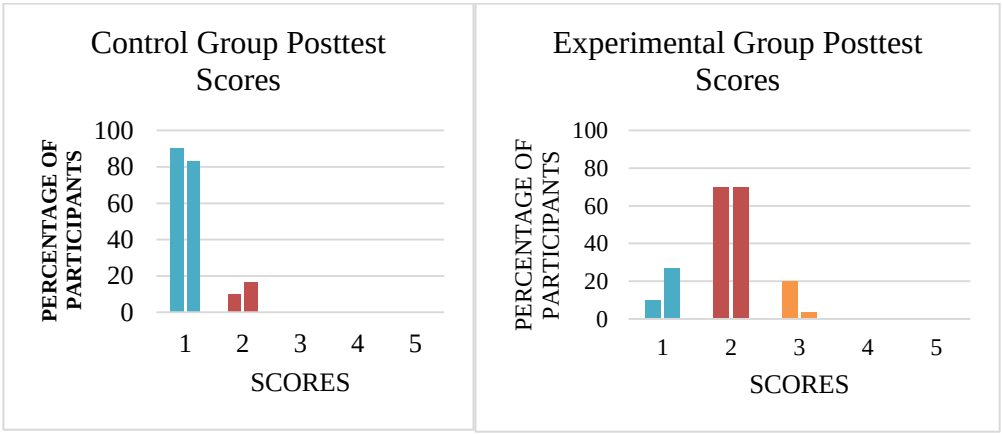

Figure 4.4. 6

Comparing Control and Experimental Groups at Post-Test in Ideate

Source: Primary Data, 2020

Figure 4.4.6 shows that while the control group still scored between 1 and 2 as it was in the pretest there is a slight improvement of fewer participants scoring 1 as compared to its pretest scores. The experimental group shows a drastic improvement with a shift from the majority of the participants scoring a range of 1 to more participants scoring 3. Comparing the difference between the two groups you notice that there is a statistically significant difference in the experimental group from pretest to posttest.

4.4.4 Pretest scores from Teacher Spaces Utilization Creativity constructs for Prototyping and Testing

Before introducing the intervention, a pretest observation was done on both the control and experimental groups as a basis for justifying the differences between the two groups at the posttest and also to ascertain if the two groups were comparable. After the pretest, a posttest observation followed and below is the presentation of the data from prototyping and testing starting with the pretest;

Table 4.4. 7

Pretest scores from Teacher Spaces Utilization Creativity Constructs for Prototyping and Testing.

Creativity Attribute	Control Group			Experimental Group		
Creative Use of Space Environment	Post-Test scores			Post-Test scores		
	Score	Freq	%	Score	Freq	%
	1	28	93.3	1	30	100
	2	2	6.7	2		
	3			3		
	4			4		
	5			5	4	13.3
Variety of Assessment Information	1	30	100	1	30	100
	2			2		
	3			3		
	4			4		
	5			5		

Source: Primary Data, 2020

Pretest: The observations before the intervention showed that the control group participants had 93.3% with 1 and 6.7% with 2 well as the experimental group had 100% scoring 1 in creative use of space environment. The data was analyzed and the statistical figure below illustrates the findings;

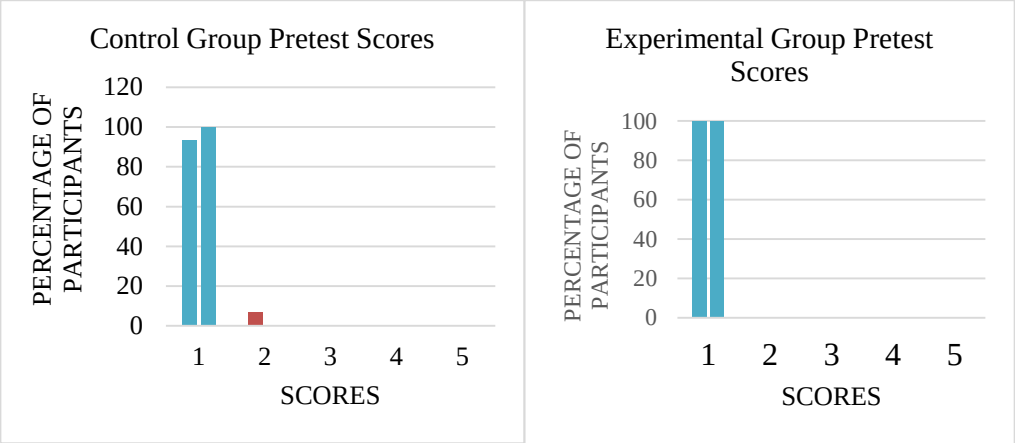

Figure 4.4. 7
Comparing Control and Experimental Groups at Pre-Test in Prototyping and Testing.

Source: Primary Data, 2020

Figure 4.4.7 above compares the control group and experimental group scores at the pretest in which the analysis shows that the control group scored between a range of 1 to 2 and the experimental group had all participants scoring 1. However both the control group and the experimental group have the highest percentage of participants scoring 1, It is clear that the experimental group has a higher percentage which implies that the control group was relatively better than the experimental group. Despite this difference, the two groups were comparable. Below is the data from the post-test observation;

Table 4.4. 8
Posttest scores from Teacher Spaces Utilization Creativity Constructs for Prototyping and Testing.

Creativity Attribute	Control Group			Experimental Group		
Creative Use of Space	Post-Test scores			Post-Test scores		
Environment	Score	Freq	%	Score	Freq	%
	1	30	100	1	18	72
	2			2	11	36.7
	3			3	1	3.3
	4			4		
	5			5		
Variety of Assessment	1	27	90	1	5	16.7
Information	2	3	10	2	25	83.3
	3			3		
	4			4		
	5			5		

Source: Primary Data, 2020

Posttest; After introducing the intervention, the scores in the creative use of spaces environment showed that in the control group, 100% scored 1 while in the experimental group participants were 72% with 1, 36.7% scored 2 and 3.3% scored 3. This data was analyzed and the figure below presents the analysis results;

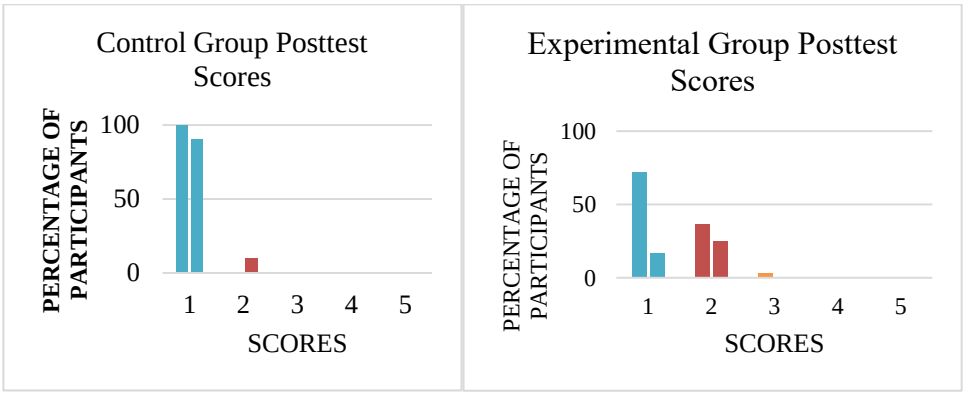

Figure 4.4. 8

Comparing Control and Experimental Groups at Pre-Test in Prototyping and Testing.

Source: Primary Data, 2020

The statistical Figure 4.4.8 above compares the percentage of participants with different scores observed from the control and experimental groups. The control group continued to score in the range of 1 to 2 though the number of participants who scored one reduced well as the experimental group showed a bigger shift with all participants scoring between 1 and 3 with the majority of the participants scoring 2 as compared to 100% scoring one in the pretest. This difference in the experimental group at pretest and posttest is significant and attributable to the art world design process.

4.4.5 The Mean and Standard Deviation in the Control and Experimental Groups at Pre-test

Descriptive Statistics

	N	Mean	Std. Deviation
CONTROLPRETEST	30	22.07	2.638
EXPERIMENTALPRETEST	30	24.80	4.147

The mean difference and standard deviation at pre-test indicate that there was no statistically significant difference between the two groups. This suggests that the teachers' creativity levels were comparable at the pre-test stage.

4.4.6 The Mean and Standard Deviation in the Control and Experimental Groups at Post-test

Descriptive Statistics

	N	Mean	Std. Deviation
CONTROLPOSTTEST	30	30.80	1.808
EXPERIMENTALPOSTTEST	30	48.60	5.386
Valid N (listwise)	30		

The mean difference and standard deviation at post-test reveal a statistically significant difference between the two groups, indicating that the teachers' creativity levels varied significantly at the post-test stage.

4.5 The Contribution of the Art World Design Thinking Process to Teacher Material Utilization Creativity (TMUC), Teacher Methodological Creativity (TMC) and Teacher Spaces Utilization Creativity (TSUC)

In objective four, the study sought to establish whether the Art World Design Thinking Process experiment had contributed to the creativity of teachers as hypothesized. To be able to obtain data for this objective the study employed a qualitative approach by developing a focus group interview, which was aligned to the five stages of the art world design thinking process. Data was collected

and coded under three themes which were represented by the teacher pedagogical creativity dimensions of TMUC, TMC and TSUC as presented below;

4.5.1 Responses on the contribution of the Art World Design Thinking Process (AWDTP) to Teacher Material Utilization Creativity

The first theme was labelled material utilization and under this theme, the study was interested in data that expressed any form of contribution in ways participants were using materials, in the views different perspectives they had about materials, the ability to identify materials ideas and to being able to conceptualize them into resourceful ideas. Under this theme, the following are the ideas that the participants reflected on in the interviews that depict forms of contribution made by the AWDTP;

The AWDTP contributed to the teacher's handling of the concept of needs assessment in a way that the demonstration activities made needs assessment more realistic and meaningful in terms of application to the classroom situation. To express this contribution this is what respondents had to say;

> *‘’The activities that were related to the size of children was a big reflection for me in terms of thinking about the size of objects I select for children to use’’ (TR08, FGD group B)*

The other said;

> *"I appreciated that it is important to plan a variety of materials even for a single activity because children like different things and this drives their focus and motivation" (TR06, FGD group A)*

These expressions show that the experimental activities had an impact on the participants, which resulted in a better understanding of what considerations are important when conducting needs assessment for materials to be used by young children in the teaching-learning process. This approach to material

utilization is an indicator of creativity as it provides unique dimensions that enrich the user experience of the children.

The AWDP contributed to developing the participant's skills in problem identification and analysis. On this, the activities help participants to be able to appreciate that every material presents a specific and unique attribute which can be recognized and examined to be able to meaningfully utilize it. The participants had this to say;

> *“I was able to realize that we have a lot of potential reference resources that we don’t put to use for example I had never used my phone for teaching ideas like during this time’’ (TR27, FGD group E)*

The other said;

> *“I realized that reframing the problem also helped to always reframe my materials. A single materials item can have many ideas in it” (TR20, FGD group D)*

In addition, the other said;

> *"I used many things found in the environment as materials by just attaching meaning to them. This made me see a lot more materials for teaching. Some I didn't think about even" (TR8, FGD group B)*

The experiences the experiment gave the participants were a revelation as far as problematizing items were concerned. There was a need for participants to understand that surface value is not always enough there is always a need for a critical analysis, which enhances our view of the potential that is within the items we have. The activities enriched and changed how participants look at items around them as expressed in the quotes above.

The AWDTP also contributed to the participants 'ability to generate ideas for teaching materials. The brainstorming challenge sessions developed the skills

of generating alternative ideas irrespective of which was the best. Participants had this to say;

> *"I realized that almost everything around us can make teaching materials, I never thought about many of the things that were identified in our brainstorm challenges…" (TR7, FGD group B)*

The other said;

> *"Trying out all these wild ideas was exciting for me and surprisingly some of them I used in my classes and children were happy with them…" (TR15, FGD group C)*

In addition, the other said;

> *"Looking around me I can now see so many items that can be used as teaching materials …" (TR11, FGD group B)*

The expressions of the participants reveal to us that having several alternatives is vital for improving the chances of having rich materials. This opened up the participants to be positive to all items within their reach as possible materials and as expressed this boosted their exposure to materials ideas.

Finally, yet importantly, the AWDTP contributed to skills in visualizing material ideas and trying them out to see how they work. In the prototyping and test phase, the participants developed materials concepts, tested them and retested after making improvements. About the prototyping activities, this is what participants said;

> *"I realized that I could use ideas from other fields and processes to give life to my material ideas…" (TR23, FGD group D)*

Another said;

> *"Testing materials made me realize that not all planned materials will always deliver on the lesson objectives. This phase made me realize that it is a continuous process of improvement …" (TR9, FGD group B)*

In addition, one said;

> *"I was able to realize that some materials are stronger than others in different subject areas after trying them out…" (TR4, FGD group A)*

The expressions from the participants show that prototyping and testing had the potential to enrich their sense of material utilization. To realize that it's not about using what you have seen others use but rather to tailor to a specific function, test to see if it works successfully and then put to use. This challenged several of the beliefs participants held on some materials.

4.5.2 Responses on the contribution of the Art World Design Thinking Process to Teacher Methodological Creativity

The second theme was methodological creativity and it contains responses that highlighted how the AWDTP contributed to TMC. The key issues that participants raised are presented below;

In the first place, the AWDTP contributed to the development of skills for methodological needs assessment with the child in mind. The participants were engaged in developing skills around how methods relate to age. This also developed a perspective that the methods must suit the child who is the immediate beneficiary. After these experiences, this is what some participants had to say;

> *"I was using methods as if they were cast in stone, but these activities have made me more flexible…" (TR8, FGD group B)*

Another said;

> *"Needs assessment taught me that not all methods are good for children, I can now appropriately choose methods for children …" (TR4, FGD group A)*

The AWDP also contributed to skills in concept development. Defining a given method, re-framing and answering several how might questions gave participants the ability to develop different perspectives of understanding how these methods apply and this is what some had to say;

> *“I did not know that learners can also use the method, engaging them was interesting …” (TR11, FGD group B)*

Another said;

> *"When you know the elements of your method, it is easy to use the method with the children …" (TR17, FGD group C)*

In addition, another said;

> *“the how might we questions were very useful in re-imagining using the methods in using it…” (TR20, FGD group D)*

The AWDTP also contributed to TMC by developing skills around generating ideas. The activities of ideation enable the participants to understand mechanisms used to come up with several ideas. This is what the participants had to say;

> *"suggesting many ideas on the role-play method yielded many alternatives for my activities…" (TR9, FGD group B)*

Another said

> *“the activities on mixing methods gave me ideas on how to make my methods evolve …” (TR5, FGD group A)*

The AWDTP also developed skills of experimenting and improving during the prototype and test session. Trying to improve in the subsequent sessions had a vital contribution to the experimental skills. This is what the participants had to say;

> *"Learning to test how to use the elements in the methods was such an insight into how to apply the methods in the real class…" (TR25, FGD E)*

Another said;

> *"After testing it was easy for me to know how to engage the learners when I was in class the children were so excited…" (TR8, FGD group B)*

4.5.3 Responses on the contribution of the Art World Design Thinking Process to Teacher Spaces Utilization Creativity

The third theme was labeled spaces utilization creativity and under this, responses on the contribution of the AWDTP to TMUC were placed. The key contributions include the following;

The first contribution of the AWDTP on space utilization creativity was developing skills in appreciation of children's physical attributes as key concerns for spaces. After the experimental trials on methods, materials and spaces activities, participants had better skills in assessing the suitability of spaces for children of different age groups. The participants developed a keen sense of appreciation for elements that motivate and excite children. These are some quotes from what participants had to say;

> *"Children come with their ideas which call for flexible spaces which allow children's contribution…"(TR4, FGD group A)*

The other said;

> *"the classroom was small and restrictive to several possibilities that children suggested…" (TR15, FGD group C)*

The second contribution of the AWDTP was to develop skills in space assessment. Through the experiment, participants were able to participate in re-definition and re-framing of spaces according to the choice of activity/materials. Using the 'how might we questions' opened a range of possibilities. This is what some of the participants said;

> *"We changed classroom plans many times and this taught me that classroom setup depends on activity…" (TR11, FGD group B)*

Another said;

> *"We identified several space possibilities outside. I have learned that learning spaces can be made out of all available spaces…" (TR10, FGD group B)*

Another also said;

> *"I did not know that classroom and outside spaces can be integrated and used together. This was very exciting…" (TR2, FGD group A)*

The third contribution of the AWDTP to space utilization creativity was developing participants' skills in the conceptualization of spaces. The activities in the ideate phase were used to develop ideas for learning spaces. These equipped participants with the skills of brainstorming and thinking out of the box for ideas. This is what the participants had to say;

> *"fear limits the possibilities we can have as spaces, we developed ideas of spaces I had never thought about like the many different classroom formations we created" (TR17, FGD group C)*

Another said;

> *"I realized that all spaces if well planned for have so much to do in them …" (TR10, FGD group B)*

In addition, another said;

> *"I can now make several space plans for the classroom …" (TR17, FGD group C)*

The fourth contribution of the AWDTP to space creativity was in developing the skills of participants in planning and prototyping spaces. After the experiment, participants were more aware of ways to actualize space. And this is what they said;

“I now know how to use simple elements like lines to add meaning to spaces …” (TR26, FGD group E)

Another said;

"using landforms as elements of the class space was very interesting …" (TR5, FGD group A)

4.6 Data Analysis and Interpretation

In this section, data is analyzed to establish the difference between the control group and the experimental group. This was done by doing a statistical analysis and interpretation of the results in each of the art world design thinking process stages as presented in the following sections.

4.6.1 Analysis and Interpretation of Control and Experiment groups Pre-test data for Teacher Material Utilization Creativity

The participants assigned to control and experiment groups were observed in the classroom sessions with a focus on material utilization creativity. This was done to collect baseline data, which was used to confirm that the groups were comparable. After analysis, results showed that the two groups were exhibiting relatively similar levels of competence across the five creativity areas that were assessed as shown in Figure 4.2.8.

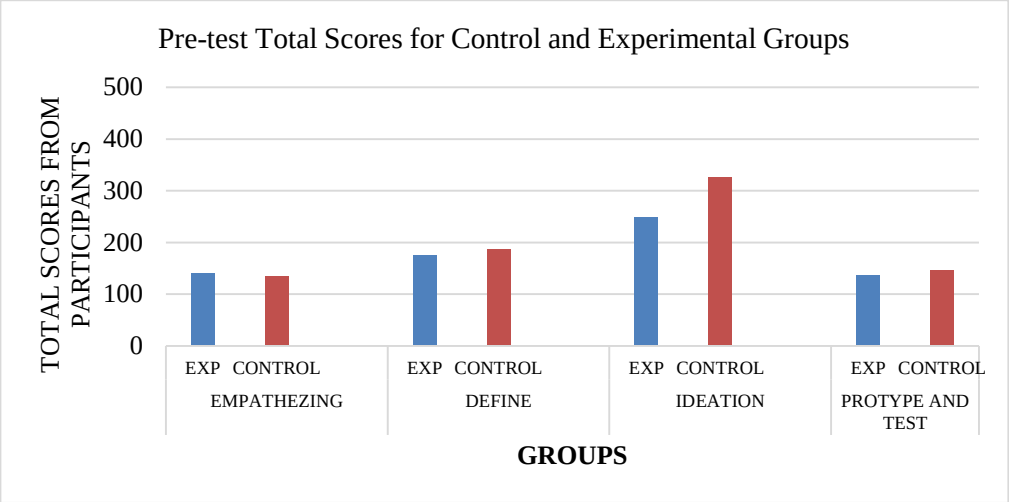

Figure 4.5 1

Analysis of Control and Experiment Groups at Pre-test Level

Source: Primary Data, 2020

Figure 4.5.1 shows that whereas the two groups were comparable at the pre-test level, the control group was showing a slightly better level of creativity than the experiment group across the five design process steps. The ideation stage was a better stage for both groups, although the control group was still better. The mean scores for the control and experiment groups were also compared as shown in Table 4.5.1.

Table 4.5. 1

Mean table Comparing Control and Experiment Groups at the Pre-test Level

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	PRETESTCONTROL	23.7000	30	2.76867	.50549
	PRETESTEXPERIMENTAL	23.1000	30	3.25206	.59374

Source: Primary Data, 2020

Table 4.5.1 shows that the control group has a mean of 23.7 and the experimental group has a mean of 23.1. With such a small mean difference of 0.6, the two groups exhibited high similarity at pretest. The SD is 2.7 and 3.2 respectively also indicates a less variability in the scores. However, the mean

difference of 0.6 can be considered negligible. The same data from the control and experiment groups were compared on a t-test and found to be not statistically different as shown in Table 4.5.2

Table 4.5. 2

T-test difference between Control and Experiment groups at pre-test.

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	PRETESTCONTROL PRETESTEXPERIMENTAL	.60000	4.09878	.74833	-.93051	2.13051	.802	29	.429

Source: Primary Data, 2020

Table 4.5.2 shows t= .802; p=.429; df =29, meaning that there is no significant difference between the two groups before the treatment was given to the experiment group.

4.6.2 Analysis and Interpretation of Control and Experiment groups Post-test data for Teacher Material Utilization Creativity

After establishing that there was no statistically significant difference between the two groups at the pre-test level, treatment was given to the experiment group. The treatment was a one-month support training on the design thinking process usage. This was coupled with hands-on training on how to develop and utilize different materials for a given lesson. The control group on the other hand was given sets of topics to do lesson plans as trained. The plans were to show the materials identified and how they are to be used. The plans were later used in the classroom observations following the five steps of the design thinking process at the posttest level. The two groups were compared at the post-test level and found to be different as shown in Figure 4.5.2.

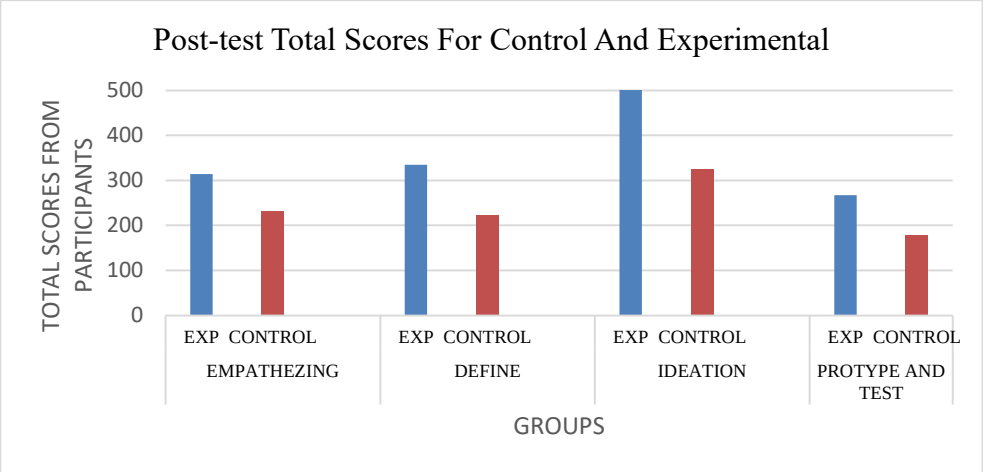

Figure 4.5 2

Analysis of Control and Experiment Groups at Post-test Level

Source: Primary Data, 2020

Figure 4.5.2 shows that generally, the experiment group showed better levels of creativity at all stages of design. Greater strides had been made at the ideation stage, while prototyping witnessed a smaller gain for both groups.

Looking into the stages where the experiment group achieved better than the control group, we notice that at the empathizing stage after going through the design process teachers exhibited a better perception of materials as a motivator for children than before as one explained:

After analyzing the qualitative information from the observations and focused group discussions, we compared the mean scores of the control and experiment groups to find out how different they were. The experiment group was found to have a higher average mean score at the post-test level compared to the control group as shown in Table 4.5.3.

Table 4.5. 3

Analysis and Interpretation of Control and Experiment groups means at Post-test level

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	POSTTESTCONTROL	31.8667	30	2.14530	.39168
	POSTTESTEXPERIMENTAL	48.2667	30	5.25182	.95885

Source: Primary Data, 2020

Table 4.5.3 shows that the experiment group had a higher mean score of 48.3 as compared to 31.9 of the control group. This is indicative of a high difference between the scores at pre-test and those at post-test. The SD of the control group is 2.4 well as that of the experimental group is 5.3. This is indicative of a higher variation as compared to pre-test data. These differences in both the sd and the mean was a result of the effect that the AWDTP had on TMUC. The groups were compared on a t-test to see if there was a statistically significant difference between them as shown in Table 4.5.4.

Table 4.5. 4

T-test difference between Experiment and Control groups at Post-test level

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	POSTTESTCONTROL – POSTTESTEXPERIMENTAL	-1.64000E1	6.08900	1.11169	-18.67367	-14.12633	-14.752	29	.000

Source: Primary Data, 2020

Table 4.5.4 shows that there was a statistically significant difference between the experiment and control groups (t=-14.7; p=.00; df=29) participants.

4.6.3 Analysis and Interpretation of Control and Experiment groups Pre-test data for Teacher Methodological Creativity.

Data for teacher methodological creativity was analyzed and presented using the statistical figure below. The findings showed that well as at individual score there was a slight difference in a more general picture after coming up with the sums of each individual, the figure shows that the control group participants were generally better in teacher methodological creativity as compared to the experimental group in all the four areas that were observed.

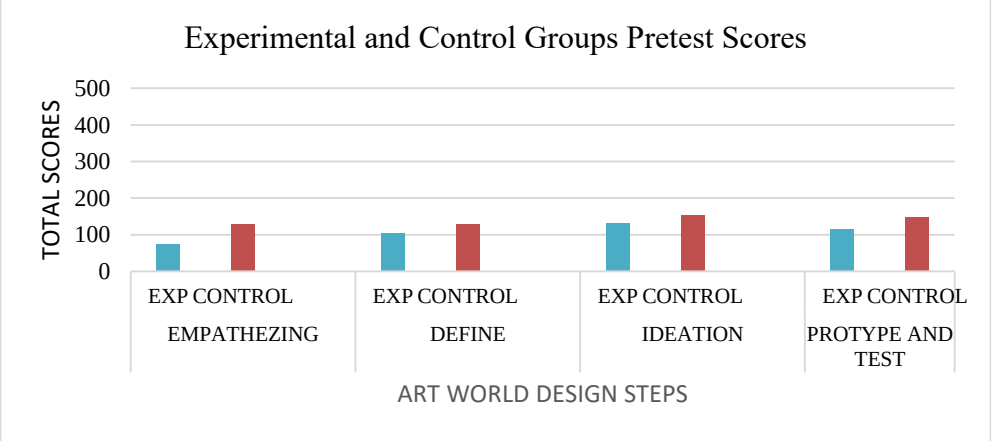

Figure 4.5 3

Analysis of Control and Experiment groups at Pre-test Level

Source: Field data 2020

In Figure 4.5.3 it's clear that despite the difference in scores, the two groups are generally comparable. The control group was much stronger in empathizing as compared to the other three steps. The mean scores of the two groups also point to the fact that at the pretest the experimental and control groups were at a relatively similar level of competence in teacher methodological creativity as shown in Table 4.5.5 below;

Table 4.5. 5

Mean table comparing control and experiment groups at pre-test level

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	CONTROLGROUPPRETEST	17.6333	30	3.05674	.55808
	EXPERIMENTALGROUPPRETEST	17.2000	30	1.68973	.30850

Source: Primary Data 2020

From Table 4.5.5 above the control group has got a mean of 17.63 well as the experimental group has a mean of 17.2. The mean difference of 0.43 significant difference between the two groups at pre-test. The control group has an sd of 3.0 and the experimental group has an sd of 1.6 which still shows a lower level of variability at 1.4. This implies that there was no difference in the groups at pretest. The same data from the control and experiment groups were compared on a t-test and found to be not statistically different as shown in Table 4.5.6

Table 4.5. 6

T-test difference between Control and Experiment groups at pre-test.

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	CONTROLGROUPPRETEST - EXPERIMENTALGROUPPRETEST	.43333	2.89689	.52890	-.64838	1.51505	.819	29	.419

Source: Primary Data 2020

Table 4.5.6 above shows t= .819; p=.419; df =29, meaning that there is no statistically significant difference between the two groups at pretest.

4.6.4 Analysis and Interpretation of Control and Experiment groups post-test data for Teacher Methodological Creativity

After carrying out the pretest, the art world design process was introduced to the experimental group and after some time a second phase of observation was carried out as the posttest observation the statistical figure 4.5.4 below presents the data from the pretest observation of the experimental and control groups;

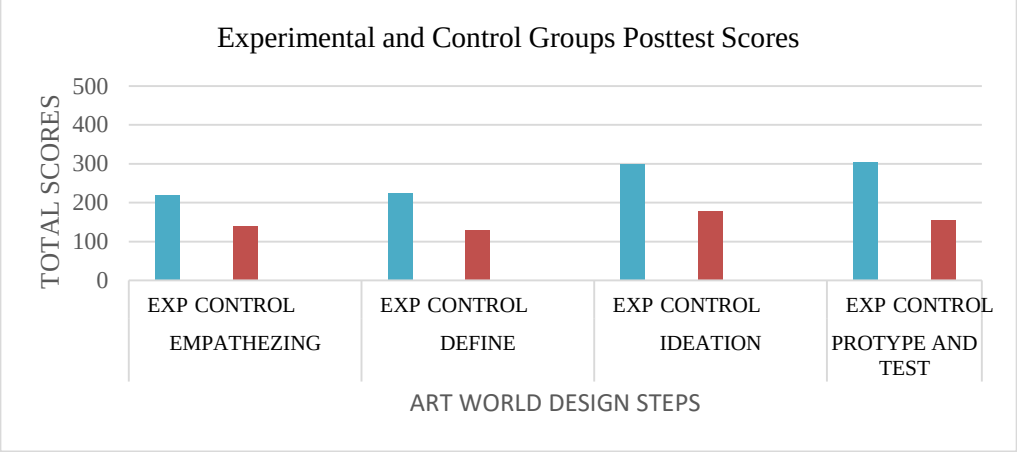

Figure 4.5 4

Analysis of Control and Experiment Groups at Post-test Level

Source: Primary Data 2020

From Figure 4.5.4 above, the data shows that well as the control group's total scores show a difference of 24 in teacher methodological creativity from 155 highest at pretest to 179 at post, and the experimental group shows a difference of 173 from 131 to 303. The data clearly shows that there was a statistically significant difference between the control and experimental groups in the post-test. This was further looked at from the mean scores in the table below;

Table 4.5. 7

Mean table comparing control and experiment groups at the post-test level

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	CONTROLGROUPPOSTTEST	20.0333	30	1.95613	.35714
	EXPERIMENTALGROUPPOSTTEST	34.9000	30	5.01274	.91520

Source: Primary Data 2020

Table 4.5.7 above, shows that the experiment group had a mean score of 34.9 and the control group had a mean score of 20.03 which shows a high difference of 14.93 as compared to 0.43 at pre-test. The SD also shows a higher variation as compared to the pretest of 3.1 against 1.4. The mean and the sd are indicative of the effect of the AWDTP. The groups were further compared on a t-test to see if there was a statistically significant difference between them as shown in Table 4.5.8.

Table 4.5. 8

T-test difference between Control and Experiment Groups at Post-test

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	CONTROLGROUPPOSTTEST – EXPERIMENTALGROUPPOSTTEST	-14.8667E1	4.61432	.84246	-16.58968	-13.14365	-17.647	29	.000

With t=-13.1; p=.00; df=29 as shown in table 4.5.8 above shows, there was a statistically significant difference between the experiment and control group participants at posttest.

4.6.5 Analysis and Interpretation of Control and Experiment groups' Pre-test data for Teacher Spaces Utilization Creativity

To be able to compare the data and determine if there was a difference between the control and experimental groups in teacher space utilization creativity, the team collected pretest data from the control and experimental groups. The data was analyzed and presented in a statistical figure 4.5.5 below;

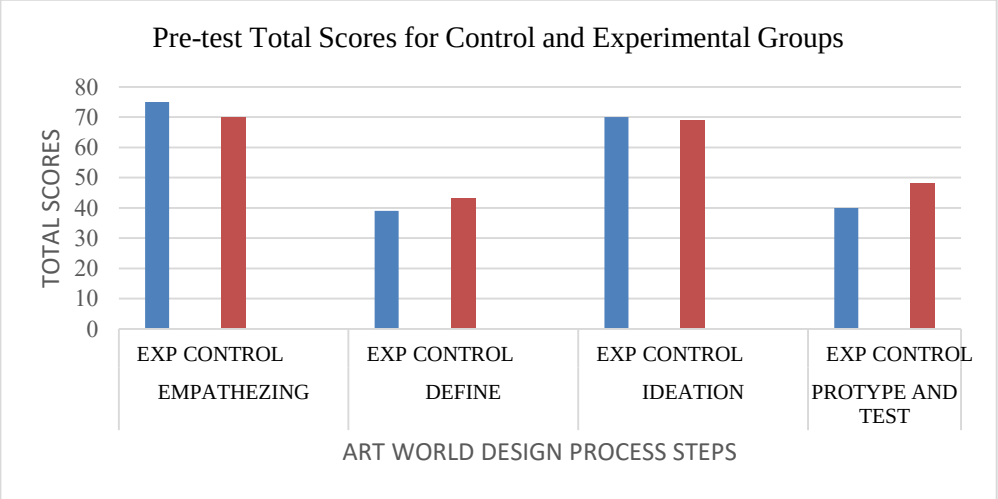

Figure 4.5 5

Analysis of Control and Experiment Groups at Pre-test Level

Source: Primary Data 2020

The statistical figure 4.5.5 above compares the analysis of the total scores at the pretest that the participants scored in each of the different competencies that were measured. The results show that in empathizing and ideation the experimental group was slightly better than the control group with a margin of 5 and 1 respectively which is so insignificant well as the control group was better in define, prototype and test with a margin of 4 and 8 respectively.

Well as there seemed to be a balance the control group's difference in the margin shows that it was at a better position at the pretest when compared with the control group which implied there was no statistically significant difference in the two groups. This was analyzed by looking at the mean scores as presented in the table 4.5.9 below;

Table 4.5. 9

Mean table comparing control and experiment groups at the pre-test level

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	CONTROLGROUPPRETEST	7.7667	30	1.13512	.20724
	EXPERIMENTALGROUPPRETST	7.4333	30	1.00630	.18372

Source: Primary Data 2020

From Table 4.5.9 above the control group has mean of 7.76 and the experimental group has a mean of 7.43. This gives a mean difference of 0.33 which shows a negligible difference. The SD=1.1 and 1.0 respectively gives a small variability in the scores. Both the mean and sd show that both the control and experimental groups were not very different at pretest. This gave an opportunity to introduce the intervention since the groups were comparable. This was further analyzed on a t-test and found to be not statistically different as shown in Table 4.5.10.

Table 4.5. 10

T-test difference between Control and Experiment groups at pre-test.

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	CONTROLGROUPPRETEST - EXPERIMENTALGROUPPRETST	.33333	1.76817	.32282	-.32691	.99358	1.033	29	.310

Source: Primary Data 2020

Table 4.5.10 above shows that at the pretest the t= 1.0; p=.310; df =29, the p-value is much higher than the critical value of 0.05 which meant that there was no significant difference between the control and experimental group at the pretest.

4.6.6 Analysis and Interpretation of Control and Experiment groups' Post-test data for Teacher Spaces Utilization Creativity

After the pretest observation, the experiment was introduced to the experimental group well and the control group was allowed to continue with the routine training program that both groups were offering. After the experimental process a posttest observation was done on both the control and experimental group to establish whether there was a statistically significant difference between the two groups in teacher space utilization creativity and after analyzing the data the results were presented in a statistical figure 4.5.6 below;

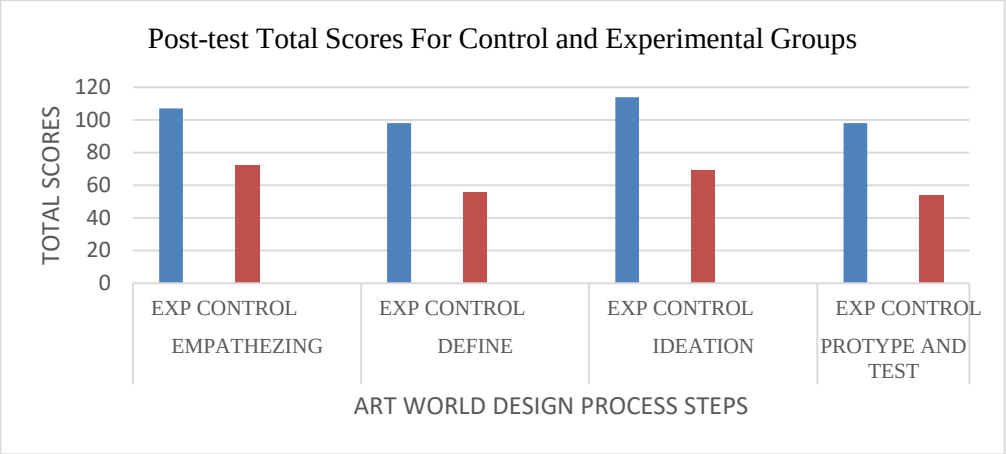

Figure 4.5 6

Analysis of Control and Experiment Groups at Post-test Level

Source: Primary Data 2020

From figure 4.5.6 above the experimental group has a higher total score in all the four areas that were measured. With an average difference of 41.5 compared with that of 4.5 at the pretest the difference is quite significant which explains the hypothesis that there was a statistically significant difference between the control and experimental group at posttest. To affirm this data was further analyzed as shown in table 4.5.10 below;

Table 4.5. 11

Mean table comparing control and experiment groups at the post-test level

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	CONTROLGROUPPRETEST	8.3667	30	1.42595	.26034
	EXPERIMENTALGROUPPRETST	13.9000	30	1.29588	.23659

Source: Primary Data 2020

Table 4.5.7 above, shows that at the posttest the experiment group had a higher mean score of 13.9 and the control had a mean of 8.3 which makes a difference of 5.6. This mean difference is higher as compared to that of pretest

of 0.33. The SD=1.41 of the control and 1.29 for the experimental group also shows an sd difference of 0.1 and compared to that pretest which is 0.13. The mean difference and sd difference portray a moderate difference which imply that the effect of the AWDTP was not as strong as compared to that in objective 1 and 2. The groups were further compared on a t-test as shown in Table 4.5.12 below;

Table 4.5. 12

T-test difference between Control and Experiment groups at post-test.

Paired Samples Test

		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	NTROL OUPPRE ST – PERIME ALGRO PRETST	-5.53333	2.02967	.37056	-6.29122	-4.77544	-14.932	29	.000

Source: Primary Data 2020

Table 4.5.12 above shows that at posttest t=-14.9; with a p=.00; and a df=29. With a p-value that is much lower than the critical value of 0.05, it's clear that there was a statistically significant difference between the experiment and control group participants at posttest observation in teacher spaces utilization creativity.

CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.0 Introduction

In the first part of this chapter, the findings are discussed. In the second part, conclusions are drawn based on the discussion of the findings and rising scholarly positions. Finally, broader recommendations that arise out of the findings of the study are given. Discussions are presented according to study objectives followed by conclusions and recommendations.

5.1 Discussion of Findings;

To address the four objectives, the study was concerned with attempting to transfer the creativity enshrined in the Art World Design Thinking Process to creative methods, creative materials usage and creative spaces while teaching young children. To achieve this aim, four specific objectives were used; a) To assess the relationship between the Art World Design Thinking Process and Teacher Material Utilization Creativity, b) To assess the relationship between the Art World Design Thinking Process and Teacher Methodological Creativity, c) To assess the relationship between the Art World Design Thinking Process and Teacher Spaces Utilization Creativity and To establish the contribution of Art World Design Thinking Process to Methodological Creativity, Material Utilization Creativity and Teacher Spaces Utilization Creativity.

5.1.1 The Art World Design Thinking Process and Teacher Material Utilization Creativity.

To find answers for the first objective, we hypothesized if there was a statistically significant effect of the Art World Design Thinking Process on Teacher Material Utilization Creativity. We found out that there was a

statistically significant effect of the Art World Design Thinking Process on Teacher Material Utilization Creativity. This affirmed our assumption that the Art World Design Thinking Process could potentially affect teacher creativity in material utilisation.

We observed that before the experiment, the participants were less conscious about the different elements of material utilization creativity indicators that we tested. They were mainly using a generic approach of repeating what they had done before. After the experiment, we observed that teachers were able to display creative thought processes in material utilization. From the difference in scores, it was evident that they were more responsive to the elements that we measured. This explained why there was an improvement in material utilization creativity in the experimental group.

This was further affirmed by the control group, which showed no statistically significant difference in their post-test scores. The observed variations in the post-test were attributed to the study program that the participants were taking at the time. The study findings proved that incorporating elements of the Art World Design Thinking Process in the early childhood teacher training program would lead to teacher material utilization creativity. However, this study engaged a group of in-service teachers who were in training and this could have given them an advantage in mind-sets to prepare and put together classroom material experience and the art world design thinking process activities.

This discussion was based on the Art World Design Thinking Process steps that are empathizing, defining, ideating, prototyping and testing;

Empathizing was focused on understanding learner needs in terms of what motivated them and their lived experiences. We wanted to establish if these needs could influence teacher material utilization creativity. We wanted to understand how they influenced material choices. This was measured against three indicators: being sensitive to materials for the individual child, relating selection to the planning process and being able to exhibit thoughts about how context relates to the selection of material;

We started with the aspect of observing if the teacher was being sensitive to material for individual children. We found out that participants were not sensitive to individual differences of children at pretest. This was mirrored in either having no materials for children at all or providing a similar material for all the children in some cases. This revealed that participants were unable to deliberately use empathize yet it would lead to concern for children's differences. With such a mindset, the teachers hardly think about providing a variety of materials because they don't realize that children are different. Caalleja's (2018) argument about transformative culture was based on the introduction of the Art World Design Thinking Process experiment to the experimental participants. It suggests that teacher educators can work collaboratively with teachers to support them in developing better skills.

We introduced an experiment to the experimental group participants with the assumption that understanding the empathizing would reshape the participants' thoughts about children's differences. This would help the participants realize the fact that each child has different needs, is motivated differently and also has personal experiences that are different from the others.

The subsequent findings showed that the participants were more responsive to the element of being sensitive to individual differences. The provision of materials changed from general or no material to deliberate focus on providing materials that would cater for different children's interests. This revealed that introducing the Art World Design Thinking Process had a positive impact on the participants. Therefore, developing teacher material utilization creativity enhances a teacher's ability to meet the material needs of each child.

Stinnett (2018) argues that paying personal attention to a child's needs not only improves confidence but also results in raising children's scores. He adds that children are always craving this personalized attention. Similarly, Harris (2011) argues that the child's interest should be at the centre of decisions that concern their learning (Harris, 2011; Leeson, 2007 & Gladstone et al, 2012). If the children are at the centre of decisions made on materials, then learner differences will always be catered for. Toros (2013) also adds that understanding the needs of a child is the first step to ensure that the child’s needs are catered for.

Although placed in a relatively different context, Pagen, (2017) raises an interesting argument on language saying that fluency in a language is a key to improving the quality of the learning experiences for children. We observed that the materials which the teachers used at the pretest were mostly in the English language. This dictated which language to use yet both the children and the teachers were more fluent in their local languages. This put the individual children at a disadvantage and did not cater for individual differences.

Marzano (2001) argues that most children are not primarily auditory learners. This means that children are different and hence learn differently.

Therefore, teachers have to provide materials that cater for these individual learner differences. Materials should not only appeal to their auditory and visual senses because learning in early childhood involves more than listening and observing. (Marzano, Pickering, and Pollock, 2001)

In addition, Goksu (2017) argues that providing a variety of materials creates an avenue for individual children to discover what works for them. This is not what we saw at the pretest both the control and experimental groups were seen to use a one-size-fits-all approach. A similar material was prepared to cater for all the children in the class. Preparing a uniform material pre-assumes that all children are similar yet they are different.

Yenilmez & Yoleu, (2007) raise an interesting argument on the interaction between the child and the teacher as an important element for a quality early childhood program. In this, the concern is on learning materials as a major player in enhancing this interaction. When teachers are using chalk, blackboard and books as the learning materials it is evidence of low teacher-child interaction. Materials are important because they provide interaction points between the teachers and learners. (Emir & Bahar, 2003; Tezei & Gurol, 2003; Yenilmez & Yoleu, 2007)

The second aspect we had concern for was the ability to associate selected materials to the planning process. Our pretest findings showed that the participants were not able to associate a given material with specific planned concerns. We observed that most of the connections could not conclusively link a given material element to a specific lesson concern planned. The participants were unable to realize that there was a need to identify new connections for every lesson planned. It was important to make these new connections because the

materials and the context were different. Thus not possible to make new connections based on teaching experience.

However, after the experiment, the participants were able to make new connections between the different lesson points and material elements. In the experiment, the participants were introduced to developing a keen interest in preparing lessons with a better understanding of the learners. This gave them a chance to preempt how things should be to the best benefit of the user/learners. Through this, they developed skills to make several connections that would ensure a good experience for the user. The participants were able to use these skills to figure out specific connections between material elements and planned lesson concerns.

This implies that a teacher should be able to directly associate materials selected to specific lessons. This makes it easy for the teacher to achieve success in teaching because the plan is well associated with the materials.

Several scholars like Shih-Yung (2016) have advanced related arguments that materials should be selected concerning specific study points in a planned lesson. This enables the teacher to use fresh and new material specifically prepared for a specific lesson. This creates space for free thinking and creativity. This gives individual children a chance to find personal points of connection with the lesson (Kaila, 2005 & Rogers, 1970). The participants exhibited deliberate thoughts and actions guided by critical thinking to relate material elements to specific lesson points.

Grainger (2004) is concerned with a good match between the selected materials and the planning process before they are put to use. The argument is that a good match is a cornerstone for a successful learning process. Irrespective

of what we observed at the pretest, the experimental group participants were more reflective of the relationship between the materials they had selected and the lesson. This made it easier for the teacher to help the children to be able to develop insights into how the materials elements connect with the lesson activities (Hargreaves, 2001)

On the ability to relate context to the selected material, the findings at the pretest revealed that the participants were not able to relate the context in which they were to the materials they had selected. We observed that participants were using generic charts which were not customized for the context. Yet it is important to understand the context for which you are preparing.

Sendur (2018) argues that employing needs analysis skills allows for a more deliberate material modification process to match the selected methods which leads to an exciting lesson experience.

After the experiment, data revealed that the participants were more responsive to context as an influencing factor in material decisions. We observed that participants were able to use situation analysis to modify familiar objects to materials for teaching. This resulted in participants developing concepts and matching them with learner needs. There is always a need to understand the context in which the learners are because it influences their learning.

Phan (2020) argues that it is important to be keen on lesson points. By ensuring that materials fit into this structure. Ensuring the fit calls for a deliberate direction in modifying materials to fit the context.

The second art world design thinking process element that guided our observations was the define stage. The define stage is the design thinking phase where the designer tries to make meaning of the situation. Usually through

reframing and connecting different meanings. This is important because the clearer the problem, the easier it is to generate ideas for solutions. This was observed using three indicators which included; the ability to contextualize materials, being able to identify and appropriately use available sources of information and also considering selections that were generally affordable and available.

To start with was the ability of the participants to contextualize materials. The focus here was the ability to redefine materials to make new relevant meaning for the learning situation. Findings revealed that participants were unable to re-imagine the materials. The materials mostly carried a generic meaning which did not appropriately reflect the context. They mostly used charts but no re-imagination to customize for context was observed. Gjalt (2018) argues that materials should adhere to the quality of instructiveness. Re-imagining materials gives them new life and the potential for instructiveness.

Based on this argument we introduced the participants to the Art World Design Thinking Process experiment. Subsequent findings showed that the participants were able to re-imagine materials to ensure that they match the context. Materials which were re-imagined were more exciting for the children. This was so because there was an existing attachment between the context and the learners which contextualizing materials gave new life. This process of re-imagining and reframing the problem to come up with a suitable solution involved a better understanding of the target audience. The participants gained concern for elements that form the description of their context as a core in the reframing of materials and material concepts. We observed that participants used

real objects from within the children's context. These were given new and exciting meanings.

Smith (2011) raises concerns about using objects in the environment as materials for teaching. The importance attached to the environment in this argument echoes a similar concern as that of contextualizing material. The concern is ensuring that materials resonate with the learners' environment or are made to suit the context of the learners (George & Lubben, 2002; Pilot & Bulte, 2006)

Gallavan (2012) raises an interesting but contrary argument about structured lessons in which he points out that they call for an orthodox approach that encourages conformity to rules. This is often discriminative in that what is selected may not offer an opportunity for all children. Therefore, contextualizing materials offers an opportunity to loosen the structured lessons. This offers learners an opportunity for a flexible approach by using several material ideas and material approaches within their context (Browne & Reynolds, 1923; Gallavan & Kottler, 2012)

We also had an interest in the ability to use the available sources to provide insights into material possibilities. On this aspect, we observed that participants were unable to think outside the use of the learning framework. They depended on the learning framework as the sole source of information to prepare the lessons. This meant that even the materials were restricted to suit the content obtained from the learning framework. Yet Tyler (2010) explains that the role of the learning framework is to provide a kind of proposal for how learning activities for children can be prepared (Tytler & Prain, 2010)

This argument opened possibilities for experimenting with the Art World Design Thinking Process experiment. After which findings showed that the participants were able to identify and use available sources. Define encouraged seeking insights from other fields to better understand the situation. This was modelled in the focused group discussion trials. Observations revealed that experimental group participants had a wider spectrum of sources of referencing as compared to what they had in the pretest observation. Re-defining sources opened an avenue for participants to discover various sources of information like using the mobile phone internet. Taping into the internet resources led to discovering a variety of ideas on material possibilities.

We also had an interest in the ability to use the concept of availability or affordability to select materials. We found out that participants were unable to consider the availability and affordability of the materials that they used at the pretest. The participants were stuck with a generic use of charts and plastic bottles. Yet these were a lot of free potential material items within their environment. Kapur (2018) argues for the use of non-conventional materials. These are usually present in a given area, accessible and affordable. They pose limitless material possibilities. It's based on this insight that we took on this for the experiment.

Having introduced the intervention and subsequently, data revealed that the participants were able to select materials that were generally available and affordable. Observations at the posttest showed that experimental group participants were able to combine familiarity, affordability and availability through the use of materials within the environment. Redefining and reframing available items bred new insights that gave a better understanding of what was

generally ignored. Bannett (2008) also proposes the use of familiar materials in teaching young children. These familiar objects possess important elements that young children find familiar and can connect with. In this argument, familiarity comes with prior experience. This allows learning to occur through association and transfer of meaning. Therefore, the use of available and affordable materials allows the teacher to identify familiar low-cost or no-cost materials and these are usually within the environment.

The third element of the Art World Design Thinking Process was ideation in which five indicators were the basis for the observation. Ability to exhibit divergent thoughts, ability to exhibit convergent thoughts, being sensitive to environmental materials as a possibility, being able to use available information to inform material decisions and understanding how to apply the concept of convenient materials;

On the aspect of the participants' ability to use divergent thought in their material ideas. We did a pretest and we found out that participants were not able to use divergent thoughts for material utilization. We observed that participants were using a single material idea usually from their experience. Yet Runco, 2011 argues for the use of divergent thinking in training packages. Divergent thoughts create several learning possibilities for the trainer.

Having observed that the response to divergent thinking was low at the pretest, we employed the Art World Design Thinking Process experiment. The subsequent data revealed that participants were able to exhibit the use of divergent thinking. We observed that participants were able to develop several material ideas by challenging the existing ideas. This was driven by the three aspects of design thinking that were explored. Participants developed the ability

to challenge their held ideas by asking the question of what other alternatives are available to answer the current situation. This led to a variety of new material ideas. Answering this question required exercising free thought, and being bold and curious. All of this helped participants to draw on new and fresh perspectives. This is in agreement with Runco's (2011) suggestion that convergent thinking breeds thoughts or ideas in different directions. This means that employing divergent thoughts is capable of empowering a participant to develop a variety of material ideas. Also, Goodman (2014) argues that divergent thinking offers a teacher the possibility to challenge existing ideas and come up with new ones.

We were also interested in participants being able to apply the concept of convergent material thoughts and we found out at the pretest that the participants were hardly able to exhibit any tendencies that showed convergent thoughts. We observed that participants always had one planned material for the session. Having a single option meant that Convergence was not applied at all yet Kim (2013) argues that employing convergence gives one a chance to map out the most suitable ideas.

To be able to develop convergence keenness the Art World Design Thinking Process experiment was conducted. From the subsequent results, we found out that participants had developed the ability to converge their thoughts. From the variety of ideas developed using their divergent skills, they were able to zero in on the best possible alternative. We observed that experimental group participants were able to arguably defend what they had selected as the best material out of the many. This was important because it was the control gear for divergent thinking. Well as it's important to generate as many possible solutions

as possible it would be worthless if there was no system to evaluate these ideas. Convergent thinking provides some criteria for evaluating the most valuable ideas and how they apply (Cropley, 2006)

We also looked at the ability to be sensitive to the environment and we found out at pretest that participants were unable to show sensitivity to the environment. Despite its richness, the environment seemed to be ignored. We observed that the most used materials were manila charts, counters of plastic/metallic bottle covers and plastic bottles which were not common materials in the environment where the study took place. This implied that the participants were not keen on the environment. Yet Niklas (2016) argues that using exotic materials ignores the pivotal importance of the learners' environment in constructing knowledge.

We took on the Art World Design Thinking Process experiment from which subsequent findings revealed that experimental group participants were exhibiting active responses to being sensitive to the environment. We observed at the posttest that experimental group participants used a lot of non-conventional materials from the environment where the study was conducted. This was a reflection of the experiment trials on how to generate a variety of ideas. This had an impact on how the participants thought about environmental objects. Participants exhibited the ability to use what was in their immediate environment as a possible source for material ideas. As Gago (2020) suggested children's immediate environments have far-reaching contributions in constructing knowledge and skills. The argument justifies why the teacher should use materials from the child's immediate environment if better learning outcomes are

to be achieved. We noted that this was exciting and fulfilling for the children to use known objects.

We were also concerned with the ability to use available information to develop material ideas. We found out that at the pretest participants were unable to use available information as a basis for decision making on materials. We observed that planning a lesson was a question of following the scheme of work as planned. At the pretest, lessons were prepared following the planned scheme without any other influencing factors. The participant did not consider things like records of assessment or records of work as determinants of their choices. Yet we know that proper tracking of records over time can reveal the performances of material. We observed that participants were duplicating lesson materials as they had used them before. Timperley (2014) argues that there is a need to shift from looking at assessment information of the learners for weakness or strength to using it to interrogate the weakness in the teaching process. This can include using this data for methods, spaces and materials.

We experimented and subsequent data revealed that the effect was that participants were able to use records of assessment and records of work. Participants were concerned with how this information could have influenced performance. Materials were selected for use based on their previous record of performance. The experimental trials developed the ability to map out different alternatives as potential causes. Similarly, Threifall (2005) argues that for a learning experience to be meaningful teachers should be able to use available information in a meaningful way. Their previous record of performance should offer insights into what is suitable in a given situation. Also, Banegas (2016) argues that materials should match the context. One of the factors raised looks at

the importance of previous performance. It is a creative practice for teachers to continuously use all available information to effect a planned scheme of work.

We were also interested in the ability to identify convenient ideas for teaching materials. We found out at the pretest that the participants were not able to identify convenient materials. The participants were using materials and ideas that they were taught in college. Some were using materials learned on the job or copied from leading schools. They did not necessarily use what was most convenient. We observed that participants were mostly using manila charts, flashcards and other commercially obtained materials. Yet locally these materials were not the most convenient material ideas. Several other environmental and locally available materials were more convenient. Sloane's (1988) argument on developmentally friendly approaches, suggests that materials should be able to meet the diverse expectations of all group members. Using materials within the child's environment provides a window into the child's prior experiences. This means that using materials found within the learners' environment would meet their expectations on several fronts.

After the experiment, observations revealed that participants had developed a more conscious ability to select material based on their convenience. We observed that participants were taking advantage of the more convenient and locally available materials. Through the experimental trials participants were able to realize that ordinary objects within the environment had extraordinary material elements. They were able to develop skills on how to re-imagine convenient materials around them to inform the learning process. This enabled them to use the convenient items around them as materials. In the article on factors that influence materials use Li (2020) raises an argument about teacher's

knowledge in using materials within reach. However, in a language context, the focus is the ability to use convenient materials. As much as we could have many objects around us, it takes creative skills to re-imagine objects into meaningful materials for teaching.

The last stage of the Art World Design Thinking Process we used as a point of observation on material utilization creativity was prototyping and testing. In prototyping and testing the aim was to develop the participant's skills in visualizing concepts, imagining mechanisms of operation, trying out solutions and appreciating iteration. This was done through experimental trials at the college. To measure this, we used three indicators that are; How participants used ideas from other disciplines to model their materials ideas, whether participants were interested in material competence assessment before using them and whether the materials selected were relevant and appropriate for a given age or level.

On how participants used ideas from other disciplines to model their materials ideas, we found out at the pretest that the participants were not aware that processes and activities from other disciplines could be used to inform material utilization creativity. We observed that most of the lessons were a repetition in terms of materials and procedures. The participants were confirming a known way of how to teach. While participants were focusing on an orthodox approach Miller (2017) argues that multi-disciplinary approaches create a rich learning experience for children. This means that we can use concepts, procedures and processes from other disciplines to improve learning experiences for children.

We introduced the experiment and consequently, findings proved that participants in the experimental group were able to use a multi-disciplinary approach to develop material ideas for teaching. We observed that participants had a keen interest in how processes in other disciplines work, their different elements and how these could be used to make meaningful materials. In one session we observed a participant who was using a bicycle chain to demonstrate the concept of movement. He was interested in how the peddles move to rotate the chain. He was looking at the bicycle process and giving it context-based meaning to act as materials for teaching as the prototyping process suggests. The focus here was on the ability to identify familiar processes from other disciplines that could be used for material concepts. Park Rogers (2020) argues that the use of reciprocal process skills such as inferring can help reinforce concepts and skills across subjects but it also improves teacher-learner interaction. This argument fits in prototyping and testing which allows one to remodify concepts from other disciplines to generate new meaning.

On materials competence assessment before use, we found out at the pretest that participants were not concerned with materials assessment. In this concept, the focus was on exploring the extent to which a material is competent. We observed that participants were using traditional materials. They were using charts, counters and flash cards as known to be used. In the post-conference participants explained that they were using materials as they were taught. This meant that they were not aware of the importance of assessing the competencies of materials. Jogan (2020) raises two important issues that inform this argument. One is the assessment of learners for materials suitability. That also the material is not only a physical object or design but also a mixture of imagination and

analytical reasoning. This argument throws light on the importance of understanding the suitability of the fit between the materials and the learners. Adding imagination and analytical reasoning makes it clear that it is important to understand material competencies.

After introducing the Art World Design Thinking Process experiment, observations revealed that participants were able to exhibit concern for material competence assessment. We observed that the participants were able to conceptualize and visualize material before use. They expressed in the preconference that they had confidence in how the selected materials would work. This means that they had tried out these materials and were sure of their competencies. Visualization in the trial experiments led to clues of how the material would be used. This was aimed at mitigating the weak points or getting a better alternative to deliver the targeted competence. Selvi (2010) argues that teachers need competencies to be able to manipulate available ideas to meet the needs of the learner. This manipulation points to improving materials competencies.

On the relevance and appropriateness of a material for a given age or level, we found out that at the pretest the participants did not exhibit deliberate concerns for age appropriateness in terms of material. We observed that there was no deliberate effort to look for elements in materials that were age-appropriate. In most of the cases, the participants were using materials that they had seen other senior teachers use. By age appropriate we expected that the participant would be concerned with sizes, content and features/forms of objects. This should relate to both the mental and physical sizes of children that use them. Courson (2010) argues that it is important that materials are age-appropriate in

terms of size, developmental stage and emerging abilities. This calls the teachers' attention to be mindful of the suitability of materials.

We conducted the experiment and the resulting data revealed that after the experiment the participants were able to exhibit thoughtfulness on elements of materials that made them more child friendly like ensuring that sizes had variations to cater for physical specifications that fit all children. Howitt (2019) argues that it is important to provide appropriate methodologies that take into consideration the different ways in which children learn. Similarly, this means that understanding appropriateness requires creative competencies on the side of the teacher.

The findings from the trial experiments on material utilization creativity and the subsequent observations revealed that the Art World Design Thinking Process generally had a positive influence on how participants understood and applied material utilization. This generally resulted in a more deliberate disposition toward creative ways of engaging material thoughts.

5.1.2 Art World Design Thinking Process and Teacher Methodological Creativity

The discussion on objective two focuses on the effect of the Art World Design Thinking Process on Teacher Methodological Creativity. We wanted to establish how we could use the approach that designers use to boost teacher creativity. To understand this, we hypothesized if there was a significant effect of the Art World Design Thinking Process on Teacher Methodological Creativity.

To be able to study this effect, and to explain this variability, we conducted several experimental trials using stages of the Art World Design

Thinking Process experiment. Teacher Methodological Creativity indicators were observed in the art world design thinking process stages. After analysis data revealed that there was no statistical relationship between the control and experimental group at pre-test. However, post-test data showed that there was a statistically significant relationship between the Art World Design Thinking Process and Teacher Methodological Creativity. In the next section, we discuss the ten creativity indicators.

To start with was the empathizing stage in which two indicators were used. On the ability to act situational in the way they used their methods, we observed that at the pretest the participants were unable to use this appropriately. In this, the interest was in the ability to seize unconventional learning opportunities. The teacher's ability to take advantage of the actions of children or activities around the learning process. CAO (2017), raises two different issues the ability of the teacher to understand the characteristics of the scene and emotional honesty. The scene takes account of the different actions that take place where teaching is taking place. Emotional honesty calls for the teacher to be in a stable emotional state.

The experiment was introduced and the subsequent findings showed that participants were more responsive to acting situational at post-test. Observations showed that participants were able to appreciate and use the scene to benefit the learning process. Observations further revealed that the majority of the participants in both groups had a particular perception of what learning opportunities were. This is based on the narrow-structured view of following the lesson plan. This view presented a narrow conception that learning takes place from within the classroom only through the teacher's planned lesson activities.

Yet in early childhood space, every moment is a learning opportunity for children. This calls for a teacher who can act appropriately in a given situation to meet these needs (Akerson, 2004). This argument focuses on a teacher's ability to act spontaneously in a given situation to seize a learning opportunity.

However, data from the post-test revealed that experimental group participants were able to score highly on the ability to act situational as compared to their counterparts in the control group. Observations further revealed that participants had developed the potential to seize opportunities for learning in unconventional ways like using sudden incidents happening around and inside the classroom to amplify and emphasize lesson targets. Ramdani & Rahmat, 2018 equally raise two aspects that favour spontaneous actions on the teacher's side. Using what they call modified role play and being learner-centered. Their focus is on teachers using what interests learners to ensure meaningful learning.

On the teacher’s ability to envisage methods applicability. Data showed at pretest that participants were less aware of this possibility. We observed that participants were indicating planned methods on a lesson plan. However, in the actual teaching, the listed method would not be followed. Yet the purpose of selecting a method is to ensure that the right method is used for a specific activity or lesson. Also, the pre-conference revealed that participants did not have a grip on what a given method was and later how it was used. Shengji, 2009 argues that if we are to attain quality education. Teachers need a better understanding of how methods play a central role in teaching. Therefore, if a teacher is unable to use a method then even the teaching is affected grossly.

We introduced the Art World Design Thinking Process experiment and the posttest observation revealed that participants exhibited a better

understanding of the selected method(s). They were able to use the selected method more appropriately. We observed that they were able to select activities and materials that were well-matched with the selected method. Understanding methods enables a teacher to use them in creative ways argues Vaughn & Baker (2001). A teacher who is proficient in teaching methods can identify suitable teaching styles which allow learners to excel. They add that understanding methods give the teacher a chance to address diverse learning needs.

We observed at the pretest that both the control and experimental group participants couldn't implement their prepared plans. We observed that they would use methods that were not included in their plan. Observations revealed that they could not follow the planned process in terms of activities. Change of methods revealed that activities did not match the methods planned for. All this was a result of not following the plan with commitment. The plans were rendered useless. Yet it aims to organize the different elements cohesively to be able to deliver effectively. Proper planning is the lifeline of any learning activity it ensures that the course objectives are met (Zeynab & Hamid, 2020)

Posttest observation revealed that the experimental group participants were able to follow their lesson plans. Through the use of how might we questions, participants developed a mechanism to reframe the process. This gave me a better understanding of the elements that form the process. It also highlighted the importance of following the lesson plan. We observed that following the plan also resulted in fewer occasions of method and activity mismatch. This led to a well-organized set of activities and processes that were appropriate for learning. (Roxana, 2018)

We also observed at the pretest that most of the participants in both the control and experimental groups were unable to give opportunities to learners to demonstrate ideas. We observed that the lessons were teacher-centered with minimal or no space for child participation. The learner engagement was in the form of only confirmatory question responses. Observations showed that the children were sitting peacefully at the receiving end of the class. This showed that they were used to sitting passively in the class as the teacher taught. Passive learners are unable to reflect and they are unaware of their knowledge (Gamboa, 2000) yet in early childhood education, participatory learning is the most effective approach.

We conducted the experiment and the subsequent observations revealed that at post-test, the participants were creating opportunities for learners to demonstrate ideas. We observed that the lessons were interactive which gave learners more control over the learning process. Learners were observed demonstrating their ideas and sharing experiences with their teachers and peers. The how might we sessions had helped the participants develop different approaches. This improved their approach to working with children in the class. Engaging learners provides for more adaptation as the basis for more innovative and personalized learning experiences (Haniya & Paquette, 2020)

At pretest observation, the majority of the participants in the control and experimental groups were unable to use methods dynamically. Observing participant's lesson plans showed that methods were tagged to a given activity. This perception of methods was a narrow and rigid one. We observed that methods like role play were mostly for outdoor games well and the demonstration method was for inside-class activities. Kosslyn, 2007 encourages

teachers to engage in an active exploration approach. The focus for active exploration involves exploring methods, materials and activities in new ways. This gives the teacher a chance to discover new and enriching methodological ways of engaging learners in meaningful activities.

The experiment was introduced after which post-test observations revealed that the experimental group participants were using methods more dynamically. We observed that participants were no longer engaging learners by way of answering specific content questions steaming from what the teacher had prepared. They were rather integrating learners' ideas with the teacher's planned method(s). This interaction improved lesson ownership and active engagement of learners (Bodmer et al., 2004) The approach to the methods gave it a broader functioning space in which both the teacher and the learners would get space for engagement.

Pretest observations showed that participants did not use a variety of ideas from the learners. We observed that teachers always had their preconceived ideas which they followed and this gave no way for learners' ideas. We observed that children had alternative ideas but the teacher simply couldn't use them. Yet we know that the centrality of the learner in any learning process is where success starts. Learners were allowed to be at the centre and influence the processes of modelling their learning (Magno & Sebrano, 2009).

The Art World Design Thinking Process experiment was introduced and posttest observations revealed that the experimental group participants were using a variety of ideas from children. We observed that teachers were showing interest in incorporating children's suggested ideas in the lesson. Observations showed that this was exciting and fulfilling for the learners. It resulted in children

taking active roles and being more engaged with the lesson. The concept of using several ideas modelled in the trial experiments gave confidence to the participants to try random ideas from children. This encourages a natural learning environment with reduced restrictions and inhibitions (Raper, 2019).

Pretest observations revealed that participants in both the control and experimental groups were not able to engage learners in modelling planned activities. We observed that planned activities were demonstrated by the teacher for children to follow. We observed that when children sought clarifications, the teachers still re-demonstrated the activities. Yet we know that learning through discovery is a rich approach to learning young children. Encouraging and giving chance to children to try nurtures their ability to explore freely. It is important to nurture the curiosity children come with through harvesting their ability to explore (Honig, 2002)

After the experiment, we observed that experimental group participants were much better at engaging learners to demonstrate planned activities. We saw that teachers were using a co-demonstration method in which both teacher and learners demonstrated in rounds. This gave the teacher a chance to get a different perspective on their planned activity and also gave the children a chance to express their views. We observed that both teachers and children were exchanging ideas and challenging held beliefs as used in the ideation phase of design thinking processes. Engaging learners in the learning process not only makes the learning experience fulfilling but also develops aspects like agency, efficacy and ownership (Krajcik & Delen, 2017)

Pretest observations showed that participants from both the control and experimental groups were not able to use a variety of methodological

connections. We observed that participants always had a planned method for a given lesson and this controlled the use of other possible methods. Using several methods in one lesson enriches the delivery of a variety of concepts and also caters for human diversity. The ability to establish a variety of methodological connections improves interactivity between the children and the teacher (Xie & Xu, 2018).

After the experiment, posttest observation revealed that participants in the experimental group were able to make different methodological connections. We observed that participants were able to tactfully twin methods to enrich the children's learning experiences. They showed a better understanding of how a play between methods enriched the different processes in the activities. Prototyping trials allowed participants to combine different solutions to broader or better options. This led participants to a better understanding of how enriching combining methods was. This enrichment improves the flow of information between the teachers and the learners (Dhande, 2019)

We observed that at the pretest majority of the lessons in the control and experimental classes were unable to be flexible with the learner's options. We observed that participants had a structure of how and what they intended to do. These guidelines would not allow participants to consider children's opinions. Encouraging a learner's curiosity for learning is rooted in the ability to encourage independence (Gonczy, 2013) this can be achieved through creating opportunities for children's opinions.

After conducting the experiment posttest observations revealed that participants were able to use the learner's opinion in shaping their methodology. We observed that participants encouraged learners to contribute to the

methodology process by way of agreeing on how to do activities. The trial phase of testing for what works and how it works gave participants the ability to allow for trials in the process. Through this, we observed that teachers allowed learners to test their assumptions and challenge their curiosity. Using learners' opinions is central to understanding how best to deliver a program and how to improve its quality (Bucker & Butler, 2011)

Pretest observations revealed that both the control and experimental group participants were unable to allow children to display their skills. We observed that the teacher was always in control of the lesson and the children were loyal followers. This made the lesson the teacher's lesson with things done according to the teacher's will. This leaves the children powerless yet they are the first beneficiaries of the lesson (Muganga & Ssenkusu, 2019). There is a need for an appropriate balance of power to ensure that learners own the learning process and the teacher just guides.

After the experiment posttest observations revealed that the participants in the experimental group were more responsive about giving children an opportunity to display their skills. We observed that planned method activities that children could use to lead in the teaching process. We observed that being in control of the lesson as leaders often gave the lesson a more child-friendly pace. We observed that children had more freedom to question and challenge what their peers were doing. To achieve quality learning and also promote skills acquisition educators need to consider approaches that put learners in control of their learning experiences (Kanga, 2020)

5.1.3 Discussion of Findings on Art World Design Thinking Process and Teacher Spaces Utilization Creativity

In this section for objective three, the discussions were guided by the creativity indicators that we used to observe the teacher's creativity on space utilization. Pretest and posttest observations are discussed in the light of teacher space utilization creativity.

Pretest observations revealed that in both the control and experimental group the spaces were not flexible. We observed that children were sitting on chairs facing the teacher in the classrooms. Even though the chairs and desk were movable it seemed that children always had to sit in this given way. We also observed that the teachers always stood in front of the learners as preachers. There was no flexibility in the spaces yet for a learning space to be of good quality for young children flexibility is a key element. Avoiding standardization offers opportunities for adaptation of the space to suit varying activities. (Soiland & Hansen, 2019)

Posttest observations of the experimental group participants revealed a lot of flexibility in the classroom setup. We observed that participants were able to rethink the classroom spaces. Classroom space arrangement was guided by the planned lesson activity. Observations revealed that the teachers and learners were interacting with the spaces more meaningfully. The trial experiments on understanding user needs yielded insights into how to customize spaces for specific activities. Children need learning spaces that are less institutionalized (Nilsen, 2012). There need for spaces that are less controlled and flexible to meet individual children.

In the pretest observations participants in both groups did not show any conscious engagement of learners in space conception. We observed that participants were using both indoor and outdoor spaces as they were. Yet space functions must be conceived and well planned to suit learning activities. A collective approach between the teacher and the learner is a joint venture of knowledge sharing (MOLL, 2020). This calls for critical engagement of spaces which children use to get a better understanding of what qualifies quality spaces in the children's view.

However, posttest observations revealed that the experimental group participants were engaging learners in space conception. We observed that teachers were consulting children on how best to organize the spaces for a given learning activity. We also observed that children were physically engaged in re-organizing learning spaces. In this process, children contributed ideas of how to use the spaces to suit their interests. Children have their patterns and behaviour in learning and play, we therefore ought to be mindful of how spaces shape their learning experiences (Latfi & Karim, 2012).

Pretest observations revealed participants in both the control and experimental groups were unable to express methodological space conception. It was revealed in the post-conference phase that participants were not aware of the importance of planning for spaces. Yet it is important to conceive how a given methodology and its activities fit into the selected space. Structured imagination is vital when designing children’s spaces (Nichols, 2020). There is a need for teachers to continue crafting novel concepts of how to use spaces that suit selected messages.

Pre-conference observations at the pretest showed that participants had no space plans. We observed that participants either used spaces in the way they would find them or made changes but with no specific plans. Creating physical space plans for children's activities helps the teacher to make prior connections between the methods, materials and activities. This is important because we observed that good activities often fail because of a wrong choice of space. Well-planned spaces encourage exploration, curiosity and imagination which are fundamental blocks for learning in the early years (Atmakur, 2016).

We observed at the posttest that in the experimental group participants had space plans as part of their documentation for lesson plans. We also observed that there was a synch between the spaces and planned activities. The participants and the learners were observed actualizing the plan as conceived by the participants. Visualizing in the prototyping phase yielded results in the participants' ability to visualize space plans. Spaces plans offer an opportunity to envisage what is suitable for a given age and ensure to meet their capabilities and motivation (Yuill, 2020)

We observed at the pretest that both the control and experimental groups were not using space elements creatively. Spaces environments are comprised of different elements which the teacher can harness and use creatively to enrich the learning experiences. We observed that teachers simply walked into the rooms without thinking about their elements as integral parts of the room. Yet we observed that often children were playfully engaging with elements in the space where they studied. Learning spaces for children attract their attention and this engages them on both physical and psychosocial grounds (Mannav & Erkan,

2012). This emphasizes the study's argument that in early childhood space is an integral part of children's learning experiences.

Lastly, for objective one, we observed that both the control and experimental groups were not using a variety of space assessment information. We observed that participants had no record of assessment information for the spaces. In the post-conference discussion, they expressed not being aware of space assessment. Yet assessing children's spaces gives supporting adults an awareness of what kind of elements are in a given space and how children can use them. Assessment information helps the teacher to evaluate the success of children's activities from the perspective of the spaces that they use. There is a need for a teacher to have space assessment information because children continuously negotiate, re-organize and re-construct the spaces we use in teaching and learning (Vuorisalo, Raittila & Rutanen, 2018)

Posttest observations revealed that participants were more interested in using information they had on space assessment. In the post-observation conference, they expressed awareness of space elements, space plans and challenges children had faced in a particular space. Such vital information was useful in adjusting the activities and spaces for a better learning experience for children. Spaces assessment helps teachers develop insights into spaces based factors that motivate children while using given spaces (Saragih & Tedja, 2017)

5.1.4 Discussion of findings on establishing the difference in teacher creativity in the study group and the control group

In this objective, the focus was on the results of the t-test analyses. We were interested in using statistical data to find out if there existed a difference in creativity between the control and experimental groups. Six different sets of

paired sample t-tests were run in SPSS. Three for pretest scores and three for post-test scores for the three objectives.

The pretest scores revealed that there was no statistically significant difference between the control and experiment group sets. Data revealed that there was a low variation in the mean values and the p values were much higher than the critical p value. This meant that there was no statistically significant difference in creativity between the control and experimental groups. However, the small mean difference revealed that the two groups were comparable. The difference between the means of the control and experimental groups also revealed that the control group participants were relatively better than those in the experimental group at the pretest.

At the post-test, there was a statistically significant difference between the control and experimental group t-test scores. The wider variations in the means and the low p values below the critical value after the treatment revealed that there was a statistically significant difference between the creativity in the control and experimental groups.

Therefore, the difference between the pretest and post-test t-test results showed that there was a difference in teacher pedagogical creativity between the control and experimental groups after the treatment.

5.2 Conclusion

The conclusion to this study will be drawn on two different dimensions that is on the theoretical application and objective specific as follows;

The results from the pre and post-test analysis showed that design thinking had an impact on the teacher's pedagogical creativity based on this we

can conclude that Thorndike and Woodworth's (1901) theory of identical elements is achievable.

Secondly based on the quantitative and qualitative data analyzed, the teachers exhibited improved Teacher Materials Utilization Creativity, Teacher Methodological Creativity and Teacher Spaces Utilization Creativity based on this evidence we can conclude that the Art World Design Thinking Process improves Teacher Pedagogical Creativity.

5.3 Recommendations

Based on the findings from the relationship between the Art World Design Thinking Process and Teacher Pedagogical Creativity, the following recommendations are key.

5.3.1 Recommendations for the Ministry of Education and Sports

Based on the findings of this study, the Ministry of Education and Sports especially the Department of Teacher Education, Training and Development is urged to consider the following recommendations;

It is recommended that the Department of Teacher Education, Training, and Development create comprehensive guidelines for educational institutions that outline clear expectations for fostering teacher creativity during training. Given the complexity of pedagogical creativity, these guidelines should provide specific strategies and best practices to help teacher educators' support and nurture creative teaching approaches. By issuing detailed guidance, the department can ensure that teacher training programs are better equipped to cultivate innovative and adaptive teaching skills, ultimately enhancing the overall quality of education

As the Department of Teacher Education, Training, and Development (TETD) holds the mandate to oversee teacher training and development, it is recommended that TETD implement robust quality control mechanisms to ensure curriculum flexibility. Such measures would allow teacher education programs to adapt curricula to diverse contexts, thereby fostering local and cost-effective creative practices. By promoting context-specific adaptations, TETD can enhance the relevance and effectiveness of teacher training, ensuring that educators are well-prepared to meet the unique needs of their communities.

It is recommended that the TETD prioritize the use of well-researched and evidence-based materials for training and guiding teachers, building on the findings of this study. By adopting and further developing these insights, the department can ensure that creative teaching practices introduced during teacher training are effectively implemented in school programs. This approach will help to establish a culture of creativity within schools and communities, fostering an environment where innovative teaching methods become an integral part of educational practice.

5.3.2 Recommendations for Teacher Training Institutions

Based on the findings of the study we recommend the following for teacher training institutions;

It is recommended that teacher training institutions consider revising their curricula to incorporate the insights from this study, particularly the adaptation of the Art World Design Process to enhance teacher creativity in early childhood education. Given that many institutions operate autonomous programs, these curriculum reviews should focus on integrating new approaches to methodology, materials, and creative use of space. This will ensure that

teacher training programs are aligned with innovative practices that foster creativity in early learning environments.

Based on the classroom observations made in this study, it is recommended that teacher-training institutions revise their teacher observation tools used for assessment. Specifically, there is a need to introduce creativity indicators in key areas such as material utilization, methodological approaches, and space utilization. Incorporating these creativity measures will ensure a more comprehensive evaluation of teaching practices, fostering innovation and creativity in classroom settings.

5.3.3 Recommendations for the National Curriculum Development Centre

Given the literature gaps identified concerning the creative utilization of materials in Early Childhood Care and Education (ECCE), it is recommended that the National Curriculum Development Center (NCDC) leverage the findings of this study to revisit and revise the ECCE Learning Framework. Specifically, the development of a comprehensive teacher's guide should be prioritized, with a strong emphasis on fostering creativity in teaching practices. This guide would support teachers in utilizing materials more innovatively, ultimately enhancing the learning experiences of young children.

5.3.4 Recommendations for Future Research

To gain a deeper understanding of the implications of this study, it is recommended that future research explore the impact of the findings on children's learning experiences. Specifically, conducting a similar study that focuses on how creative teaching practices influence children's engagement and development would be beneficial.

Additionally, a parallel investigation could be conducted with pre-service teachers to compare outcomes, as this study focused solely on in-service teachers. This would offer a broader perspective on how creativity in teaching is fostered across different stages of teacher training.

Given the increasing integration of technology in education, future research should explore the use of Artificial Intelligence (AI) to enhance and evaluate the application of the Art World Design Thinking Process in fostering teacher pedagogical creativity. AI-powered tools offer significant potential to transform educational research and practice by delivering real-time feedback, simulating creative teaching scenarios, and analyzing instructional practices through advanced machine learning algorithms. Incorporating AI into future studies could improve the precision of data collection, generate deeper insights into pedagogical strategies, and facilitate more personalized teacher development through adaptive learning systems. Furthermore, AI-based observational tools can help reduce observer bias, ensuring more objective and consistent assessment of teaching behaviors in classroom settings.

REFERENCES

Abramo, J. M. and Reynolds, A. (2014) *"Pedagogical Creativity" as a Framework for Music Teacher Education Journal of Music Teacher Education 2015,* Vol. 25(1)

Acemoglu, D. and Robinson, J.A. (2012). Why Nations Fail: The Origins of Power, Prosperity, and Poverty. *Journal of Southeast Asian Economies 29(2).* ASEAN Economic Bulletin, Vol. 29, No. 2 (August 2012), pp. 168-170.

Akerson, V. (2004). Designing a Science Methods Course for Early Childhood Preservice Teachers. *Journal of Elementary Science Education, 16*(2), 19-32. Retrieved July 20, 2020, from www.jstor.org/stable/43155754

Alashwal, M. (2020). Design Thinking in STEM Education: A Review 1 Department of Learning Sciences and Educational Research, University of Central Florida, Orlando, USA

Anderson, J. R. (1983). The Architecture of Cognition. Cambridge, Mass.: Harvard Univ. Press.ar.

Atmakur, J.S. (2016). *Children's Play in Urban Areas*.

Ata-Akturk, A., & Sevimli-Celik, S. (2023). Creativity in early childhood teacher education: beliefs and practices. *International Journal of Early Years Education*, *31*(1), 95–114. https://doi.org/10.1080/09669760.2020.1754174

Ata-Akturk & Serap Sevimli-Celik (2020). Creativity in early childhood teacher education: beliefs and practices, *International Journal of Early Years Education*. DOI: 10.1080/09669760.2020.175417

Ben-Horin, O., & Boylan, M. (2016). Towards a professionalization of pedagogical improvisation in teacher education. *Cogent Education*, *3*(1). https://doi.org/10.1080/2331186X.2016.1248186

Bhattacherjee, (2012). A. *Social Science Research: Principles, Methods, and Practices*,

Bodrova, E. Leong, D. (2001). *American Early Childhood and Primary Classrooms. Geneva, Switzerland*: UNESCO International Bureau of Education; 2001. The Tool of the Mind: a case study of implementing the Vygotskian approach.

Bonnardel, N., Forens, M., & Lefevre, M. (2016). Enhancing collective creative design: An exploratory study on the influence of static and dynamic personas in a virtual environment. Design Journal, 19(2), 221-235.

Bonnardel N, Wojtczuk A, Gilles P, Mazon S. (2017). *The creative process in design*. The Creative Process: Perspectives from multiple domains.

Calleja, J., Bezzina, C. (2018). *Teacher Supporting Teacher.*

Craft, A. (2001). *An analysis of research and literature on creativity in education. Qualifications and Curriculum Authority*.

Craft, A. (2006) Fostering creativity with wisdom. *Cambridge Journal of Education*, 36, 3, 337-350, DOI: 10.1080/03057640600865835.

Creswell, J. W. (2008). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research*. 3rd ed. Upper Saddle Creek, NJ: Pearson Education.

Cropley, Arthur (2008). In Praise of Convergent Thinking. *Creativity Research Journal.*

Csíkszentmihályi, M., & Wolfe, R. (2014). *New Conceptions and Research Approaches to Creativity*: Implications of a Systems Perspective for Creativity in Education.

Cutter-Mackenzie, A. et al., (2014). *Young Children's Play and Environmental Education in Early Childhood Education, Springer Briefs in Education*.

de Leon-Abao, E. (2014). Teachers' Instructional Competence on Students' Comprehension Skills and Critical Thinking Ability. *Open Journal of Social Sciences*, 2, 334-339. http://dx.doi.org/10.4236/jss.2014.24037

Dhande, M. (2019). *Defects in Quality Education in University System.*

Ejuu, G. (2012). Early childhood development policy advanced in Uganda; *Contemporary issues in early childhood, 13,* (3), Kyambogo, Retrieved from: *www.wwwords.co.uk/CIEC*

Florida, R. (2002). *The Rise of the Creative Class and How It's Transforming Work, Leisure, Community and Everyday Life*. New York: Basic Books.

Gabora, L. (2002). *Cognitive mechanisms underlying the creative process*. In: Hewett T., Kavanagh E., editors. Proceedings of the Fourth International Conference on Creativity and Cognition; 2002 October 13–16; Loughborough University, United Kingdom. pp. 126–133.

Gago, G., Lucas, Grandis M., Jaume, Luis E., & Angel M. (2020). *Home Environments and its Contribution to Early Childhood Negotiatory Capabilities* (ECDC).

Garvin, W. L. (1964). Creativity and the Design Process Source: *Journal of Architectural Education* (1947-1974), Vol. 19, No. 1 (Jun. 1964), pp. 3-4Published by Taylor & Francis, Ltd. on behalf of the Association of Collegiate Schools of Architecture, Inc

Gauntlett, D. (2011). *Making Is Connecting: The Social Meaning of Creativity, from DIY and Knitting to YouTube and Web 2.0*. Cambridge: Polity Press.

George. J.M, Lubben, T. (2002). *Facilitating teacher's Professional Growth through their involvement in creating context-based materials in science.*

Giglio, M. (2015). Creative Collaboration in Teaching. Houndmills: Palgrave Macmillan. *https://doi.org/10.1057/9781137545978*

Gjalt. T. Prins, Astrid M., Buite & Abert P. (2018). *Designing Context-based teaching materials by transforming authentic Scientific Modelling Practices in Chemistry.*

Gladstone, J., Dumbril, G. Leslie G., Koster, A., Young, M., & Ismaila, A. (2012). *Looking at Engagement and outcome from the perspectives of child protection workers and parents. Child and Youth service review.*

Gonczy, T. (2013). *The Importance of Play and Child Learning*.

Goodman, Stacey (2014). Final Creativity in the Classroom with Divergent Thinking.

Grainger, T., Barnes, J., & Scoffham, S. (2004). A creative cocktail: Creative teaching in initial teacher education. *Journal of Education for Teaching, 30*, 243-253.

Gregory, B. (2019). *Artistic creativity beyond divergent thinking*: Analysing sequences in creative sub processes, Thinking Skills and Creativity,

Gregory. E, Mariale. H, Julia. Y, Luke. R, and Charles. L. (2013). Building creative thinking in the classroom: From research to practice. *International Journal of Educational Research,* Vol. 62. 43-50.

Haniya, Samaa & Paquette, Luc (2020). *Understanding Learner Participation at scale. How and why e-learning and digital media.*

Hargreaves, D. (2001). *Towards education for innovation*. In *Design Council. Changing.*

Harris, N. (2011). Does responsive regulation offer an alternative? Questioning the role of formalistic assessment in child protection investigation. *British journal of social work* 41 (7), 1383-1403.

IBM Corporation (2010) *Working beyond Borders: Insights from the Global Chief Human Resource Officer Study*. New York: IBM Global Business Services. Retrieved from http://www-935.ibm.com/services/c-suite/chro/study.html

Ichendu, C. (2020). Morality and ethics in research. *World Journal of Advanced Research and Reviews*. 8. 171-174. 10.30574/wjarr.2020.8.3.0470.

Ismuratova, S. I. (2016). Formation of the Future Specialists' Pedagogical Creativity. *Indian Journal of Science and Technology*, 9(22), 48-56.

Interaction Design Foundation - IxDF. (2016, May 25). *What is Design Thinking (DT)? Interaction Design Foundation* - IxDF. https://www.interaction-design.org/literature/topics/design-thinking.

Kadirbaeva, R. I. (2010). Scientific and Pedagogical Bases of Professional Training of the Future Teachers for the Development of Creative Abilities in Schoolchildren: PhD Thesis. Almary, 315.

Kaila, H. (2005). Democratizing schools across the world to stop killing creativity in children: An Indian perspective. *Counselling Psychology Quarterly, 18*, 1-6.

Kanga, Anne (2020). *Learner Centred Pedagogies*. A Critical Review of the Use and Implications for Learner-Centred Pedagogies.

Kapur, Shikha. (2018). *Teaching Aids, Non-Conventional and Modern*

Kaufman, J. and Sternberg, R. (2006). *The International Handbook of Creativity*. Boston: Cambridge University Press.

Kendler, H. H. (2016, November 3). Transfer of training. Encyclopedia Britannica. https://www.britannica.com/topic/transfer-of-training

Kimbell, L. (2011). Rethinking Design Thinking: Part I. *Design and Culture*, *3*(3), 285–306. https://doi.org/10.2752/175470811X13071166525216.

Kosslyn S.M (2007). Clear and to the Point & Psychological Principles for Compelling Power point presentations. New York. Oxford University Press. *Creativity Research Journal*, *24*(1).

Krajcik, J. & Dalen, I. (2017). Engaging Learners in STEM Education. Engaging Learners in STEM Education. *Estonia Journal*.

Krejcie, R. V, & Morgan, D.W. (1970). "Determining sample size for research activities'' *Educational & Psychological Measurement,* No: 30, pp.607-610.

Kumar, R. (2011). *Research Methodology: A step-by-step guide for beginners*.

Kupers, E., Lehmann-Wermser, A., McPherson, G., & van Geert, P. (2019). Children's Creativity: A Theoretical Framework and Systematic Review. *Review of Educational Research, 89*(1), 93-124. https://doi.org/10.3102/0034654318815707

Leeson, C (2007). My life in care: Experiences of non-participation in discussion-making process. *Child and family social work*. 12(3):268 – 277.

Logan, G. D., & Klapp, S. T. (1992). Automatizing alphabet arithmetic: Is extended practice necessary to produce automaticity? *Journal of Experimental Psychology: Learning, Memory & Cognition*, 17: 179-195.

Lucas (2019). Teaching and assessing creativity in schools in England. *Impact Journal*, 7: 5-8

Marchetti, G. (2018). *Consciousness: a unique way of processing information*. *Cogn Process* **19**, 435–464 https://doi.org/10.1007/s10339-018-0855-8

Martiniano, C. (2016). The Scientization of Creativity Christopher. *The Journal of the Midwest Modern Language Association*, Vol. 49, No.2.

Marzano, R. Pickering, D. & Pollock, J. (2001). *Pre-assessment for classroom instruction that works: Researched Based Strategies for increasing student achievements.*

Miller, D. L. (2015). Cultivating Creativity. *The English Journal*, Vol. 104, No. 6.

Moll, Henrike (2020). How Young Children Learn from Others. *Journal of Philosophy of Education*

Morgan, D. (2007). Paradigms lost and pragmatism regained: Methodological implications of combining qualitative and quantitative methods. *Journal of Mixed Methods Research,* 1(1), 48– 76

Muganga, Lawrance & Senkusu, Peter (2019). *Teacher Centred versus Student Centred Cultural and Pedagogical Inquiry.*

NAPE (2018). National Assessment of Progress Report. *The achievement of primary school learners and teachers in Uganda in numeracy and literacy in English.*

National Curriculum Development Centre (2007). *Early Childhood Development Government Policy, Kampala, Uganda*, NCDC

Nicholas, D. (2020). *Structured Imagination: Designing Children's Play Spaces*.

Nilsen, R. (2012). *Flexible Spaces – Flexible Subjects in Nature*.

Nolan, A., Robertson, N., & Bussey, K. (2024). The ‘it’ factor: expectations of ‘good’ early childhood teachers in Australia. *Early Years*, 1–15. https://doi.org/10.1080/09575146.2024.2303045

Smith, J. Noble, H. (2015). *Issues of validity and reliability in qualitative research. Evidence-Based Nursing,* 18, (2): 34-35

OECD (2012). *Equity and Quality in Education: Supporting Disadvantaged Students and Schools, OECD* Publishing. http://dx.doi.org/10.1787/9789264130852-en.

Pageni, S. & Rimal, Y. (2017). *Roles of physical instructional material in early childhood learning centres*

Parkhurst, H. (1999). Confusion, lack of consensus, and the definition of creativity as a construct. *Journal of Creative Behavior,* 33, 1-21.

Phan, N. (2020). *Reflection on the Implications for Teaching Materials old.*

Pilot, A.& Buite, A. (2006). *The use of contexts as a challenge for the chemistry curriculum: its Success and Understanding*.

Ramdani, J. M. & Rahmat (2018). *Promoting Speaking Spontaneity in Large Classes. An Action Research approach in an Indonesian EFL setting*.

Raper, S. (2019). *Turning Points. Fisher’s Random Idea. Significance*

Rogers, C. (1970). Toward a theory of creativity. In: P. Vernon, Ed., *Creativity: Selected reading*, Harmondsworth: *Penguin Books*,

Rolfe, G. (2006). Validity, trustworthiness and rigour: quality and the idea of qualitative research. *Journal of Advanced Nursing*; 53, 3, 304-310.

Runco, M. (2011). *Divergent Thinking*

Russell, T. & Vaughan P. (2010). *A Framework for Rethinking Learning in Science from recent Cognitive Science Perspectives.*

Saragih, J. & Tedja, M. (2017). *How Children Create Their Spaces for Play*? IOP Conference Series, Earth and Environmental Science.

Sawyer, R. K. (2006). *Explaining creativity: The science of human innovation*. New York: Oxford University Press.

Selkrig, M. & Keamy, K. (2017). Creative pedagogy: a case for teachers' creative learning being at the centre. *Teaching Education*, *28*(3), 317–332. https://doi.org/10.1080/10476210.2017.1296829

Selvi, K. (2010). Teacher Competencies. Cultural, *International Journal of Philosophy of Culture and Axiology*

Sendur, M. Agnieszka (2018). *Materially Media We Wspolczesnej Glpttodydaktyce: Wybrane Zagadnienia.*

Shah. R. K (2021). *Conceptualizing and Defining Pedagogy. Sanothimi Campus Tribhuvan University Sanothimi, Bhaktapur, Bagamaati Province 3, Nepal*

Shaheen, R. (2011). *Creativity and Education, School of Education, University of Birmingham, Birmingham*, UK.

Slevin, E. (2002). *Enhancing the truthfulness, consistency, and transferability of a qualitative study: using a manifold of two approaches*. Nurse Researcher, 7, 79-197.

Smith, D. (2011). *From Crazy Chemists to Engaged Learners through Education, Nature Chemistry.*

Soiland, E. & Hansen, G. (2019). *Ideas or Reality*? Flexible Spaces - Flexible People. Intelligent Buildings International

Sternberg, R. (2001). *What Is the Common Thread of Creativity*: It's Dialectical Relation to Intelligence and Wisdom. American Psychologist, 56, 360-362.
https://doi.org/10.1037/0003-066X.56.4.360.

Stinnett, H (2018). *How Time with Students Made me a Better Teacher*

Syed-Ikhsan, S.O. and Rowland, F. (2004). Knowledge Management in a Public Organisation: A Study on the Relationship between Organizational Elements and the Performance of Knowledge Transfer. *Journal of Knowledge Management,* 8, 95-111. https://doi.org/10.1108/13673270410529145

The Sustainable Development Goals Report (2018) (SDG4)

Timperley, H. (2014). *Using Assessment Information for Professional Learning*.

Toros, K., Tiko, A., & Saia, K. (2013). *Child-centred approach in the context of the assessment of child in need.* Reflections of child protection workers in Estonia. Child service review.

Trainor, A. & Graue, E. (2013). *Reviewing qualitative research in the social sciences*, New York; London, Routledge

Treffinger D. J., Isaksen S. G. (2005). *Creative problem solving: the history, development, and talent development.*

UNICEF (2019). *Uganda Annual Report 2019.*

Uzakbaeva, B. & Baimukhanbetov, K. (2013). *To the Problem of Forming Creative Competence of Future Teachers Sakipzhamal*.

Vandervert L. R., Schimpf P. H., & Liu H. (2007). *How working memory and the cerebellum collaborate to produce creativity and innovation*. Creativity Res. J. 9:1–18.

Vaughn, L. & Baker, R. (2001). *Teaching in the medical setting: Balancing teaching styles, learning styles and teaching methods*. Medical Teacher.

Visscher-Voerman, I. & Gustafson, K.L. (2004). *Educational technology research and development* 52: 69. *https://doi.org/10.1007/BF02504840*

Vuorisalo, M. & Raittila, R. & Rutanem N. (2018). Pre-Primary School Spaces and Autonomy in Construction. Exploration during team Ethnography in a Finnish Pre-Primary School. *Journal of Pedagogy.*

Wall, S, Litjens. I, Taguma. M. (2015). *Pedagogy in early childhood education and care (ECEC)*: an international comparative study of approaches and policies.

Walter H. & Clark, J. (1986). Some Thoughts on Teaching Creativity. *The Journal of Aesthetic Education*, Vol. 20, No. 4, 20th Anniversary Issue (winter, 1986), pp. 27-31

Xie, Jian & Xu, Binbin (2018). *Application of the MOOC Mixed Teaching methods under the Background of Internet + Education Science*. Theory and Practice.

Yuill, N. (2020). Metadata of the Chapter that will be Visualised Online. Chapter Title: *Play Space Design in Autism*. Play Space Design in Autism and Definition. Play Space Design in Autism

Internet Sources;

https://www.youtube.com/watch?v=7XWMAteuaks

https://www.youtube.com/watch?v=iG9CE55wbtY

https://www.merriam-webster.com/dictionary/creative%20play

http://www.pbs.org/wholechild/providers/play.html

http://www.sdgfund.org/goal-4-quality-education

http://www.unesco.org/education/wef/countryreport/uganda/contents.htm\cont

APPENDICES

Appendix 1: Observation Tool

TEACHER CREATIVITY OBSERVATION TOOL (V3/2019)

Teacher Creativity indicator is the tool used to measure Creativity Tendencies and practices exhibited by a teacher in the teaching and learning process

How it works: Conduct a standard classroom observation involving a **Pre-Observation Conference, In-classroom Observation and a Post-Observation Conference** the observer scores the participant accordingly and records all necessary information

STAGE	OBSERVATION INDICATORS	SCORE					TOTAL
PRE-OBSERVATION CONFERENCE, IN-CLASSROOM OBSERVATION AND POST-OBSERVATION CONFERENCE	**TEACHER MATERIALS UTILIZATION CREATIVITY**	**1**	**2**	**3**	**4**	**5**	
	Empathizing						
	Materials for Individual Child (Sensitive to differences)						
	Selection is related to the planning process						
	Relates context to selection						
	Define						
	Contextualized Materials (Ideas be educational)						
	References (Identifies and uses available sources of information)						
	Selection is generally affordable/available						
	Ideation						
	Divergent materials Thoughts (Novelty, Trying out things)						
	Convergent Material Thoughts						
	Environment (Sensitive, uses local and available materials)						
	Available (Uses available information to develop ideas)						
	Convenient (Able to take advantage of situations)						
	Prototyping and Testing						
	Multi-disciplinary (Uses ideas from other disciplines)						
	Materials competence assessment						
	Appropriate (Picks relevant material for a given level / Age)						
	TEACHER METHODOLOGICAL CREATIVITY	**1**	**2**	**3**	**4**	**5**	
	Empathizing						
	Ability to act situational						
	Teacher's ability to envisage methods applicability.						
	Define						
	How close is the delivery to the methodological plan						
	Opportunity for learners to demonstrate methodological ideas						
	Ideation						
	Dynamic Use of Methods						
	A variety of methodological ideas from learners used						
	Engaging learners to model planned methodological activities						
	Prototyping and Testing						
	Variety of methodological connections						
	Flexible with learners' options or alternatives						
	Learners can take over the learning situation and display skills						
	TEACHER SPACES UTILIZATION CREATIVITY	**1**	**2**	**3**	**4**	**5**	
	Empathizing						
	Flexibility spaces						
	Define						
	Engaging learners in spaces conception approval						
	Ideation						
	Spaces methodological Conceptions						
	Variety of Space plans						
	Prototyping and Testing						

	Creative use of spaces Elements						
	Variety of space assessment information						
GENERAL FIT		**1**	**2**	**3**	**4**	**5**	
	Fit between methods, Materials and Spaces						
		GRAND TOTAL					

Appendix 2: Experiment Procedure

EXPERIMENT PROCEDURE FOR DEVELOPING TEACHER CREATIVITY

	EXPERIMENT STEPS	DESIGN PROCESS	TEACHER PROCESS	THOUGHT PROCESS QUESTIONS
1	Empathizing	- Set aside assumptions and share experiences with persons involved to get the human side of the challenge. -develop the best possible understanding of the users, their needs, and the problems that underlie the development of that particular product. -Research user and competitor products	Learner Needs Assessment - materials - methods - spaces	-What are their needs -What motivates them -What are their experiences - for materials - for methods - for spaces
2	Define	-Study the expected Competences - Definition Concepts -Make Connections on meanings using other fields. -Reframe the Problem -State the problem -Ideas to establish features, functions, and any other elements required -Select ideas that have a large impact	- Identification of Specific Problems. - Definition / Reframing of these problems - relate to materials - methods - spaces	-Do I understand the situation? -How might we …? -Is the approach iterative in nature - for materials - for methods - for spaces
3	Ideate	-Think out of the box and brainstorm / Suggest ideas even strange ones. -Challenge commonly held beliefs -At this point, it's about a broader range of ideas, not the best idea	- Suggesting a range of possible solutions to the problems - for materials - for methods - for spaces	-What other alternative ways can the problem be viewed -Am I exercising free thought -Are we bold and Curious? -Are we drawing our focus on fresh Perspectives? -Iteration - for materials - for methods - for spaces
4	Prototype	-Evaluate/ Discuss the available options for ideas -Put real-life / Visual versions of ideas -Bring stages 1,2 and 3 ideas in	- Put the suggested ideas to life. - Identify their features/elements and how they manifest themselves - for materials	-What are the elements needed? -What are their features?

			- for methods - for spaces	-What can/do these features mean? -What are the best possible solutions? - for materials - for methods - for spaces
4	Test	--Share and test the prototypes -Interface solutions with real people -Iterative approach to testing / trying out	Test them in a classroom setting or real educational context - for materials - for methods - for spaces	-What solutions are working -What's not working? - How better can we present successful solutions? -Is Fidelity in the check? - for materials - for methods - for spaces

Appendix 3: Focus Group Interview Guide

FOCUSED GROUP INTERVIEW GUIDE (V1/2019)

The focused group discussion interview guide is designed to guide the discussion with the participants on the question; what is the contribution of the Art World Design Thinking Process to Teacher Material Utilization Creativity, Teacher Methodological Creativity and Teacher Spaces Utilization Creativity?

How it works: Participants are engaged in a group interview discussion in which a mix of open-ended and semi-structured questions are used to guide the conversation on what contributions the participants gained from the art world design thinking process experiment. **Then the observer takes notes or records all necessary information**

SN	INTERVIEW GUIDE QUESTIONS
1	**SECTION A: Teacher Material Utilization Creativity**
	Empathizing
	1. Tell me about the activities involved in empathising for materials utilization 2. Tell me about what you like most about these activities and why/ 3. Tell about the connections between empathy and materials
	Define
	1. Tell me about define for material utilization 2. How would you describe this process? 3. What parts satisfy you most 4. Tell me about the connections between define and material utilization
	Ideation
	1. Tell me about the ideation project you loved most and why 2. Is there anything that was outstanding? Describe it more 3. Tell me about the materials used in the activities 4. Tel me about the connections between ideation and using materials
	Prototyping and Testing
	1. How would you describe the prototyping and testing for materials? 2. Tell me about material utilization prototyping and testing 3. Tell me about the connections between prototyping and material utilization 4. Tell me about the most exciting activities and why
2	**SECTION B: Teacher Methodological Creativity**
	Empathizing
	1. How would you describe empathy for teaching methods? 2. Tell me about the empathy project you loved most in methodological creativity and why 3. Is there anything outstanding? Describe it more 4. Tell me about the contradictions you observed 5. Tel me about the connections between empathy and using methods
	Define
	1. Tell me about the defined phase in methodological creativity 2. Which project was more exciting and why 3. Is there anything outstanding? Describe it more 4. Tell me about the contradictions you observed 5. Tel me about the connections between defining and using methods
	Ideation
	1. Tell me about the ideation in methodological creativity 2. Is there anything outstanding? Describe it more 3. Tell me about the stage that was more productive in ideation for methods 4. Tel me about the connections between ideation and using methods
	Prototyping and Testing
	1. How would you describe the prototyping and testing for methods? 2. Tell me about the most exciting activities in prototyping and testing for methods 3. Tell me about the connections between prototyping and the use of methods 4. Tell me about the projects in which you felt most satisfied with prototyping and testing for methods
3	**SECTION C: Teacher Spaces Utilization Creativity**
	Empathizing
	1. How would you describe empathy for space utilization creativity? 2. Tell me about the empathy project you executed well in space utilization creativity and why 3. Is there anything outstanding? Describe it more 4. Tell me about the contradictions you observed 5. Tel me about the connections between empathy and space utilization creativity
	Define

	1. Tell me about the define phase in space utilization creativity 2. Which project was more exciting and why 3. Is there anything outstanding? Describe it more 4. Tell me about the contradictions you observed 5. Tel me about the connections between define and space utilization creativity
	Ideation
	1. Tell me about the ideation in methodological creativity 2. Is there anything outstanding? Describe it more 3. Tell me about the stage that was more productive in ideation for methods 4. Tel me about the connections between ideation and using methods
	Prototyping and Testing
	1. Describe the prototyping and testing for space utilization creativity 2. Tell me about the most exciting activities in prototyping and testing for spaces 3. what connections are there between prototyping and use of spaces? 4. Tell me about the projects in which you felt most satisfied with prototyping and testing for spaces
4	What other observations or lessons does the design thinking process bring to materials, methods and Spaces?

Appendix 4: Similarity Index Report

The Art World Design Thinking Process and Teacher Pedagogical Creativity: A Case of Kyambogo University Early Childhood Diploma in Teacher Education

ORIGINALITY REPORT

16%	16%	2%	3%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	ajest.info Internet Source	7%
2	journal.unche.or.ug Internet Source	3%
3	123dok.com Internet Source	1%
4	worldwidescience.org Internet Source	<1%
5	educationdocbox.com Internet Source	<1%
6	umispace.umi.ac.ug Internet Source	<1%
7	ijllalw.org Internet Source	<1%
8	ir.kiu.ac.ug Internet Source	<1%

repository.up.ac.za

Appendix 5: Research Ethics Approval

ST. JOHN BOSCO CORE PTC-LODONGA

DEPARTMENT OF EARLY CHILDHOOD DEVELOPMENT

P.O. BOX 85 YUMBE
Tel: (+256) 0772964436
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E-mail: lodongaptc@gmail.com

Vision:" To Be A College Of Distinction"

10TH JANUARY 2020

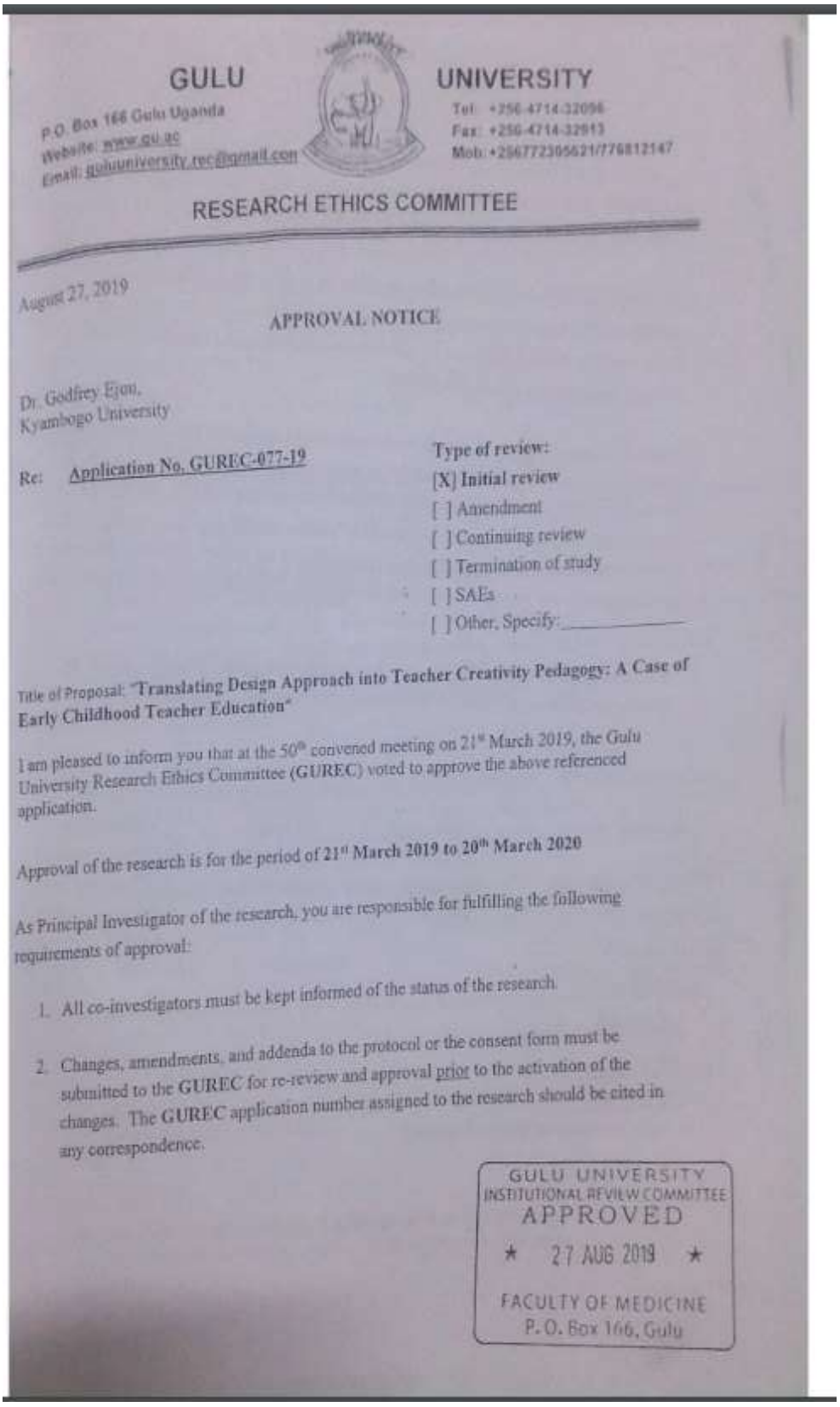
To:
Professor Godfrey Ejuu
Kyambogo University
P.O.Box 1
Kyambogo – Kampala

Dear Sir,

Ref: ADMINISTRATION CLEARANCE TO CONDUCT RESEARCH

Reference is made to your letter dated **20th November 2019** requesting to conduct a research in St. John Bosco CPTC-Lodonga. I am delighted by the choice of our College to participate in this study. I, therefore, declare my consent to this effect. Wishing you success in his great academic pursuit.
Regards.
Fr. Hillary Orwinya Kago.

Appendix 6: Research Ethics Approval



GULU UNIVERSITY

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RESEARCH ETHICS COMMITTEE

August 27, 2019

APPROVAL NOTICE

Dr. Godfrey Ejau,
Kyambogo University

Re: Application No. GUREC-077-19

Type of review:
[X] Initial review
[ ] Amendment
[ ] Continuing review
[ ] Termination of study
[ ] SAEs
[ ] Other, Specify:_____

Title of Proposal: "Translating Design Approach into Teacher Creativity Pedagogy: A Case of Early Childhood Teacher Education"

I am pleased to inform you that at the 50th convened meeting on 21st March 2019, the Gulu University Research Ethics Committee (GUREC) voted to approve the above refcrenced application.

Approval of the research is for the period of 21st March 2019 to 20th March 2020

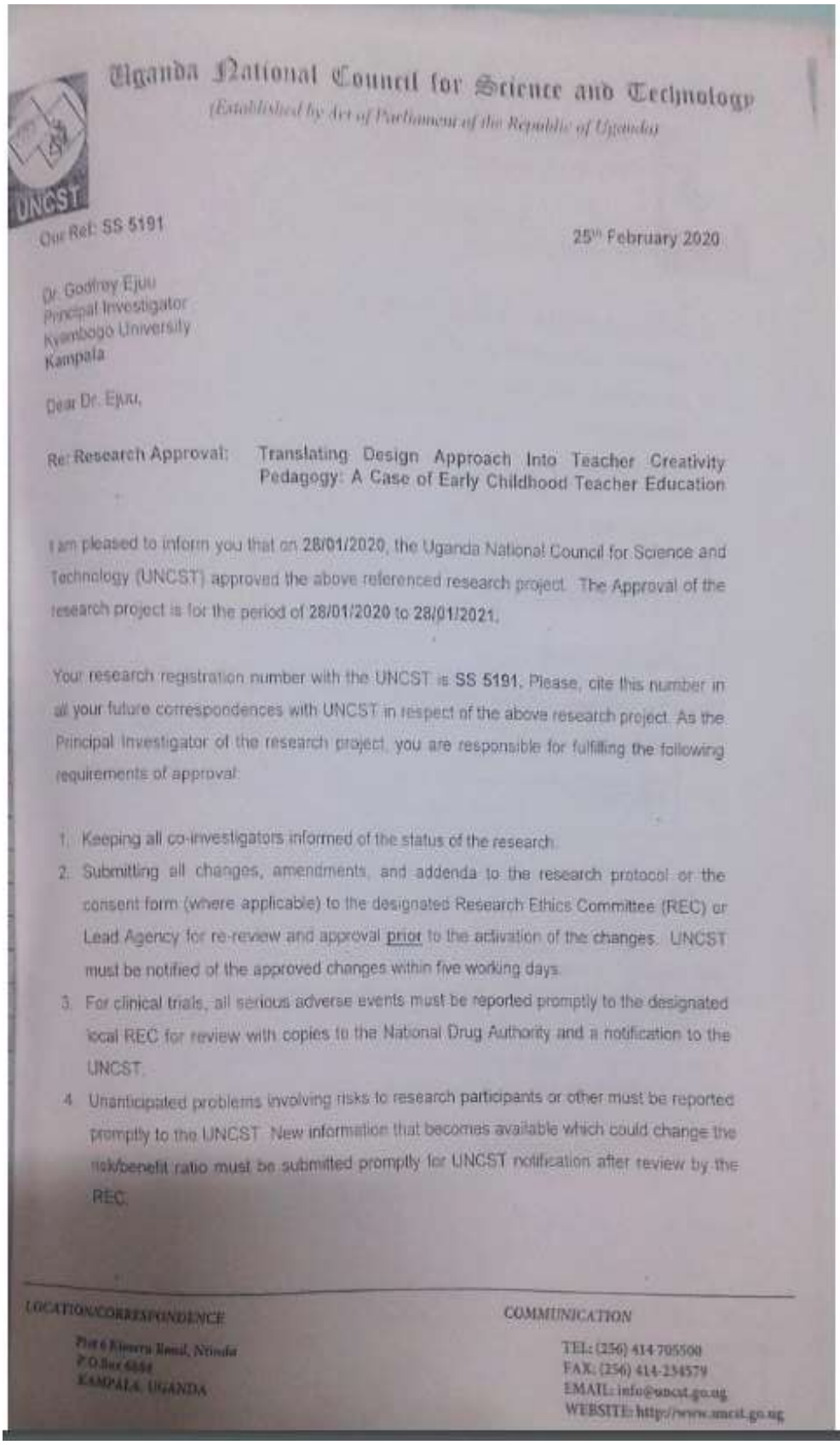
As Principal Investigator of the research, you are responsible for fulfilling the following requirements of approval:

1. All co-investigators must be kept informed of the status of the research.
2. Changes, amendments, and addenda to the protocol or the consent form must be submitted to the GUREC for re-review and approval prior to the activation of the changes. The GUREC application number assigned to the research should be cited in any correspondence.

GULU UNIVERSITY
INSTITUTIONAL REVIEW COMMITTEE
APPROVED
★ 27 AUG 2019 ★
FACULTY OF MEDICINE
P. O. Box 166, Gulu

Appendix 7: Uganda National Council for Science and Technology

Research Approval



Uganda National Council for Science and Technology

(Established by Act of Parliament of the Republic of Uganda)

UNCST

Our Ref: SS 5191

25th February 2020

Dr. Godfrey Ejuu
Principal Investigator
Kyambogo University
Kampala

Dear Dr. Ejuu,

Re: Research Approval: Translating Design Approach Into Teacher Creativity Pedagogy: A Case of Early Childhood Teacher Education

I am pleased to inform you that on 28/01/2020, the Uganda National Council for Science and Technology (UNCST) approved the above referenced research project. The Approval of the research project is for the period of 28/01/2020 to 28/01/2021.

Your research registration number with the UNCST is SS 5191. Please, cite this number in all your future correspondences with UNCST in respect of the above research project. As the Principal Investigator of the research project, you are responsible for fulfilling the following requirements of approval:

1. Keeping all co-investigators informed of the status of the research.
2. Submitting all changes, amendments, and addenda to the research protocol or the consent form (where applicable) to the designated Research Ethics Committee (REC) or Lead Agency for re-review and approval prior to the activation of the changes. UNCST must be notified of the approved changes within five working days.
3. For clinical trials, all serious adverse events must be reported promptly to the designated local REC for review with copies to the National Drug Authority and a notification to the UNCST.
4. Unanticipated problems involving risks to research participants or other must be reported promptly to the UNCST. New information that becomes available which could change the risk/benefit ratio must be submitted promptly for UNCST notification after review by the REC.

LOCATION/CORRESPONDENCE

Plot 6 Kimera Road, Ntinda
P.O.Box 6884
KAMPALA, UGANDA

COMMUNICATION

TEL: (256) 414 705500
FAX: (256) 414-234579
EMAIL: info@uncst.go.ug
WEBSITE: http://www.uncst.go.ug

Appendix 8: Consent Form

INFORMED CONSENT DOCUMENT FOR TEACHERS

Title of the study: The Design Thinking Process and Teacher Pedagogical Creativity: A Case of Early Childhood Teachers of Kyambogo University

Investigator(s): Godfrey Ejuu, Grace Lubaale and Katungi Juma

Institution(s): Kyambogo University

Introduction

This study will be concerned with the subject of developing teacher creativity in which the researcher will use the design process as a starting point to establish possibilities of developing teacher creativity. The study objectives will include the following; To document opportunities in play sessions that teachers can use to develop creativity in children in early childhood classes, To explore the creativity processes that teachers use for developing creativity in children during play sessions in early childhood classes, To adapt the design process into the teacher preparation processes to enhance learner creativity in early childhood classes and To establish difference in teacher creativity between study and control group. The study will take approximately 30 days in which a pre-test will be done, an intervention will be introduced and then a post test will also be carried out all this will focus its self on developing teacher creativity.

A brief description of the sponsors of the research project:

Project is sponsored by the researcher in partnership with Kyambogo University

Purpose:

The study seeks to study how the design process can contribute to improving teacher creativity. The findings of this study will help to improve on teacher creativity in early childhood education and care.

Procedures:

Your participation in this study will involve being a member of the experimental group or Control Group.

Who will participate in the study?

You have been chosen to participate in this study because you are part of the population that this study focuses on and you are a student at the participating College /Sample.

The interview/Participation will last for approximately 6 months and *will involve 90 participants*

Risks/discomforts:

There is no foreseeable risk of harm or discomfort that will arise from your participation in this study. The only risk or discomfort will be the inconvenience in terms of time spent during the interview, Focused group discussion activities and experiential activities.

Benefits:

At a personal level, the study will provides participating teachers with insights into creative approaches to early childhood education and care.

The study will benefit early childhood educationists and practitioners by enriching their practice in the area of teacher creativity, play in early years learning.

The study will clarify and explain the relevance and application of creativity in play for learning and this will enhance better practices and successes in the field of early childhood. .

Lastly, the study will contribute to the existing body of scholarship in the area of teacher creativity for early childhood development and play in Uganda, regionally and internationally. The findings will provide a platform for scholars to carry out further research in this area of creativity and play.

The participants will get feedback on findings and progress of the study, and any new information that affects the study participants (including incidental findings) will be made available to research participants.

Confidentiality:

Your identity will not be revealed to any one as we shall only use codes to identify participants. Information obtained will only be accessible by the research team. Soft copies of the data will be protected by password and hard copy files will be kept under lock and key. Confidential information will only be accessed by the principal investigator.

Alternatives:

You do not have to participate in this study if you are not interested. You will not lose any benefit in case of no participation.

Cost:

There will not be any additional cost incurred as a result of participating in this study.

Questions:

If you have any questions related to the study, or your rights as a research participant, you can contact the principal investigator, **Godfrey Ejuu** on telephone number **0704 151 905 / 0773 147 577** or via email on **godfreyejuu@gmail.com**

Statement of voluntariness:

Participation in the research study is voluntary and you may join on your own free will. You have a right to withdraw from the study at any time without penalty.

If you have any issues pertaining to your rights and participation in the study, please contact the Chairperson, Gulu University Research Ethics Committee, Dr. Gerald Obai Tel: No., 0772305621; email: lekobai@yahoo.com/lekobai@gmail.com; or the Uganda National Council for Science and Technology, on plot 6 Kimera road, Ntinda, Kampala on Tel 0414705500.

Statement of consent

..... has described to me what is going to be done, the risks, the benefits involved and my rights as a participant in this study. I understand that my decision to participate in this study will not affect me in any way. In the use of this information, my identity will be concealed. I am aware that I may withdraw at any time. I understand that by signing this form, I do not waive any of my legal rights but merely indicate that I have been informed about the research study in which I am voluntarily agreeing to participate. A copy of this form will be provided to me.

Name …… Signature of participant……Date ……

Name…….Signature of interviewer……Date……

Appendix 9: IAAT Teacher Pedagogical Creativity Model