Factors Related to the Critical Thinking Skills of Grade 11 Learners Enrolled in Different Academic Subject Streams

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Preface

I, **Darlington Masimba Gorogodo (212539156)**, declare that:

1. The research reported in this dissertation, except where otherwise indicated, is my original research.
2. This dissertation has not been submitted for any degree or examination at any other university.
3. This dissertation does not contain other persons' data, pictures, graphs, or other information unless expressly acknowledged as being sourced from other persons.
4. This dissertation does not contain other persons' writing unless expressly acknowledged as being sourced from other researchers. Where other written sources have been quoted, then:
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Abstract

The Department of Basic Education in South Africa has strongly emphasised fostering critical thinking skills in learners, a priority that continues to be relevant in light of technological advancements and the evolving demands of life and work in the 21st century. In this study, an explanatory sequential mixed methods approach was adopted with the purpose of identifying the factors that are related to the level of critical thinking skills of Grade 11 learners, particularly those enrolled in different academic subject streams. An understanding of how and why these factors are related to the critical thinking skills of Grade 11 learners enrolled in different academic subject streams was sought in this study. In gathering data, 116 participants were conveniently selected, and the Cornell Critical Thinking Skills Test Level X survey was administered to them, while nine participants were engaged in focus group interviews. Key findings drawn from the data were a statistically significant difference in participants' performance in the critical thinking skills test based on the academic subject stream, F (2,110) =10.49; p = .001, with η^2 = .160. Specifically, Science and Technology learners performed better in contrast to their counterparts in the Commerce and Business academic subject stream and Human Sciences and Social Services academic subject stream. The Mathematical group participants were enrolled in was also significantly related to differences in participants' critical thinking skills test performance, t (114) = 6.62; p = .001 with a Cohen d = 1.31. The Core Mathematics learners performed better on the test when compared to their Mathematical Literacy counterparts. Gender (F (1,114) = 0.35; p = .554), recognised home language (F (4,106) =1.27; p = .285), and area of residence of participants (F (2,110) = 0.95; p = .38) did not have a statistically significant relationship with participants' performance in the critical thinking skills test. The qualitative findings revealed that the choice of academic subject stream participants enrolled in was not related to the need to develop critical thinking skills but to prepare them for career aspirations, knowledge skills and the need to address the injustices some participants encountered in their communities. The Department of Basic Education in South Africa should actively incorporate pedagogy to influence the development of critical thinking skills across all

academic subject streams. Empowering educators with effective teaching methods to nurture critical thinking in learners within different academic streams is also crucial. When choosing academic subjects for enrolment, a significant emphasis should be placed on cultivating critical thinking skills alongside acquiring conceptual knowledge and skills relevant to future career aspirations. Additionally, there is a pressing need to explore utilising all officially recognised home languages in the instruction and learning process across all academic subject streams. This approach can positively influence the development of critical thinking skills in individuals.

Keywords: *critical thinking skills, Cornell critical thinking skills test level x, inductive reasoning, deductive reasoning, credibility of judgements*

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Dedication

This master in education dissertation is a heartfelt dedication to the memory of my late father, Godfrey, and my late mother, Mazviitiraini. They instilled in me from an early age the belief that education is the essence of life, and they made countless sacrifices to ensure that I received the best possible academic foundation. This journey began in 1990 when I embarked on my educational path, starting with Grade 1 at Tangenhamo Primary School.

"If we knew what it was we were doing,

it would not be called research, would it?"

Albert Einstein

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CHAPTER 1

INTRODUCTION

1.1 Rationale of Study

Citizens' critical thinking skills development has remained a topical issue in the 21st century (Chen, 2020; Ennis, 2016; Erstad & Voogt, 2018; Geisinger, 2016; Kuhn, 2019). This is primarily due to the rapid advancement of technology, globalisation, climate change, the emergence of new diseases, and the nature of work and life in the 21st century (Murnane & Levy, 2007; Schleicher, 2019; World Economic Forum, 2020). Individuals are encouraged to develop critical thinking skills, and critical thinkers are expected to create novel solutions to novel problems (Ennis, 2016; Facione, 2015; Rotherham & Willingham, 2010; Silva, 2009; World Economic Forum, 2020). Nevertheless, employers around the world are complaining about a growing shortage of people who can take on new roles in fields such as robotics development, artificial intelligence, and virtual reality, all of which rely heavily on critical thinking skills (Herborn et al., 2018; Krüger Mariano & Chiappe, 2021; Rifandi & Rahmi, 2019; Schwab, 2016). According to recent surveys of employers worldwide, the most desirable skills for employment in the 21st century are socioemotional skills at 50%, higher-order thinking skills at 29.7%, technical skills at 12.7%, and basic cognitive skills at 6.8% as noted by Cunningham and Villaseñor (2016, p. 110). The labour market is expected to experience a critical thinking skills shortage of 55.4% by 2025, making it challenging to find individuals to employ who possess higher-order thinking skills, such as the ability to analyse information at hand, synthesise new knowledge and skills to interpret data, resulting in 70% of current employees requiring upskilling as noted by the World Economic Forum (2020, p. 5).

Developing critical thinking skills is a top priority for South Africa's Department of Basic Education, as stipulated by the Department of Basic Education (2011c, p. 4). Some of the general goals of the National Curriculum Statement Grades R-12 specified in the Physical Sciences Policy Statement by the Department of Basic Education (2011c, p. 5) include the development of learners who can identify and solve problems creatively and critically, the

development of learners who can work effectively as individuals or in collaborative settings, and the development of learners who can collect, organise, and effectively communicate synthesised knowledge using the most appropriate methods. These curriculum goals are essential indicators of critically thinking individuals, hence emphasising their development.

Curriculum developers are generally of the opinion that a change in pedagogy can enable the development of critical thinking skills in learners regardless of socioeconomic background, gender, race, physical abilities, or intellectual abilities (Blignaut, 2021, p. 2; Department of Basic Education, 2011c, p. 4). However, an analysis of the Grade 12 examination diagnostic report revealed a dismal and concerning learner performance in questions requiring higher-order thinking skills, as remarked by the Department of Basic Education (2022, p. 7). This suggests that the educational system is struggling to develop critical thinking skills relevant to the nature of work and life in the 21st century. There has been much discussion about the importance of understanding how critical thinking skills can be developed, but information is scarce on which factors are related to the possessing of these critical thinking skills by individuals (Clarke-Midura & Dede, 2010, p. 309; OECD, 2016; Schleicher, 2019).

Failure to develop critical thinking skills can be attributed to a limited understanding of the factors that are related to possessing critical thinking skills and how these factors are perceived by learners to be related to possessing critical thinking skills (Care et al., 2018, p. 6; Helsper & Eynon, 2013; van Laar et al., 2020, p. 4). In this explanatory sequential mixed methods study, I sought to find the factors related to the level of critical thinking skills in Grade 11 learners enrolled in different academic subject streams and to explain how and why these factors are perceived to be related to the possession of critical thinking skills.

Subjects offered in the Further Education and Training (FET) phase (Grades 10-12) in the South African education system are divided into three streams: academic subjects, technical vocational subjects, and technical occupational subjects, as explained by the Department of Basic Education (2021, p. 30). Notably, learners enrolled in academic subject streams are not permitted to take Technical Mathematics, Technical Sciences, Civil,

Electrical, and Mechanical Technology, as stipulated in the National Policy Pertaining to the Programme and Promotion Requirements (NPPPPR) of the National Curriculum Statement Grades R – 12 (Department of Basic Education, 2021 p. 31). The inclusion of different subject streams in the South African FET curriculum is viewed as a means of correcting the mismatch between skills required by the labour market and graduates produced by education systems, thereby closing the skills shortage gap in future careers such as medicine, information technology, engineering, law, and teaching (Department of Basic Education, 2015).

1.2 Purpose of Study

The purpose of this explanatory sequential mixed methods study was firstly to identify the factors that are related to the critical thinking skills of Grade 11 learners enrolled in different academic subject streams and, secondly, to attempt to explain how and why these factors are perceived by Grade 11 learners to be related to their critical thinking skills.

1.3 Significance of Study

Presently, the predominant approach in formal assessments across different academic subject streams primarily emphasises evaluating conceptual subject knowledge and its application but does not assess learners' proficiency in critical thinking abilities. This study examines the critical thinking skills of Grade 11 learners enrolled in different academic subject streams and provides valuable insight into the current status quo on the level of critical thinking skills of Grade 11 learners. The study also sheds light on which factors are related to the critical thinking skills of Grade 11 learners and why these factors are perceived to be related to the possession of these skills.

With the ongoing discussion surrounding the implementation of a three-stream subject model in South African schools, this study holds significance for the broader education community as it will shed light on the impact of learner enrolment in different academic subject streams on the development and possession of critical thinking skills, which are increasingly essential in the 21st century workforce and everyday life.

Critical thinking skills are essential when making decisions, particularly in novel contexts; thus, there was a need to generate knowledge about what factors are related to the possession of critical thinking skills. This study also adds to the existing understanding of the factors related to possessing critical thinking skills, and educators will be able to use this knowledge to improve their practice in the classroom. Understanding the factors related to critical thinking skills is also valuable for supporting the rationale behind designing interventions to foster the development of critical thinking skills in learners.

1.4 Research Objectives

The objectives of this explanatory sequential mixed methods study were:

1. To investigate if there is a statistically significant difference in critical thinking skills test performance of Grade 11 learners enrolled in different academic subject streams.
2. To investigate which factors relate to the critical thinking skills of Grade 11 learners enrolled in different academic subject streams.
3. To investigate how these factors are related to the critical thinking skills of Grade 11 learners enrolled in different academic subject streams.
4. To explain why these factors are perceived to be related to critical thinking skills by Grade 11 learners enrolled in different academic subject streams.

1.5 Research Questions

The following are the research questions derived from the objectives:

1. Is there a statistically significant difference in the critical thinking skills test performance of Grade 11 learners enrolled in different academic subject streams?
2. What factors relate to the critical thinking skills of Grade 11 learners enrolled in different academic subject streams?
3. How are these factors related to the critical thinking skills of Grade 11 learners enrolled in different academic subject streams?
4. Why are these factors perceived to be related to the critical thinking skills of Grade 11 learners enrolled in different academic subject streams?

1.6 The Methodology

The research's philosophical framework was the pragmatic paradigm. A pragmatic paradigm takes into account both the objective and subjective natures of reality, and the researcher uses the best research methods to respond efficiently to research questions and provide a comprehensive understanding of behaviour (Creswell & Creswell, 2018, p. 8; Tashakkori et al., 1998). The explanatory sequential mixed methods research design was employed, and it involved the sequential collection of quantitative and qualitative data from a conveniently sampled group of 116 Grade 11 learners enrolled in different academic subject streams. I gathered quantitative data after each participant completed the Cornell Critical Thinking Skills Test Level X survey (see **Appendix 6**).

In this study, participants' biographic information such as gender, home language and areas of residence were sourced from Dawnview High School's computerised school management program after permission was requested and granted by the school management team. To create a subjective grasp of the factors that are related to the possession of critical thinking skills by individuals, a purposefully selected group of nine Grade 11 learners took part in a focus group interview in which I gathered qualitative data.

1.7 Research Study Overview

This research study is structured into seven chapters. Chapter two provides a conceptual understanding of the dispositions and abilities involved in developing critical thinking skills. It also delves into examining several factors, such as gender, academic subject groupings, home language, age, and participant areas of residents, which may be related to learners' possession of critical thinking skills. This chapter also includes exploring the critical thinking skills development framework postulated by Heard et al. (2020) and the rationale for its application in this study.

Chapter three of this research study provides an overview of the employed explanatory sequential mixed methods design. Initially, it discusses the participant selection process and addresses the ethical considerations considered throughout the study. The chapter further outlines the method for collecting quantitative data using the Cornell Critical

Thinking Skills Test Level X and the procedures implemented for gathering qualitative data through a focus group interview. Additionally, it explains how data transformation, validity, and reliability issues were managed within the study.

Chapter four first describes the participants' demographics, such as gender, home language, area of residence, and age, relevant to data analysis and the participants' scores on the Cornell Critical Thinking Skills Test Level X (see **Appendix 6**). Inferential statistical analysis was employed to examine any significant differences in critical thinking skills test scores based on gender, academic grouping (Science and Technology, Commerce and Business, and Human Sciences and Social Services), recognised home language, type of Mathematics and area of residence. Chapter five incorporates the narrative presentation of the qualitative data obtained through a focus group interview.

Chapter six thoroughly discusses the findings obtained during the study to answer the research questions. Finally, chapter seven provides a summary of the entire study. In this chapter, the implications of the findings are discussed, along with an exploration of the limitations encountered during the study.

CHAPTER 2

REVIEW OF RELATED LITERATURE

2.1 Introduction

In this chapter, a literature review is presented, focusing on gaining a deeper understanding of the meaning of critical thinking skills and the associated dispositions and abilities related to critical thinking skills of individuals. Additionally, I will examine relevant literature on factors that affect human behaviour and skills to ascertain their perceived relationship to possessing critical thinking skills. Lastly, I will explore a theoretical framework aimed at fostering the development of critical thinking skills.

2.2 Conceptual Referents

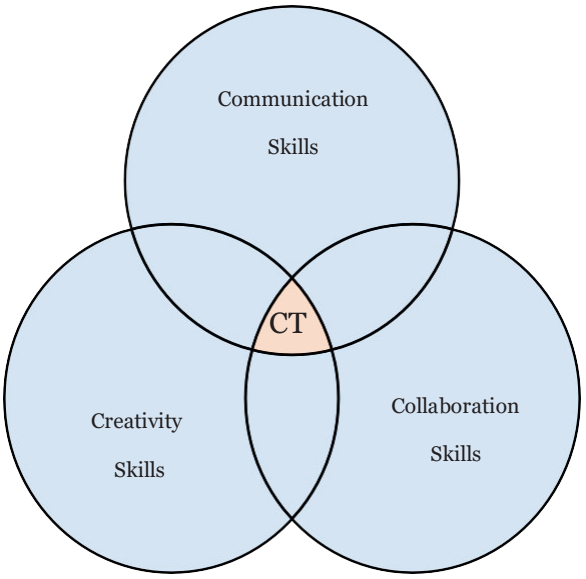
The ability to think critically has become an essential part of our lives, owing to the nature of work and life in the 21st century (Cunningham & Villaseñor, 2016; Rotherham & Willingham, 2010; World Economic Forum, 2020) and critical thinking skills form part of a set of skills that have been coined 21st century skills by Erstad and Voogt (2018, p. 3). Scholars have developed various conceptual frameworks to elaborate on 21st century skills such as critical thinking. One such framework developed by Partnership for 21st Century Learning (2007) categorised 21st century skills into three categories: learning and innovation skills (4Cs), life and career skills, and media, information and technology skills. The Assessment and Teaching of 21st Century Skills (AT21Cs) by Griffin et al. (2012, p. 4) is another framework that categorises 21st century skills into four categories. As noted by Binkley et al. (2012, pp. 17-19), these four categories are ways of thinking (creativity and innovation; critical thinking, problem-solving, and decision-making; learning to learn and metacognition), ways of working (communication; collaboration), tools for working (information literacy; ICT literacy), and ways of living in the world (citizenship; life and career skills; personal and social responsibility).

Despite differences in defining what 21st century skills entail, the frameworks recognise that individuals must be equipped with critical thinking, communication, collaboration, and creativity skills, commonly referred to as 21st century skills (Erstad &

Voogt, 2018, p. 3). When examining the different conceptual frameworks, it becomes apparent that the 4Cs (critical thinking, communication, collaboration, and creativity) are interconnected. An individual's proficiency in critical thinking relies on competence in other dispositions and abilities, such as practical communication skills, collaboration skills, and creativity, as I illustrate in **Figure 2. 1.**

Figure 2. 1

Interdependence of Skills in the 21st Century Skills Frameworks



Thinking critically is essential because it relies on other competencies such as communication, collaboration and creativity (Partnership for 21st Century Learning, 2007). Critical thinking (CT) skills form the central intersection of communication, collaboration, and creativity skills, as shown in **Figure 2. 1**.

Developing and applying critical thinking abilities is significantly influenced by practical communication skills, active listening, the knowledge to ask pertinent questions, and engaging in meaningful dialogue, all of which are vital components of effective communication. Through active communication, individuals can gather multiple perspectives, challenge assumptions, and explore various viewpoints, ultimately impacting and enriching their critical thinking skills (Binkley et al., 2012; Care et al., 2018).

The impact of collaboration on critical thinking skills is significant. Individuals engaging in group collaboration are exposed to various perspectives, ideas, and experiences. This diversity creates an environment that nurtures critical thinking skills by prompting individuals to question assumptions, delve deeper into analysis, and gain a more comprehensive understanding of the subject at hand. Collaborative endeavours compel individuals to consider alternative viewpoints and more thoroughly evaluate evidence and arguments, positively influencing competence in critical thinking (Care et al., 2012).

On the other hand, creative skills involve generating fresh and innovative ideas, while critical thinking skills focus on evaluating and analysing these ideas for their fitness of purpose. Critical thinking skills complement creative skills by examining creative concepts' viability, feasibility, and logical coherence (Ennis, 2016, p. 167). Conversely, creative skills enhance critical thinking by expanding the range of potential solutions and alternative perspectives that can be explored and analysed. Flexibility of thought is emphasised in creative skills, enabling individuals to approach problems from various angles and explore unconventional possibilities. Critical thinking skills then come into play to assess the different options, weigh evidence, and make reasoned decisions. Integrating creative and critical thinking skills promotes adaptability in problem-solving, allowing individuals to consider alternative perspectives and adjust their approaches as needed.

Due to globalisation and technological advancement, there is also an abundance of information to which individuals are constantly exposed in various contexts. This exposure necessitates the need to analyse, evaluate, and interpret information to determine whether or not it is valuable data and allows individuals to make critical decisions about what to believe or do with the information (Ennis, 2016, p. 165). Competence in analysing, evaluating, and interpreting data is crucial in developing critical thinking skills. In some cases, this information is derived from novel contexts, such as climate change information, military conflict between nations, and new diseases, all necessitating innovative, creative, and novel approaches to doing things. This leverages the critical thinking skills of individuals. Despite the importance of critical thinking skills in the 21st century, many scholars have

concentrated their research on the conceptual development of skills and the psychological and biographical factors that may influence the development of critical thinking. However, reviewed studies rarely provide supporting data on how and why factors such as academic subject groupings, gender, the language of learning, globalisation, media, and information technology are related to possessing critical thinking skills (Ugwuozor, 2021; van Laar et al., 2020).

2.3 Critical Thinking

Critical thinking is a metacognitive process that consists of several indicator skills, such as remembering, understanding, applying, analysing, evaluating, and creating, as noted by Anderson and Krathwohl (2001, pp. 67-68). These skills are described in **Table 2. 1**.

Table 2. 1

Revised Bloom Taxonomy Levels Anderson and Krathwohl (2001, pp. 67-68)

Revised Bloom Taxonomy Levels	Description of Skills
1. Remembering	Retrieving (recognising, recalling) relevant knowledge from long-term memory.
2. Understanding	Determining the meaning of instructional messages, including oral, written, and graphic communication (interpreting, exemplifying, classifying, summarising, inferring, comparing, and explaining).
3. Applying	Conducting (executing) or using (implementing) a procedure in each situation.
4. Analysing	Breaking material into its constituent parts and detecting how the aspects relate to one another and an overall structure or purpose (differentiating, organising, and attributing).
5. Evaluating	Making judgements (checking, critiquing) based on criteria and standards.
6. Creating	Combining elements entails generating, planning, and producing new knowledge to create a novel, coherent whole or an original product.

Higher-order thinking skills such as evaluating and creating are indicators of critical thinking skills (Anderson & Krathwohl, 2001, pp. 67-68) and allow for the development of critical thinking dispositions and abilities in individuals. Higher-order skills work in tandem with lower-order thinking skills, such as remembering, understanding, and applying. The significance of critical thinking extends beyond the retention of information by learners. It influences the development of habits in which the learners can use the retained conceptual

knowledge in critical thinking processes when solving problems (Halpern & Dunn, 2021, p. 2). Dwyer et al. (2014, p. 43) noted that when used appropriately, critical thinking skills *"increase the chances of producing a logical conclusion to an argument or developing solutions to novel problems"*.

Interest in developing critical thinking skills in education can be traced back to Dewey (1910, p. 9), who theorised critical thinking as a *"reflective and iterative thinking process"*. The reflective nature of critical thinking allows for the ability to suspend initial judgements made when making decisions. It allows for the utilisation of other methods of inquiry to obtain new material and utilise such material in accepting or rejecting initial judgements, as remarked by Dewey (1910, p. 19).

Understanding how humans think has remained relevant in the 21st century, with scholars such as Facione (2015), Ennis (2016), Paul and Elder (2019) and Halpern and Dunn (2021) having varying views on what critical thinking is in the educational context. In illustrating what critical thinking entails, Facione (2015) divided critical thinking skills into cognitive skills and dispositions that allow for critical thinking. Cognitive skills influencing critical thinking are interpreting, analysing, evaluating, explaining, inferring, and self-regulation, as Facione (2015, p. 5) remarks. These cognitive skills are supported by dispositions found in individuals with the self-efficacy to think critically and are inquisitive, open-minded, prudent, confident, truth-seeking, and analytical (Facione, 2015, p. 5). According to Ennis (2016, p. 167), a renowned expert in the field of critical thinking skills development in education in the 21st century, critical thinking is *"reasonable and reflective thinking that focuses on deciding what to believe and do"*, and it is demonstrated through a set of dispositions and abilities as illustrated in **Table 2. 2**.

Table 2. 2

Outline of General Critical Thinking Dispositions and Abilities Ennis (2016, p. 167)

Dispositions Ideal critical thinkers are disposed to:	Abilities Ideal critical thinkers can:
• Look for and offer clear statements of the conclusion or question. • Look for and offer clear reasons and be clear about their relationship with each other and the conclusion. • Try to be well-informed. • Use credible sources and observations and usually mention them. • Consider the total situation. • Keep in mind the basic concern in the context. • Be alert for alternatives. • Be open-minded. • Seriously consider other points of view. • Withhold judgement when the evidence and reasons are insufficient. • Look for as much precision as the nature of the subject admits. • Seek the truth when it makes sense to do so and, more broadly, try to 'get it right' to the extent possible or feasible. • Employ their critical abilities and dispositions.	Basic clarification • focus on the question. • Analyse arguments. • Ask and answer clarification questions. • Understand and use elementary graphs and maths. Basis of a decision • Judge the credibility of a source. • Observe and judge observation reports. • Use existing knowledge background knowledge, including (with discrimination) internet material, their knowledge of the situation, and their previously established conclusions. Inference • Deduce and judge definitions. • Make and judge inductive inferences and arguments. • Enumerative induction. • Argument and inference to the best explanation. • Make and judge value judgements. Advanced clarification • Deduce and judge definitions. • Handle equivocation appropriately. • Attribute and judge unstated assumptions. • Think suppositional. • Deal with fallacy labels. • Be aware of and check the quality of their thinking ('metacognition'). • Deal with things in an orderly manner. Non-constitutive but helpful Employ rhetorical strategies.

Norris and Ennis (1989) also linked the development of critical thinking skills, dispositions, and abilities to three teaching methods. These are (a) an independent curriculum for critical thinking skills without a specific subject domain, (b) an integrated curriculum where critical thinking skills are linked to specific subject domains and applicable

to specific fields and (c) a mixed curriculum where subject domain knowledge pedagogy is taught parallel to a pedagogy of critical thinking skills with learners utilising skills where appropriate in their various subject domains. In this study, the concept of critical thinking is informed by the work of Ennis (2016) and presumed to be developed through the lens of the curriculum learners are exposed to, as well as other factors that may be influential in critical thinking skill development.

Challenges to the development of critical thinking skills in educational settings stem from a variety of factors, including disagreements about what critical thinking is (Care et al., 2018), theoretical and pedagogical frameworks that purport to foster critical thinking (Clarke-Midura & Dede, 2010; OECD, 2017), a lack of clarity on the factors that influence the development of critical thinking abilities (Care et al., 2018; van Laar et al., 2019) and scant information on how critical thinking pedagogy can be implemented in the classroom (Vandeyar, 2014, pp. 346-349). Studies on pedagogy aimed at developing critical thinking skills in the 21st century are gaining traction in the African context (Giacomazzi et al., 2022, p.2; Ugwuozor, 2021, p. 3). Most of Africa is still experiencing the after-effects of previous industrial revolutions, and its economies are agriculturally based and reliant on manual labour. There is an urgent need for educational systems to incorporate pedagogies that promote the development of critical thinking skills appropriate for the 21st century (Ugwuozor, 2021). However, the need to equip individuals with relevant critical thinking skills has yet to produce the desired results, as evidenced by increased critical thinking skills shortages in many African countries (Sutherland, 2020, pp. 4-6).

Scholars have reported on a variety of factors that influence the development of critical thinking skills as an output product of the educational process; however, a gap in the literature has emerged due to a lack of knowledge and evidence of how and why these factors are related to the possession of critical thinking skills by individuals in the African context. Some of the factors that can influence the development of critical thinking skills include subject groupings in academic setups (Fletcher & Tan, 2021; Fletcher Jr et al., 2018; Kavenuke et al., 2020), socioeconomic status (Gelerstein et al., 2016; Schulze & Lemmer,

2017; Slameto, 2017), gender (Ramdani et al., 2021), language and cultural context (Grosser & Lombard, 2008) and the integration of technology in pedagogy for critical thinking skills (Chen et al., 2021; Dede, 2010; Larson & Miller, 2011; Sönmez, 2021). This study explores how some of these factors are related to the critical thinking skills of Grade 11 learners enrolled in different academic subject streams and provides an explanation of why learners perceive these factors to be related to their critical thinking skills.

2.4 Subject Groupings and Critical Thinking Skills

South Africa's education system has been mired in crisis before and after 1994. One such crisis was the adoption of discriminatory policies, such as the Bantu Education Act in 1953 (Asmal & James, 2001, p. 187; Blignaut, 2021, p. 1). Access to education was structured through racial classification in such a way that Bantu education purposefully avoided educating black people in Mathematics and Science, as remarked by Asmal and James (2001, p. 196). The language of teaching and learning was also predominantly Afrikaans, leading to the Soweto uprising of 1976 (Blignaut, 2021). Kallaway (1984, p. 94) notes that the Bantu education system was aimed at shrinking the minds of African children by denying them intellectual and educational challenges. School subjects in Bantu education were aimed at developing limited skills in communication, literacy and numeracy, preparing African children for subordinate positions and making them readily available for exploitation, as Christie and Collins (1982, p. 63) note. The targeting of the schooling system by the Nationalist Party in the 1940s was a deliberate act to frustrate the development of critical thinking skills in African children towards attaining the goals of the apartheid government of the day.

Since 1994, the South African government has made numerous changes to the education curriculum to address the issues caused by the apartheid Bantu education system and to develop citizens with strong critical thinking abilities, as pointed out by Botha (2002, p. 362) and the Department of Education (1997, p. 3). The initial change was the implementation of Curriculum 2005 in 1998 (Department of Education, 1997), which aimed to foster thinking skills in citizens through outcomes-based education. This shift marked a

departure from the content-focused curriculum before 1994. Instead, it emphasised developing critical thinking skills, problem-solving, information analysis, effective communication, and responsible decision-making, as pointed out by the Department of Education (1997, p. 11). These outcomes align with the indicators of critical thinking skills identified by scholars like Ennis (2016) and Facione (2015). These outcomes have also remained a fundamental aspect of South African education, as they are presented as outcomes in the Curriculum, Assessment, and Policy Statements (CAPS) (Department of Basic Education, 2011c).

However, Curriculum 2005 fell short of achieving its intended vision due to various challenges, one of which was the trivialisation of academic subject content. This resulted in a curriculum that primarily focused on measuring what had been learned as outcome skills that learners could demonstrate rather than emphasising the importance of academic subject content as the driving force behind developing outcomes such as critical thinking skills. Jansen (1998, p. 8) argued that learners could not learn in a vacuum and that academic subject content should play a central role in providing meaning to a curriculum that leads to the development of outcome skills such as critical thinking. As a result, revisions have been made to the outcomes-based education system. These include re-emphasising subject content in the curriculum (Department of Basic Education, 2002), aligning outcomes with subject content, and specifying what should be assessed at different stages, as outlined in the Curriculum and Assessment Policy Statements (Department of Basic Education, 2011c). Despite these changes, the education system still faces challenges in producing individuals who possess critical thinking skills. Currently, one example of a disastrous outcome of the education system is the scarcity of critical thinking abilities among individuals exiting the educational system (De Angelis et al., 2019; Sikhakhane et al., 2021, p. 1).

In South African education, when learners advance to Grade 10 from Grade 9, they must choose a subject pathway they will pursue in their Further Education and Training phase (FET). The subjects offered in the FET phase are grouped into three categories. These are academic, technical, and vocational subject streams as identified by the Department of

Basic Education (2021, p. 20). In most instances, academic achievement in Grade nine summative assessments informs acceptance in a particular subject pathway. These subject groupings are expected to facilitate connections between curriculum and real-world applications while providing learners with relevant employability skills, such as critical thinking skills (Gordon & Schultz, 2020; Pierce & Hernandez, 2015, p. 224). The main distinction between these subject streams, as previously stated, is that learners enrolled in the academic subject pathway are not permitted to take Technical Mathematics, Technical Sciences, Civil, Electrical, or Mechanical Technology as is stipulated in the National Policy Pertaining to the Programme and Promotion Requirements of the National Curriculum (Department of Basic Education, 2021).

Historically, academic subject streams are seen as a gateway to university education systems (Department of Basic Education, 2015). On the other hand, the introduction of the technical subject pathway is viewed as a means of equipping learners with technical knowledge aligned with technical and artisanal career pathways, thereby reducing the skills shortage in the vocational and occupational labour market.

In a study that examined the extent of critical thinking skills in prospective educators in Tanzania, Kavenuke et al. (2020) reported that subject groupings had no significant relationship with the critical thinking skills of future educators who majored in science subjects versus those who did not. Kavenuke et al. (2020) systematically sampled 965 participants (60.5% females and 39.5% males) from clustered groups of individuals based on the degree programmes they were enrolled in and the year of study. Using a 10-point Likert scale, the researchers used a questionnaire that solicited participants to identify and rate their critical thinking skills, dispositions, and abilities. Items included in the questionnaire were based on the work of Shin et al. (2015). They had items on participants' perception of their self-confidence (nine items), scepticism (nine items) and systematicity (nine items). To a greater extent, the items included in the study as indicators of critical thinking skills are consistent with those proposed by other leading scholars on the development of critical thinking skills, such as Facione (2015), Ennis (2016) and Paul and Elder (2019).

Systematicity is an organised procedural approach to problem-solving, self-confidence is the trust individuals place in their reflective thinking processes, and scepticism is an inherent disposition in individuals to always strive for the best understanding of situations (Shin et al., 2015). The participants showed significant levels of indicators of critical thinking skills dimensions with a mean score of 5.7 and a standard deviation of 1.1 in scepticism, a mean score of 5.7 and a standard deviation of 1.1 in systemically and a mean score of 5.3 and a standard deviation of 1.1 in self-confidence. However, in their correlational analysis of collected data to determine the relationship between academic achievement and critical thinking skills dimensions, Kavenuke et al. (2020, pp. 7-8) note no correlation between academic achievement and critical thinking skills dimension, as shown in **Table 2. 3**.

Table 2. 3

Mean Score and Correlation Coefficients Between Dimension of Critical Thinking and Academic Achievement Kavenuke et al. (2020, p. 7)

Critical Thinking Skills Dimension	Mean Score	Standard Deviation	Correlation Coefficient with Academic Achievement
Systematicity	5.7	1.1	.07
Self-confidence	5.3	1.1	.02
Scepticism	5.7	1.1	.02

According to Dancey and Reidy (2017, p. 207), correlation coefficient values between 0 and .1 show no correlation between independent and dependent variables. The researchers employed regression coefficients (β) to assess the impact of the degree program in which prospective teachers were enrolled and their grade point average (GPA) scores on developing critical thinking skills dimensions. The degree programmes considered were B.E. Ad. (n=401), B.Sc. Ed. (n=228), B.Ed. (Arts) (n=190) and B.Ed. (Science) (n=190). The researchers also reported no statistically significant effect of GPA and degree programme in influencing the development of critical thinking skills dimension as estimated effect size (β) values were below .2 and p-values were greater than .05.

According to Gray and Kinnear (2012), the effect size of an independent variable is considered weak when $\beta < .2$; for an estimated effect size of $.2 \leq \beta < .5$ the effect is

considered moderate, and a large effect is realised when $\beta \geq .5$. For determining the significance of the estimated effect size, the α value was set at .05. The estimated effect size values and significance test values are as shown in **Table 2. 4**.

Table 2. 4

Effect Size and Significance of Determinants of Critical Thinking Skills Dimensions

Kavenuke et al. (2020, p. 8)

Independent Variable:	Systematicity			
	β	Std Error	*t*	*p*
GPA	.007	.052	.087	.931
Degree Programme	-.027	.042	-.636	.525
	Self-confidence			
	β	Std Error	*t*	*p*
GPA	.007	.082	.087	.931
Degree Programme	-.027	.042	-.636	.525
	Scepticism			
	β	Std Error	*t*	*p*
GPA	.042	.078	.542	.588
Degree Programme	-.020	.040	-.487	.627

Some researchers have consistently linked the content and procedures involved in science learning in degree programmes and academic intelligence measures such as GPA to the development of critical thinking skills (Forawi, 2016; Wagh et al., 2017, p. 22; Wilmes & Siry, 2018, p. 1124). Kavenuke et al. (2020) did not provide reasons and explanations for the absence of a relationship contrary to possibilities held by other scholars of the existence of a relationship between subject groupings and critical thinking skills.

Rodzalan and Saat (2015) conducted a study involving 2000 undergraduate students (682 males,1138 females) from Malaysian public universities. The researchers aimed to explore the relationship between critical thinking skills and the academic discipline of the participants. The sample was divided into three academic disciplines: social sciences (785 students), sciences (568 students), and engineering (647 students).To assess the participants' critical thinking abilities, the researchers used the Belbin Team Role Self-Perception Inventory (Belbin, 2013). This inventory consisted of eleven statements measuring the participants' perception of their competence in critical thinking skills, such as problem-

solving, analysis, and evaluation. The study's findings indicated that the participants perceived themselves as capable critical thinkers, with an average score above 4.0 on the inventory questions, as argued by Rodzalan and Saat (2015, p. 728). Furthermore, when comparing the mean scores of the three academic disciplines, statistically significant differences were observed in all statement items of the inventory. For instance, in Statement 5, which focused on participants' perceptions of their competence in analysis and objective evaluation, social sciences students had a mean score of 5.5 (*SD* = 1.0), sciences students had a mean score of 5.3 (*SD* = 1.0), and engineering students had a mean score of 5.2 (*SD* = 1.0). Rodzalan and Saat (2015, p. 728) reported a *p*-value of .001 for all statements, except for Statement 9, when the alpha value was set at .01 (two-tailed test).

To further explore these differences, a post hoc Bonferroni test was conducted. The results revealed statistically significant variations in critical thinking dispositions between social sciences students and those enrolled in sciences and engineering disciplines, and the researchers noted that this difference could be attributed to the creative approach and ability to see patterns independent of theories that the social sciences students employed when faced with novel situations. However, the researchers noted no significant differences in critical thinking dispositions between sciences and engineering disciplines. This lack of substantial difference was attributed to the similarity of concepts that participants are exposed to in these two academic disciplines, as Rodzalan and Saat (2015, p. 731) concluded.

2.5 Gender and Critical Thinking Skills

Gender is an essential factor to consider in any study that seeks to understand human behaviour because it can influence behaviour in various ways (Morley & Lugg, 2009). The influence of gender on the development of critical thinking skills has seen scholars reaching varying conclusions (Kavenuke et al., 2020). According to some researchers, gender has no significant influence on the development of critical thinking skills in individuals (Liu et al., 2019; Peerbolte & Collins, 2013; Ugwuozor, 2021).

In a quantitative study in Taiwanese universities that had 449 prospective nurses (females =310, males=139) as participants, Liu et al. (2019) note that the gender of

participants did not have any significant influence on the development of critical thinking skills and the study did not offer any insight into what influences the development of critical thinking skills. The participants in Liu et al. (2019, p. 21)'s study answered various questions from a critical thinking disposition inventory consisting of 20 items, and these are systematicity (nine items, score=54), open-mindedness (four items, score=24), inquisitiveness (three items, score =18) and reflective thinking (four items, score=24). A six-point Likert scale was also used to indicate participants' application of critical thinking skills (one=never to six=always). As illustrated in **Table 2.5**, there were no statistically significant differences in critical thinking skills between female and male participants, with t = -1.12 and p = .262 when the α value was set at .05 (Liu et al. 2019, p. 21). The researchers also reported that there were no statistically significant differences in the mean scores in systematicity, open-mindedness, inquisitive and reflective thinking of female and male participants.

Table 2. 5

Differences in Critical Thinking Skills Due to Gender Liu et al. (2019, p. 21)

Variable	Females (n=310)		Males (n=139)		t	p
	M	*SD*	*M*	*SD*		
Critical Thinking	93.5	13.3	95.0	13.0	-1.12	.262
Systematicity	41.7	6.2	45.5	6.1	-1.37	.172
Open-mindedness	19.4	2.7	19.5	2.7	-.158	.894
Inquisitive	13.8	2.3	14.1	2.3	-1.22	.222
Reflective thinking	18.5	2.9	18.7	2.7	-1.09	.275

The findings of Liu et al. (2019) are in line with findings reported by Salahshoor and Rafiee (2016), who noted that gender did not have any influence on the critical thinking skills of Iranian English students when the Watson-Glaser Critical Thinking Appraisal Test was used to assess the extent of critical thinking skills as derived from the results of t-test: t (184) = 1.84; p = .064 (p >.05) with a mean difference of 2.3 (Salahshoor and Rafiee, 2016, p. 122). In these studies, no suggestions are given on what may influence the development of critical thinking skills.

Mawaddah et al. (2018), however, found that in a study of grade nine mathematics learners in Indonesia, female learners outperformed their male counterparts in critical thinking. Data was collected using interviews on essential thinking dispositions and analysed, concluding that females possess better critical thinking skills. However, this finding is contrary to the results of other scholars.

In a quantitative study that utilised the Watson-Glaser Critical Thinking Appraisal Test to investigate in-service English teachers' critical thinking skills, Ashraf et al. (2017) noted that males performed better in the critical thinking appraisal test. Participants were randomly sampled from 160 English educators, and 113 participated in the study (69 females and 44 males). The critical thinking appraisal test Ashraf et al. (2017, pp. 25-26) utilised consists of 80 items that are divided into five groups, and these are inference (16 items), recognition of assumptions (16 items), deduction and interpretation (32 items) and evaluation (16 items). Data analysis shows that the mean score in the critical thinking appraisal test was 54.6, with a standard deviation of 13.2. On the other hand, the females' mean score was 48.0, with a standard deviation of 15.1. An independent *t*-test statistic was also calculated, and a *t*-value=2.37 at sig .01 (p= .009757) was reported. These results revealed a statistically significant difference in the mean score of males and females, with males reported to have better thinking skills than females. In this study by Ashraf et al. (2017), the researchers did not investigate the factors that influence the differences in thinking skills observed between males and females or how such factors influence participants' critical thinking skills.

In a survey of Malaysian university students as participants, Rodzalan and Saat (2015) note that male students were perceived to have better critical thinking skills than their female counterparts. Unfortunately, the researchers did not provide information on whether the majority of male and female participants held this view; however, this difference in critical thinking skills was attributed to males frequently using the left side of their brain, which is linked to logical and analytical thinking. In contrast, females are inclined to use the right side of the brain due to their feelings and interpersonal-based thinking preferences.

2.6 Culture, Language and Critical Thinking Skills

Developing critical thinking skills depends on cultural norms and the language of teaching and learning (Grosser & Lombard, 2008; Madondo, 2018; Schendel & Tolmie, 2017; Vygotsky, 1980). Culture is a complex set of abilities, beliefs, and attitudes that individuals acquire due to being members of society, as Ayisi (1992, p. 92) points out. Cultural abilities, beliefs, and attitudes govern what knowledge is, as well as morals, cultural tools, and customs. In the African context, the quest to redress the injustices of colonialism has seen an increase in interest in investigating how critical thinking skills are related to culture and the influence culture has in developing critical thinking skills (Giacomazzi et al., 2022; Ugwuozor, 2021). Members of some cultural groups share several consistent beliefs and attitudes that influence how individuals develop their thinking skills.

In most cases, abilities, beliefs, and attitudes are not questionable by members of such cultural groups (DiMaggio, 1997). These cultures advocate for interdependence among cultural community members as a way of life in which collective agency governs individual thinking (Atkinson, 1997; Ramanathan & Kaplan, 1996). This approach is mainly evident in non-western cultures where automatic cognition occurs and is passed through generations. Thinking activities are aimed at respecting the hierarchy in society, harmony seeking and achieving good for the cultural community and not focused on individuals and this, in turn, stifles the development of critical thinking opportunities (Atkinson, 1997; Ramanathan & Kaplan, 1996). However, in these non-western cultures, thinking processes are also self-regulated, and the best alternatives in solving problems are always sought whilst respecting cultural customary beliefs (Atkinson, 1997).

In contrast, Western cultures tend to be individualistic and non-hierarchical and tend to allow individuals to question prevailing cultural norms (Atkinson, 1997). When sufficiently motivated and dissatisfied with the cultural status quo, members of cultural communities in Western cultures tend to override aspects that do not make sense to them as individuals, leading to the development of new beliefs and attitudes rather than automatic cognition (Higgins et al., 2008). While this individualistic approach has a positive impact on the ability

to think critically (Atkinson, 1997; Ramanathan & Kaplan, 1996), it has also been noted that this individualistic standpoint is often associated with uncontrolled, unregulated and expeditious actions aimed at achieving desired goals at all cost and this is not a characteristic that critical thinkers are known to possess (Atkinson, 1997; Ramanathan & Kaplan, 1996).

The ability to think critically is envisaged as leading to the development of economies and political freedom for initially oppressed societies (Giacomazzi et al., 2022). However, the development of critical thinking skills is often done through a second language and the instruments to measure critical thinking skills are also developed in a language that most participants in the African context are not proficient in (Grosser & Nel, 2013; Schendel & Tolmie, 2017). Some scholars call for the teaching and assessment of critical thinking skills to be contextualised in environments that African learners are familiar with (Schendel & Tolmie, 2017). In a highly urbanised environment, which has seen many individuals migrating into urban centres, the issue of concern is not contextualising teaching and assessments but rather the need for a more in-depth understanding of what critical thinking is in an African context and what factors influence the development of these critical thinking skills. Besides, items in the Cornell Critical Thinking Skills Test Level X (Ennis et al., 2005), often used in critical thinking skills studies, are not directly related to any specific cultural context. The issue of language in critical thinking skills development and assessment is critical as low proficiency in the language of teaching and learning can lead to individuals misinterpreting the information they need to analyse, impacting their thinking and ability to solve problems (Grosser & Lombard, 2008).

2.7 Recognised Official Languages in South Africa

The role of language in influencing the development of critical thinking skills is a crucial consideration within a study aiming to find factors impacting the development of such skills. This section will delve into the various official languages acknowledged in South Africa and spoken by the participating learners in this study.

In South Africa, there are eleven officially recognised spoken languages. These encompass isiZulu, isiXhosa, Sesotho, Setswana, XiTsonga, English, Afrikaans, isiNdebele,

Tshivenda, siSwati, and Sepedi (SeSotho sa Leboa). With the exception of English and Afrikaans, the remaining official languages are currently categorised into four groups: Nguni, Tsonga, Venda, and Sotho, van Schalkwyk (2005, p. 43) noted.

2.7.1 Nguni Languages

The Nguni people communicate through languages such as isiZulu, isiNdebele, siSwati, and isiXhosa, as remarked by van Schalkwyk (2005, p. 7). While speakers of these languages can understand one another when speaking, the written forms of their languages diverge. Within the Nguni people, the Zulu ethnic group employ isiZulu as their spoken language. Predominantly located in the KwaZulu Natal province, isiZulu is also widely spoken across other South African regions, notably Gauteng province. The Zulu community takes immense pride in their language, culture, and long-standing traditions (van Schalkwyk, 2005).

The Xhosa people are a segment of the Nguni ethnic group, primarily located in the Eastern and Southwestern Cape of South Africa. They communicate using the isiXhosa language, which has various dialects influenced by the sub-groups within the Xhosa community, including Phondo, Bhaca, Hlubi, and the Thembu subgroup.

In 1994, the South African government acknowledged isiNdebele as an official language, joining the ranks of Nguni languages. Those who speak isiNdebele often have proficiency in other languages, such as Afrikaans. Interestingly, Afrikaans complements isiNdebele, as these two languages have exchanged several borrowed words. For instance, terms like *"ukurasa*" in isiNdebele, meaning making noise, corresponds to *"raas"* in Afrikaans, while *"idugu"* in isiNdebele, which refers to a cloth used to wrap around the head, aligns with *"doek"*, in Afrikaans.

Another constituent group of the Nguni population is the EmaSwati. They communicate through the siSwati language, intricately linked to isiNdebele. In South Africa, approximately 900,000 individuals speak siSwati, with the majority living in Mpumalanga and its surrounding regions.

2.7.2 Sotho Languages

The Pan South African Language Board categorises Sotho as a language cluster encompassing three primary languages: SeSotho, Setswana, and SeSotho sa Leboa (SePedi) van Schalkwyk (2005, p. 43) points out. Those who associate themselves with the Sotho identity are spread across several provinces, including Limpopo, Mpumalanga, Gauteng, Northwest, Northern Cape, Eastern Cape, and Free State. The Sesotho language borrows click sounds from the Nguni languages.

The Batswana individuals are also affiliated with the Sotho collective. They converse in SeTswana, which is their home language. The Batswana are geographically located in Southern African nations like Namibia, Botswana, and South Africa. SeTswana is used by around 4 million people in the Southern African region and encompasses numerous distinct dialects (van Schalkwyk, 2005).

2.7.3 Tsonga Language

The VaTsonga community predominantly resides in the Northern provinces and certain areas of Mpumalanga. They communicate using the XiTsonga language, which includes various dialects like Nkuna (Xinkuna) and Nhlangano (Xinhlangana) (van Schalkwyk, 2005, p. 57).

Xitsonga is widely regarded as the standard dialect and is frequently employed in educational settings, media, and governmental affairs in the Northern provinces of South Africa. It has been shaped by various linguistic influences, notably Portuguese, owing to historical interactions with Portuguese colonisers in Mozambique.

Tsonga possesses its distinct alphabet and orthography, utilising the Latin script for written communication. Being a tonal language, the meaning of a word can vary based on its tone or pitch. Tsonga is characterised by its abundance of proverbs, idiomatic expressions, and oral traditions, which serve as a repository of the cultural heritage and wisdom of the Tsonga community (van Schalkwyk, 2005).

2.7.4 TshiVenda Language

Tshivenda is a distinct language spoken in South Africa, primarily within the Limpopo province, once the Venda homeland. The individuals who communicate in this language are referred to as Vhavenda. Notably, TshiVenda lacks any linguistic commonalities with the Sotho and Nguni languages (van Schalkwyk, 2005, p. 63).

However, similar to other Bantu languages, TshiVenda is tonal, meaning that the pitch or tone of a word can change its meaning. Like Tsonga, it has a unique alphabet and orthography that uses Latin script for written communication. Tshivenda is recognised as one of the official languages of South Africa and is used in various domains, including education, media, government, and cultural expression.

The language is also rich in oral literature, folklore, and cultural traditions, which are passed down through generations. It has a vibrant musical tradition, with traditional songs and dances integral to Venda culture. Tshivenda speakers often take pride in their language and its contribution to their identity and heritage (van Schalkwyk, 2005).

2.8 Socioeconomic Status and Critical Thinking Skills

Individuals' socioeconomic backgrounds largely determine the schools they enrol in, influencing their intellectual output (Budsankom et al., 2015; Gelerstein et al., 2016; Hanushek, 2020). There is a lack of literature on how social variables could influence the development of critical thinking skills (Karahan & İskifoğlu, 2020; Patil Vishwanath & Mummery, 2019; Smith et al., 2019). Many studies focus primarily on the impact of teaching strategies on improving critical thinking skills (Care et al., 2018; Ennis, 2016; Facione, 2015). What is not always clear in such studies is how pedagogy best influences the development of critical thinking dispositions (Patil Vishwanath & Mummery, 2019; van Laar et al., 2020) or whether pedagogies are indeed influential in the development of critical thinking skills or whether socially occurring variables such as socioeconomic status may influence critical thinking skills.

Socioeconomic status refers to the well-being of family members as influenced by socioeconomic status proxies such as access to technology, the number of family siblings, the

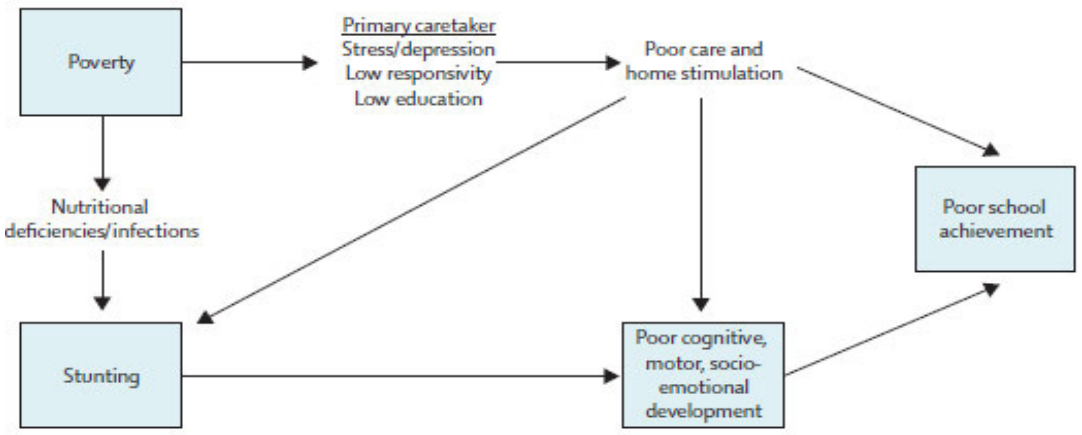
level of education of parents, their income, and community access to social amenities (Karahan & İskifoğlu, 2020; Ugwuozor, 2021). Learners from low-income families frequently lack resources for adequate housing, food, clothing, and educational supplies, and they tend to develop weaker academic skills, remarked Hernandez (2011, p. 7). Amran et al. (2019) note that individuals' socioeconomic status impacts the resources available in their classroom environments, which psychologically impacts how individuals learn and, as a result, affects the development of critical thinking skills. The socioeconomic status of parents, whether low or high, has an impact on the availability of resources required in academic settings, such as access to medical care that may be necessary to enhance the development of critical thinking skills, access to nutritious food, and adequate hygiene, and this makes socioeconomic status a critical determinant of critical thinking skills development in individuals (Grantham-McGregor et al., 2007; Karahan & İskifoğlu, 2020). According to Grantham-McGregor et al. (2007, p. 3), there is a relationship between poverty and academic achievement, as illustrated in **Figure 2.2.**

Due to poverty, individuals experience stunted growth due to a lack of nutritious food, and caregivers tend to suffer from stress. Individuals' cognitive development is affected by stunted growth, which in turn influences academic achievement. However, there is a gap in knowledge about how poverty affects critical thinking skills.

Figure 2. 2

Hypothesised Relations Between Poverty, Stunting, Child Development and School

Grantham-McGregor et al. (2007, p. 3)



The discourse on parental socioeconomic status influencing resource availability is also related to learner access to technology and technology integration in teaching and learning. Gelerstein et al. (2016) note that low-income parents are less concerned with their children's education and are more concerned with their children developing skills that will enable them to find work.

2.9 Technology and Critical Thinking Skills Development

In the South African educational context, effective integration of technology into teaching and learning is expected to transform how learners communicate, collaborate, and present their knowledge creatively (Department of Education, 2004). Technology integration is also viewed as a mechanism for developing critical thinking skills in the 21st century (Dede, 2010; Erstad & Voogt, 2018). The Department of Basic Education, in its Framework for Digital Learning (Department of Basic Education, 2019, p. 20), alludes to the significance of effectively integrating technology through educators who have high levels of subject content knowledge, competence in technology-enabled pedagogies, and a better understanding of the various educational technologies available. The relationship of socioeconomic factors on access to technology and with the possession of critical thinking skills was investigated in this study. However, the ability to access or effectively integrate technology into teaching and learning activities cannot be assumed to lead to critical

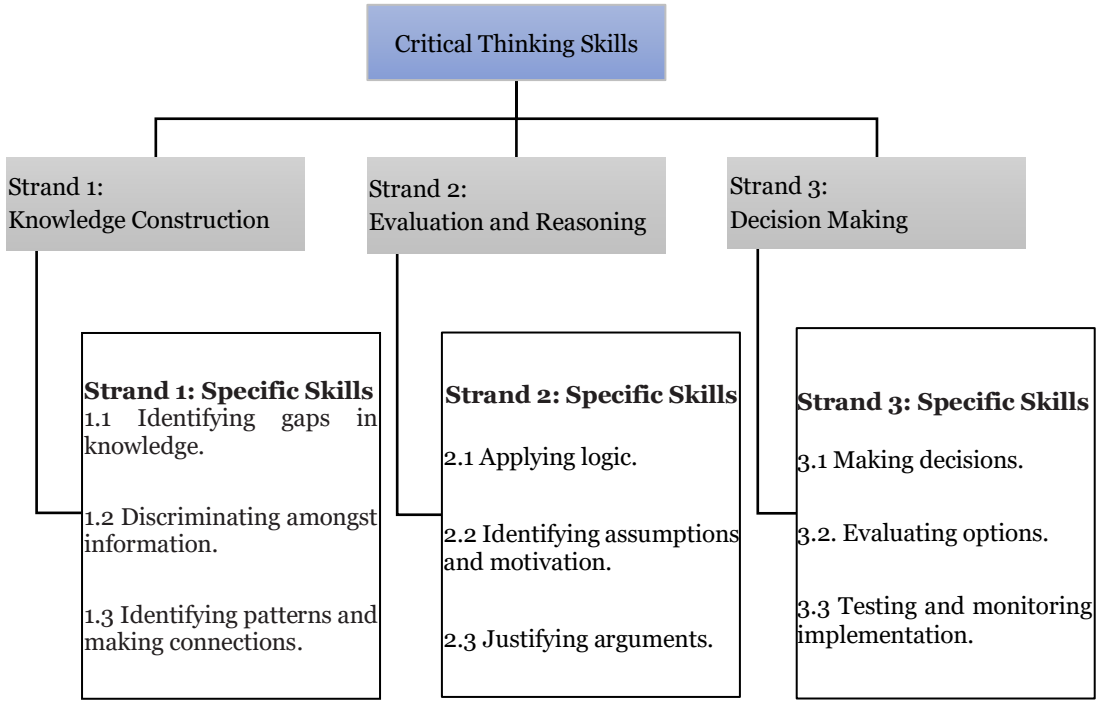
thinking. Thus, it is necessary to investigate if and how technology influences the development of critical thinking skills in individuals.

2.10 Critical Thinking Skills Theoretical Framework

A theoretical framework is built on theories and concepts proposed by experts in a field of study, as emphasised by Kivunja (2018, p. 18). A theoretical framework provides a scholarly foundation for practical data analysis and interpretation. This study was guided by the critical thinking skills development theoretical framework described by Heard et al. (2020), which was combined with disposition, abilities, and factors related to critical thinking skills possession derived from the work of renowned scholars such as Ennis (2016). The critical thinking skills development theoretical framework divides the ability to think critically into three strands: the ability to construct knowledge, the ability to evaluate information logically, and the ability to make decisions, as pointed out by Heard et al. (2020, p. 11). Each strand is further developed and contains three aspects, which are specific skills and knowledge that emerge during the development of the core critical thinking elements (see **Figure 2.3**). The strands operate concurrently during activities that require the application of critical thinking skills, as Heard et al. (2020, p. 11) pointed out. The critical thinking skills core elements (strands) and supporting sub-elements (aspects) are derived from and influenced by dispositions and abilities proposed by leading critical thinking skills researchers such as Ennis (2016), Facione (2015) and Paul and Elder (2019).

Figure 2. 3

Critical Thinking Skills Development Framework Heard et al. (2020, p. 12)



2.10.1 Knowledge Construction Strand

Developing critical thinking skills requires effectively developing knowledge through reflective and evaluative engagement with available information (Dewey, 1910). This knowledge construction uses an individual's ability to identify gaps and deficiencies in the information given. The discovery of information gaps sparks the desire for investigation, leading to the development of critical thinking skills (Ennis, 2016). Not all information leads to the ability to think critically; there is always a need to discriminate among available information to support knowledge construction. Knowledge construction is aided by knowing what is relevant and what hinders critical thinking through information discrimination (Facione, 2015). Valid knowledge construction also depends on the ability to formulate patterns and connections within available information (Bailin & Battersby, 2015; Ennis, 2016; Willingham, 2019).

2.10.2 Evaluation and Reasoning Strand

Evaluating available information, justification, and motivation to make decisions based on underlying assumptions are crucial factors in developing critical thinking skills (Heard et al., 2020). Logical reasoning enables the identification of contradictions and consistency in the information. Logical reasoning is based on dispositions and abilities, such as the ability to draw conclusions from available data and assess the validity and reliability of available data and assumptions before utilising these dispositions and assumptions in the decision-making process (Ennis, 2016; Facione, 2015).

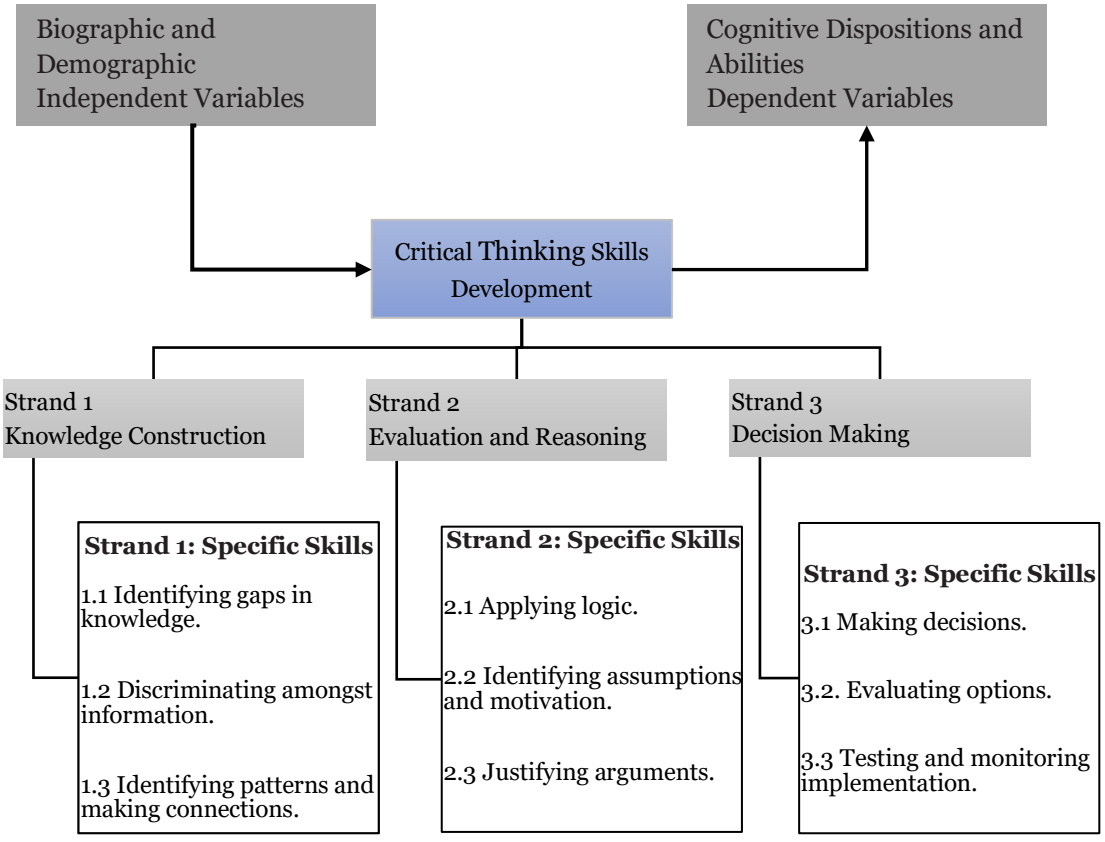
2.10.3 Decision-Making Strand

The critical thinking skills development framework's decision-making strand emphasises the ability to analyse and evaluate what is thought to be a plausible outcome in solving problems (Heard et al., 2020). The hypothetical plausible outcome is criterion-referenced to individuals' understanding of a problem and decisions made in developing the outcome. Decision-making becomes a probabilistic event that increases the likelihood of the plausible outcome being true and leads to the development of what to believe and do (Butler et al., 2017; Ennis, 2016; Halpern & Dunn, 2021).

The critical thinking skills development framework focuses primarily on skill development rather than dispositions, abilities, and factors that influence skills development. Integration of dispositions, abilities, and factors that influence critical thinking skills into the theoretical framework of critical thinking skills development leads to the formulation of a theoretical framework that links dispositions and abilities of critical thinking skills to factors that influence the development of critical thinking skills. This integrated critical thinking skills development theoretical framework is presented in **Figure 2. 4**.

Figure 2. 4

An Integrated Critical Thinking Skills Development Framework



This study focused on the presence of dispositions and abilities such as induction, deduction, observation, interpretation, and credibility of responses in Grade 11 learners enrolled in different academic streams. These dispositions and abilities form sections of the Cornell Critical Thinking Skills Test Level X. The participant's performance in the critical thinking test was interpreted as being related to the level of critical thinking skills that would have been developed in the participants as informed by the critical thinking skills development framework. To understand the factors that are related to possessing critical thinking skills, Grade 11 learners' biographic data was analysed with respect to critical thinking skills test scores and data collected through focus group interviews.

2.11 Exploring the Relationship Between the Critical Thinking Skills Development Framework and the Cornell Critical Thinking Skills Test Level X

The Cornell Critical Thinking Skills Test Level X assesses an individual's ability to make inductive and deductive inferences. These inferences are built upon specific observations and assumptions rooted in accepted general principles. Deductive and inductive reasoning are fundamental components that underpin practical critical thinking skills, dispositions, and abilities. The breakdown of inference and basis of inference items in the Cornell Critical Thinking Skills Test Level X is presented in **Table 2. 6**.

Table 2. 6

Cornell Critical Thinking Skills Test Level X Items Distribution

Inferences and Basis of Inferences Items in Cornell Critical Thinking Skills Test	Number of Items in Test
Inductive	25
Deductive	24
Observation	24
Assumption	24
Credibility of Judgements	10

The development of critical thinking skills, as outlined in the knowledge construction strand of the framework, is strongly associated with the inductive and observational items of the Cornell Critical Thinking Skills Test Level X. Inductive inferences are drawn from specific observations, enabling individuals to make generalisations and draw logical conclusions about broader principles. These observations also facilitate the identification of gaps in available information, the recognition of logical patterns, and the formulation and testing of hypotheses.

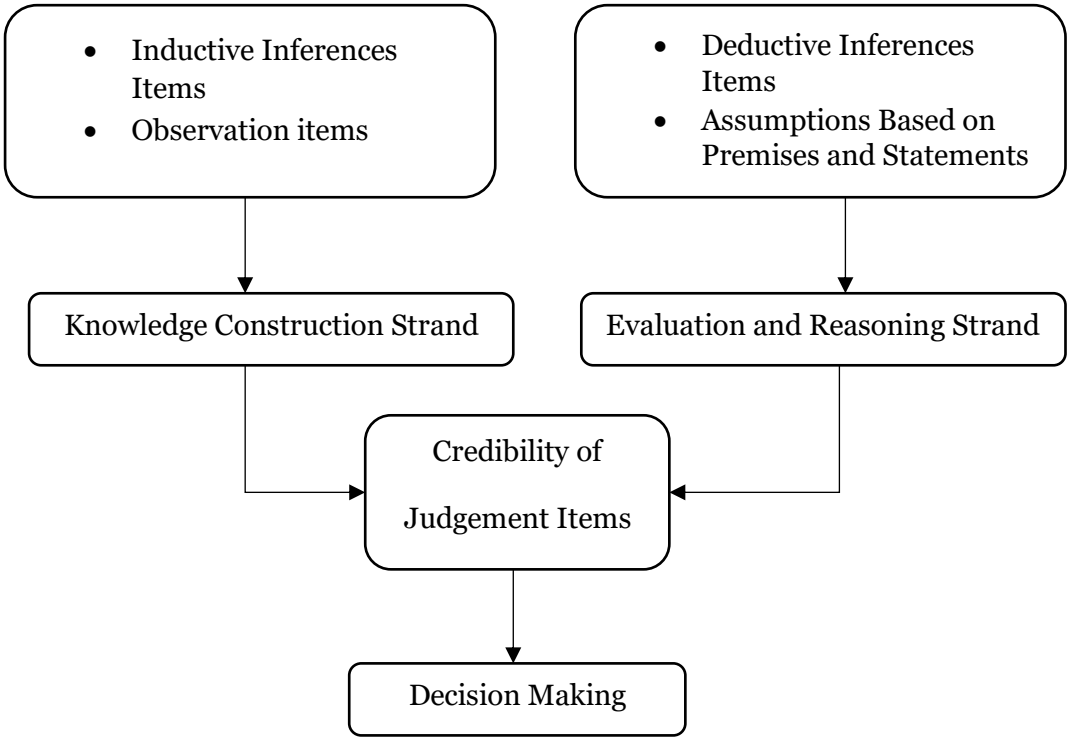
On the other hand, the deductive inference items in the test rely on assumptions derived from general principles and premises, which are closely related to the evaluation and reasoning strand of the critical thinking skills development frame. These deductive inference-seeking items in the test provide a means to evaluate information through logical reasoning. Deductive inferences are considered valid based on authentic and accurate

principles, and the conclusions resulting from deductive evaluating and reasoning are also deemed valid.

The decision-making process of individuals forms a strand of the critical thinking skills development framework. Items that solicit competence in making informed, credible judgements were utilised in the decision-making part of the Cornell Critical Thinking Skills Test Level X. The linkage between the Critical Thinking Skills Development framework and items in the Cornell Critical Thinking Skills Test Level X is illustrated in **Figure 2. 5**.

Figure 2. 5

Relationship Between Critical Thinking Skills Development Framework and Cornell Critical Thinking Skills Test Level X Items



The study perceives knowledge construction as achievable through academic subject streams individuals engage with and their lived experiences intertwined with Indigenous knowledge systems within their communities. Within academic subjects, individuals are prompted to identify knowledge gaps, such as in mechanics within the Physical Sciences curriculum, and discern valuable information, as demonstrated in tasks like answering comprehension questions in English and History. Additionally, subjects like Mathematics

emphasise pattern recognition, contributing to skill development in identifying patterns within information.

The study integrates biographic and demographic factors into the framework for developing critical thinking skills, acknowledging the relationship between possessing critical thinking skills and these factors. Participants' lived experiences, influenced by factors like socioeconomic status, contribute to their competence in knowledge construction. Individuals develop skills in identifying information gaps, evaluating information, and applying logic to address societal challenges such as water shortages, inadequate housing, healthcare deficiencies, and electricity shortages.

Throughout these processes, decision-making based on credible judgments is honed, leading to the acquisition of critical thinking skills. The administration of the critical thinking skills test aims to gauge how these cognitive dispositions, along with other factors, enable individuals to possess critical thinking skills through their proficiency in inductive and deductive reasoning, observations, judgment credibility, and decision-making abilities, all of which serve as indicators of critical thinking skills.

2.12 Conclusion

Developing critical thinking skills in citizens is a core element of the South African education system (Department of Basic Education, 2011c, p. 4). Critical thinking is *"reasonable and reflective thinking that focuses on what to believe or do",* as affirmed by Ennis (2016, p. 167). Critical thinking skills are evident in individuals who exhibit competence in dispositions and abilities such as interpreting, analysing, evaluating, explaining and inferring (Ennis, 2016; Facione, 2015; Paul & Elder, 2019). According to the Department of Basic Education (2022), in a diagnostic report analysing learner performance in examination questions requiring higher-order critical thinking skills, learner performance is dismally low. This suggests a failure in the South African education system to develop citizens who possess critical thinking skills.

The reviewed literature suggests that numerous factors can relate to learners' possession of critical thinking skills. Some of these factors include academic subject

groupings of learners, gender, socioeconomic status, home language and cultural norms of learners. Hence, this study sought to explore and understand if and how these factors are related to the possession of critical thinking skills by Grade 11 learners. The development of critical thinking skills is viewed through the lens of the critical thinking skills development framework (Heard et al., 2020) in conjunction with biographic and other factors that can be related to individuals' possession of critical thinking skills. Identifying the factors related to the possession of critical thinking skills in learners enrolled in different academic subject streams may provide insights into how stakeholders in the education system can improve learners' critical thinking skills.

CHAPTER 3

RESEARCH METHOD

3.1 Introduction

In this study, I sought to determine which factors are related to the critical thinking skills of Grade 11 learners enrolled in different academic subject streams and to explore how and why these factors are perceived to be related to possessing critical thinking skills. The following research questions influenced the approach and method I used in the study:

1. Is there a statistically significant difference in the critical thinking skills test performance of Grade 11 learners enrolled in different academic subject streams?
2. What factors are related to the critical thinking skills of Grade 11 learners enrolled in different academic subject streams?
3. How are these factors related to the critical thinking skills of Grade 11 learners enrolled in different academic subject streams?
4. Why are these factors perceived to be related to critical thinking skills by Grade 11 learners enrolled in different academic subject streams?

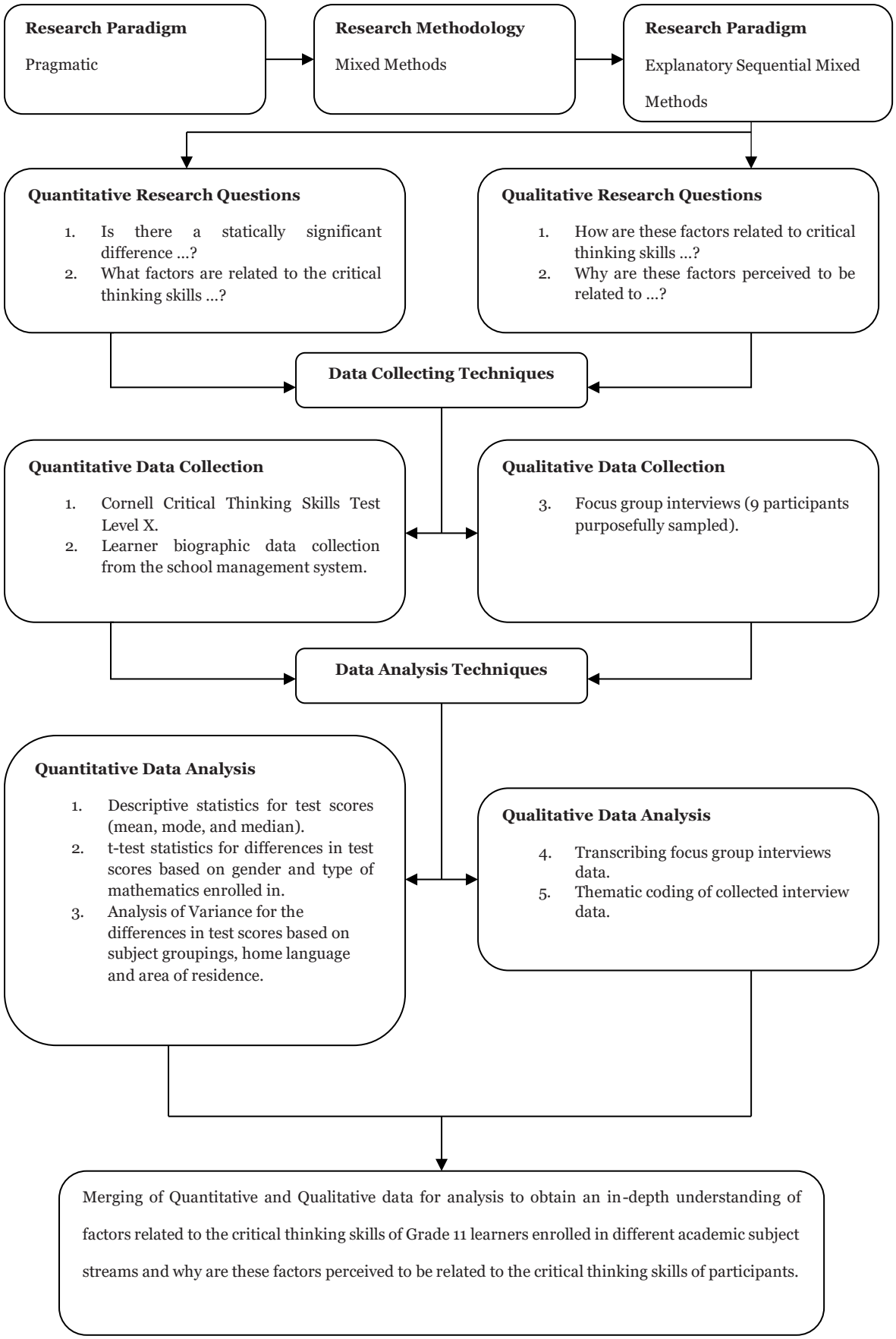
I now describe the philosophical approach and research design underpinning this study and discuss the data collection methods I employed. Ethical issues and the validity, credibility, and reliability of the instruments and design used in this study are also addressed. I outline the methodological approach in **Figure 3.1**.

3.1.1 Research Paradigm

The pragmatic paradigm strongly influenced this study's philosophical approach, guided by the research questions. I employed an explanatory sequential mixed methods design to comprehensively understand the factors related to participants' critical thinking skills. This design effectively combined quantitative data from the Cornell Critical Thinking Skills Test Level X with qualitative data from purposefully selected participants interviewed in a focus group. To further elaborate on the philosophical underpinnings of this study, ontological, epistemological, and axiological assumptions will be discussed.

Figure 3. 1

Research Approach Flow Diagram



3.1.2 Ontological Assumptions

Ontology refers to the researcher's underlying beliefs about the nature of reality Mertens (2014, p. 58). Within the pragmatic paradigm, it is deemed acceptable to utilise both a postpositivist and a constructivist perspective to understand knowledge related to human behaviour (Burrell & Morgan, 2017; Tashakkori et al., 1998). Postpositivists view reality as objective, while constructivists perceive reality as subjective and multifaceted (Mertens, 2014). Postpositivists seek to identify and understand the causal effects of influential factors on human behaviour. In examining these causal relationships, postpositivists aim to formulate general principles or patterns that can help explain and predict human behaviour (Campbell & Riecken, 1968; Cook et al., 2002; Maxcy, 2003). When adopting a postpositivist lens, the relationship between the researcher and the behaviour under investigation is characterised by the reliance on theories, hypotheses, and background information. The researcher's role in this study was to gather empirical evidence and analyse it objectively to develop an understanding of differences in critical thinking skills among Grade 11 learners enrolled in different academic subject streams. By embracing the postpositivist approach, the researcher's primary goal was to reduce the impact of personal biases and interpretations that might sway objectivity. Emphasis was placed on upholding stringent research methodologies and principles to guarantee that the conclusions regarding differences in critical thinking skills among Grade 11 learners enrolled in different academic streams are founded on dependable and legitimate evidence, a viewpoint supported by scholars such as Cook et al. (2002).

In contrast, constructivists focus on achieving a hermeneutic understanding of behaviour. They emphasise the importance of considering the contexts in which individuals live and experience behaviour (Vygotsky, 1980). Constructivists recognise that various social, cultural, and contextual factors shape behaviour. They emphasise interpreting and understanding behaviour within these contextual frameworks, aiming to uncover the subjective meanings and interpretations that individuals attribute to their experiences of their behaviour. In doing so, constructivists seek to gain a deeper understanding of the

complexities and nuances of human behaviour. Furthermore, constructivists argue that any study aimed at understanding human natural behaviour should take into account the multifaceted influence of the societal context in which the behaviour is constructed, including interactions between the researcher, participants, and the behaviour under investigation, rather than seeking correspondence of findings to some arbitrary theoretical true condition in a naive realistic world (Schwandt, 2000). So, while the objective nature of learners' critical thinking skills is realised in the study through the collection and analysis of numerical data using a critical thinking skills test and analysis of relationships between critical thinking skills test scores and biographic data, purposefully selected participants were interviewed to gain an in-depth qualitative understanding of how the social context experienced by participants influences the development of their critical thinking skills.

3.2 Methodology

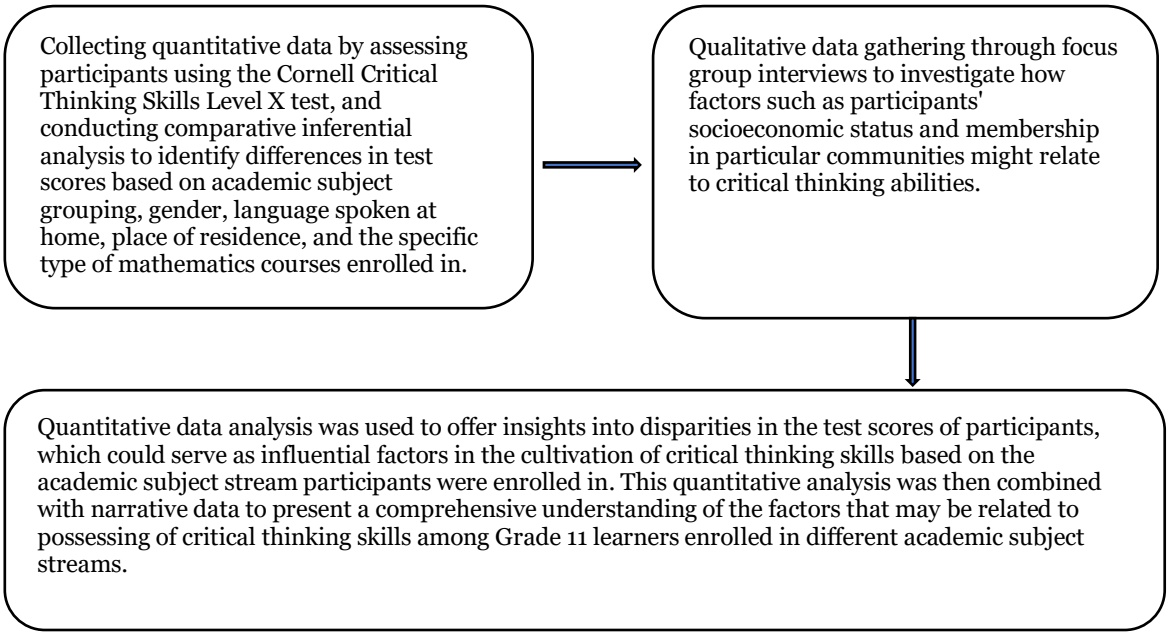
The methodology describes how the researcher will acquire the necessary knowledge and understanding of human behaviour, Mertens (2014, p. 58) remarked. Due to the orientation of the pragmatic paradigm, various appropriate research designs can be combined and used to provide comprehensive answers to research questions (Creswell & Creswell, 2018; Tashakkori et al., 1998). Using a combination of research methods became popular due to the realisation that using only quantitative or qualitative designs to understand a phenomenon or behaviour was ineffective, especially when inquiring about factors that influence human behaviour Gorard and Smith (2006, p. 61) notes. Hence, mixed methods designs were created to uncover detailed information about behaviour, different perspectives on what influences behaviour, and increasing corroboration between different data formats to avoid potential bias due to the use of singular forms of data (Reams & Twale, 2008).

Mixed methods research entails collecting quantitative and qualitative data in response to research questions and rigorous data analysis to understand behaviour better (Creswell & Creswell, 2018; Mertens, 2014). Some of the advantages of the utilisation of a mixed methods design, as noted by Denscombe (2008, p. 272), include increasing data

accuracy, providing a complete picture of behaviour under study that would not typically be elaborated when a single design is used; and allowing the researcher to develop a credible analysis of the originally collected data. In this study, the researcher used the explanatory sequential mixed method design. The study employed a cross-sectional survey to gather quantitative data, as it was well-suited for quantifying trends and relationships between variables. This research design collected quantitative data as test scores from the Cornell Critical Thinking Skills Test Level X, as described in **Section 3.6.1**. The process of quantitative data analysis included assessing whether there were statistically significant differences in the participants' performance based on factors such as their academic subjects, gender, home language, area of residence, and the specific type of Mathematics they were enrolled in. The survey provided economic advantages, as the data was collected at a single point in time, which resulted in a rapid turnaround time for data collection and analysis. The quantitative phase results were used to identify participants from whom qualitative data was generated. Participants are given a voice in qualitative interviews to explain how various factors influence their behaviour, as Cohen et al. (2011, p. 219) remarked. The qualitative data provides meaning to what constitutes factors that lead to the development of participants' critical thinking skills as viewed from the participants' standpoint. The use of participants and researchers as research instruments has the advantage of humans being adaptable and capable of providing a complete picture of factors influencing the development of critical thinking skills over the objective nature of reality that the critical thinking test can describe and explain (Cohen et al., 2018). The combination of quantitative and qualitative data allowed for a comprehensive understanding of the factors related to possessing critical thinking skills by Grade 11 learners enrolled in different academic subject streams. The research design is illustrated in **Figure 3. 2**.

Figure 3. 2

Explanatory Sequential Mixed Methods Design Creswell (2020, p. 602)



3.3 The Participants

Sampling is a decision made by the researcher to determine who will participate in a study and who will provide valid and reliable data (Mertens, 2019). Grade 11 learners (n=116) enrolled at Dawnview High School in the Ekurhuleni North Educational District of Gauteng province, South Africa, were conveniently sampled for the quantitative phase of the study. The participants in the study comprised 37% males (n=43) and 63% females (n=73). Consent was obtained from parents and guardians before participants could participate in the study, as the average age of male participants was 17.60 years and for female participants, it was 17.15 years. According to the National Health Act (2003, p. 72), individuals below the age of 18 years can participate in a research study only if their parents or legal guardians have granted consent for their involvement. Attached in **Appendix 4** is the consent letter that was sent to parents and guardians.

In Grade 10, learners must choose three subjects to align each learner's choice of subjects with a specific academic subject stream as recommended in the National Policy Pertaining to the Programme and Promotion Requirements (NPPPPR) of the National Curriculum Statement Grades R – 12 (Department of Basic Education, 2021, p. 53). Physical

Sciences, Life Sciences, History, Consumer Studies, Accounting, Economics, Tourism, Geography, Business Studies, and Computer Applications Technology are among the subjects learners can choose from. The organisation of subjects leading into different academic streams is shown in **Table 3. 1**.

Table 3. 1

Organising Fields of Learning and Subjects Department of Basic Education (2021, p. 53)

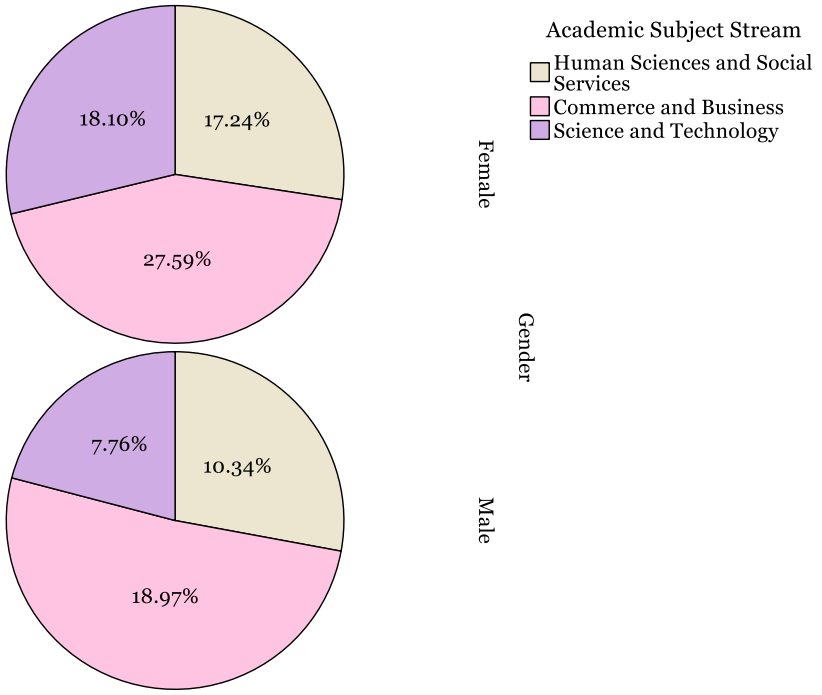
No	Organising fields of learning	Secondary School Subjects
1.	Agriculture and Nature Conservation	Agricultural Management Practices; Agricultural Sciences; Agricultural Technology
2.	Culture and Arts	Dance Studies; Design; Dramatic Arts; Music; Visual Arts.
3.	Business, Commerce, and Management Studies	Accounting; Business Studies; Economics
4.	Communication Studies and Language	All official languages and approved non-official languages.
5.	Education, Training and Development	No subjects Assigned
6.	Manufacturing, Engineering and Technology	Civil Technology; Electrical Technology; Mechanical Technology; Engineering Graphics and Design
7.	Human and Social Studies	Religion Studies; Geography; History; Life Orientation
8.	Law, Military Science and Security	Subjects not offered in secondary schools.
9.	Health Sciences and Social Services	Consumer Studies, Hospitality Studies, Tourism, Life Sciences
10.	Physical, Mathematical, Computer and Life Sciences	Computer Applications Technology, Information Technology, Life Sciences, Mathematical Literacy; Mathematics, Physical Sciences.
11.	Services	Consumer Studies; Hospitality Studies; Tourism.
12.	Physical Planning and Construction	No Subjects were assigned.

The participants were spread across three academic subject streams: Commerce and Business n=54 (47%), Human Sciences and Social Services n=32 (28%), and Science and Technology n=30 (25%). In relation to gender, there were thirty-two female participants in the Commerce and Business stream, twenty in the Human Sciences and Social Services stream, and twenty-one in the Science and Technology stream. As for male participants, there were twelve in the Commerce and Business stream, twelve in the Human Sciences and Social Services stream, and nine in the Science and Technology stream. The distribution of participants in different academic groups shows that the percentage of females is greater

when compared to that of males in all academic subject streams, as illustrated in **Figure 3. 3**.

Figure 3. 3

Distribution of Participants into Different Academic Subject Streams Based on Gender



In South African education, secondary school Mathematics is categorised into Core Mathematics and Mathematical Literacy. Core Mathematics involves using symbols and notations to describe numerical, geometrical, and graphical concepts, as stated by the Department of Basic Education (2011b, p. 13). On the other hand, Mathematical Literacy focuses on developing practical skills and competencies applicable to everyday life in the 21st century, primarily through basic numeracy skills, according to the Department of Basic Education (2011a, pp. 8-14). In this study, the participants were also spread into two groups based on their chosen Mathematics group. The first group comprised 38 Core Mathematics learners, 11 males and 27 females. The second group included 78 Mathematical Literacy learners, thirty-two males and 46 females.

3.3.1 Participants' Areas of Residence

The feeder zone for Dawnview High School includes areas such as Germiston, Tembisa, Primrose, Vosloorus, Edenvale, and Katlehong. In this study, participants were

distributed according to their residential addresses as follows: 60 learners from Primrose (31 females and 29 males), 21 learners from Germiston (18 females and three males), five learners from Tembisa (two females and three males), five female learners from Vosloorus, six learners from Malvern (three females and three males), one female learner from Midrand, five learners from Elandsfontein (three females and two males), 12 learners from Katlehong (10 females and two males), and only one male learner from Bedfordview. It can be seen in **Figure 3. 4** that most of the participants reside in Primrose (51.72%), with areas such as Germiston and Katlehong also contributing a significant number of learners that are enrolled in Grade 11 at Dawnview High School.

The participants' residential areas are predominantly situated within the City of Ekurhuleni, except for Midrand and Malvern. The City of Ekurhuleni has an estimated population of around 3,178,470, as the Department of Cooperative Governance and Traditional Affairs (2020) affirmed. Sixty-six per cent of the city's population falls within the working-age bracket, and 53% are between the ages of 20 and 49, with a median age of 30. Key areas within the central part of the City of Ekurhuleni, such as Primrose, Germiston, Elandsfontein, and Bedfordview, have a combined population of 255,863 and 91,237 households (Department of Statistics South Africa, 2011). Tembisa, located in the northern part of the city, is the second-largest township in South Africa, with a population of 463,109 and 166,340 households. In the South African context, a *"township"* refers to historically disadvantaged areas created during the apartheid era, primarily inhabited by black Africans (Department of Statistics South Africa, 2011). Participants also come from Katlehong, the third-largest township in South Africa, with a population of 407,294 and 124,841 households, as well as Vosloorus, the sixteenth-largest township in South Africa, with a population of 163,216 and 46,095 households (Department of Statistics South Africa, 2011).

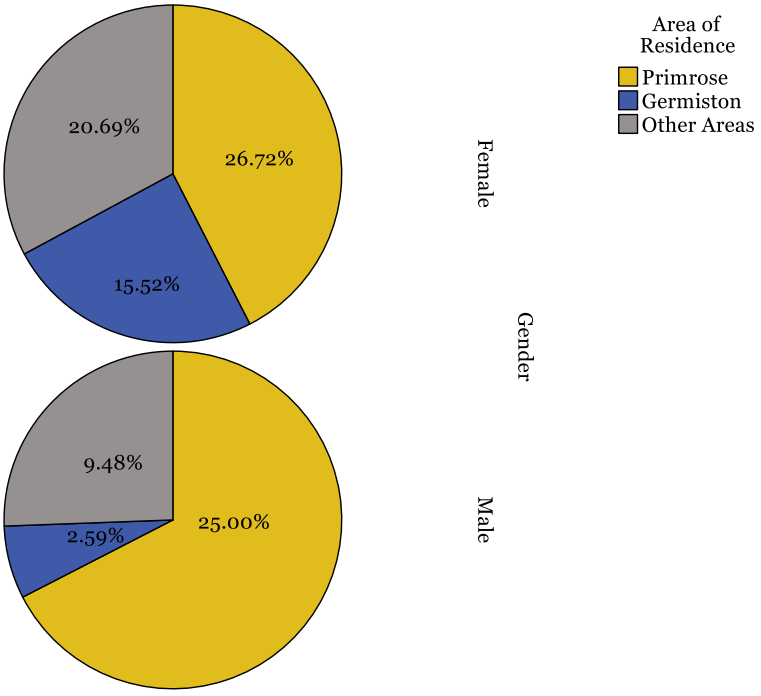
Approximately 78.7% of the City of Ekurhuleni's population comprises Black Africans, while whites make up 15.8%, and other races account for only 5.5%. Residential areas in the City of Ekurhuleni are highly urbanised, with 77.4% of the population living in formal dwellings and 18.7% in informal settlements (Department of Cooperative Governance

and Traditional Affairs, 2020). Dawnview High School enrols a considerable number of learners from informal settlements like Makause squatter camp and Marathon informal settlement, which border the town of Primrose.

In the City of Ekurhuleni, 31% of the population lives in poverty, with an average annual household income of R29,400. Approximately 56% of the population earns an annual income of R40,000 or less (Department of Cooperative Governance and Traditional Affairs, 2020). The unemployment rate in the City of Ekurhuleni is 31.6%, with a youth unemployment rate of 36.9%. This unemployment rate is higher than that of the Gauteng province, leading to 30.8% of households and 19.2% of individuals in the population receiving some form of government social assistance to mitigate the effects of poverty. The average life expectancy in the city is approximately 61.2 years for male residents and 66.7 years for females (Department of Cooperative Governance and Traditional Affairs, 2020).

Figure 3. 4

Distribution of Participants Based on Area of Residence



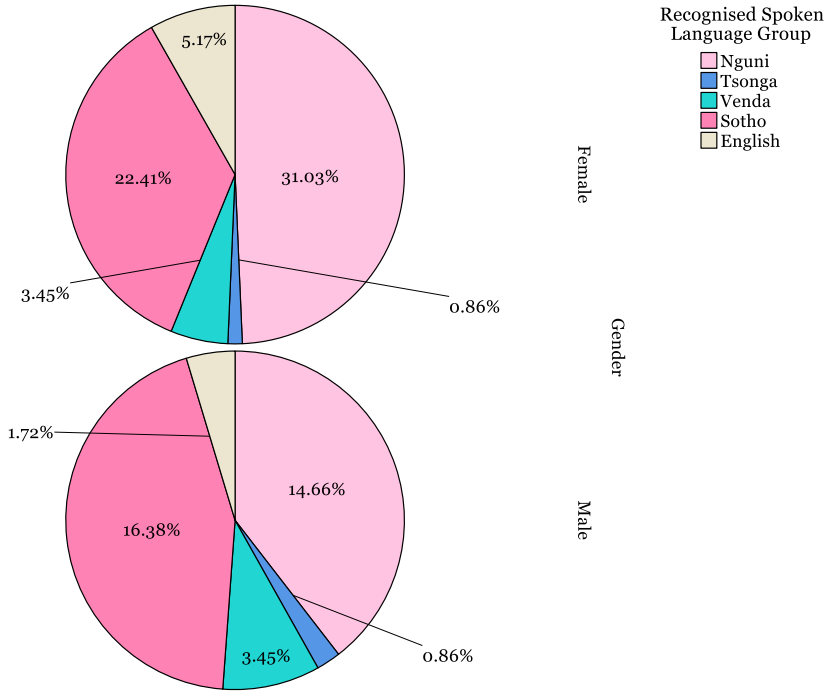
3.3.2 Participants' Home Language

Among the participants, Isizulu was the most spoken language at home, with 36 participants (26 females and 10 males). The distribution of participants based on their other

home languages was as follows: eight learners spoke SeTswana (four females and four males), eight learners spoke English (six females and two males), eight learners spoke Tshivenda (four females and four males), 20 learners spoke Sesotho (nine females and 11 males), two learners spoke Xitsonga (one female and one male), 16 learners spoke IsiXhosa (10 females and six males), 17 learners spoke Sepedi (13 females and four males), and there was only one male learner whose home language was Siswati. The school's language of teaching and learning is English, and Afrikaans is offered as a first additional language. **Figure 3. 5** shows the distribution of learners based on their recognised spoken home language.

Figure 3. 5

Distribution of Participants Based on Recognised Spoken Home Language



3.3.3 Focus Group Interviews Participants

To generate credible qualitative data, a sampled number of nine Grade 11 learners was interviewed in a focus group format. The maximal variation sampling strategy was used to select the interviewed participants. This is a purposeful sampling strategy in which participants are chosen based on differences in their groupings and specific characteristics under investigation Creswell (2020, p. 241) notes. Participants in the study were

purposefully selected for the interview phase based on their academic subject grouping, gender, and performance on the critical thinking skills test. Nine learners were interviewed, with three from the Human Sciences and Social Services stream, three from the Sciences and Technology stream, and three from the Commerce and Business stream; the small number of interviewees allowed for effective data management and thematic analysis of the collected data. The critical thinking skills test scores were classified into three categories: high performers, average performers, and low performers. The three learners from each academic subject stream were purposefully chosen from each performance category. To reflect the gender distribution among learners in the sample of 116, a ratio of one male participant to three female participants was implemented when selecting participants for the interview phase. **Table 3. 2** displays the composition of participants in the qualitative phase, who were selected based on their percentile position in test scores. Specifically, one learner from the 25th percentile, another from the 50th percentile, and a third from the 75th percentile were chosen from each academic subject grouping.

Table 3. 2

Participants in the Qualitative Phase

25th Percentile			
ID	Gender	Academic Grouping	Score
136	male	Human Sciences and Social Services	22
102	female	Commerce and Business	23
71	female	Science and Technology	31
50th Percentile			
ID	Gender	Academic Grouping	Score
96	male	Human Sciences and Social Services	29
5	female	Commerce and Business	29
18	female	Science and Technology	34
75th Percentile			
ID	Gender	Academic Grouping	Score
65	female	Human Sciences and Social Services	33
135	male	Commerce and Business	35
40	female	Science and Technology	47

3.4 Ethical Issues

Ethical considerations in a study include the researcher's sensitivity to the right to privacy and anonymity of study participants (Douglas, 1977). These considerations are to be maintained throughout the study, including when the study's purpose is developed, selecting the methods for data collection, defining the type of data to be gathered, and establishing protocols for data storage, as Cohen et al. (2011, p. 76) remarked. At all stages of the study, the researcher adhered to the principles of primum non nocere (do no harm) when dealing with participants.

Firstly, a gatekeeper's permission from the school management team was obtained to access participants and use participants' biographic information sourced from the school management system. By law, the school management team serve as loco parentis. The gatekeeper's permission letter and access and use of participants' biographic data are presented in **Appendix 1** and **Appendix 2,** respectively. This enabled the researcher to obtain ethical clearance from the Humanities and Social Sciences Ethics Committee at the University of KwaZulu Natal (See **Appendix 3** for the full ethical clearance letter).

In a study involving minors (children under the age of 18), researchers must obtain permission from the minor's parents or guardians to allow the minors to participate in the study (Moore et al., 2018). Since the participants in this study were Grade 11 learners with an average age of 17 years, three months before data collection, informed consent letters were sent to parents and guardians of all Grade 11 learners who were under the age of 18 years, informing them about the nature of the study. The parental consent form is provided in **Appendix 4**. Informed consent refers to participants being given the option of participating or refusing to participate in a study after being informed about the facts likely to influence their decision (Cohen et al., 2011, p. 77; Diener & Crandall, 1978, p. 57). All Grade 11 learners were informed about the nature of the study, the type of data to be collected, and that participation is voluntary; no payments or gifts were to be offered to participants. The participant consent form can be found in **Appendix 5**. The participants were also given the opportunity to ask questions about the study, and answers were provided accordingly. The

school had 152 learners enrolled in Grade 11, but twenty-three of them refused to take part in the study. The refusal to participate in such a study could be attributed to the nature of the data that the study sought to collect, which included competence in critical thinking skills, which is a personal skill, as well as parental level of education and income. According to an American Psychological Association (2017) report, in some cases, participants cannot divulge personal information that threatens their livelihood, including information about income and individual attributes such as intelligence. In such instances when participants do not give consent to take part in a study, Cohen et al. (2011, p. 79) note that the logical and ethical plan of action is to respect the individuals by not asking questions about their decision not to participate in the study, and no data was collected from such individuals. Information about such participants was not included in this study's report.

When collecting and reporting data, the researcher must respect the participants' rights to privacy, anonymity, and confidentiality. The researcher was sensitive to the type of data collected, such as parents' income and participants' critical thinking abilities. As such, care was taken in reporting to develop mechanisms that would make it difficult to trace the data back to the participants. To ensure participant privacy throughout all phases of the study, pseudonyms in the form of randomly selected numbers by participants were used. The anonymity of the participants was maintained by using a number system. Anonymity refers to the fact that information provided by participants cannot be traced back to the participants' identities, as Cohen et al. (2011, p. 91) remarked. Maintaining anonymity was, however, a challenge, despite learners using a numbering system as their identification code, because data had to be collected from a subset of participants in the qualitative phase, as dictated by the study's design. The study design was an explanatory sequential mixed methods study, with a subset of participants identified and chosen for the qualitative phase based on their performance on the Cornell Critical Thinking Skills Test Level X. According to Raffe et al. (1989), maintaining anonymity is difficult in studies that combine data collected at various points. In such a case, this could jeopardise interview participants' anonymity, leading to data being traced back to participants.

3.5 Piloting of Survey Instrument

The procedure in which an instrument is tried on a sample of comparable participants to the intended participants in the study is referred to as piloting the instrument (Mertens, 2019). The purpose of conducting a pilot test of research instruments is to enhance their reliability and comprehensibility and to ensure that they appropriately measure the construct they are intended to assess. Additionally, the pilot test helps determine the feasibility of using the instrument in data collection and analysis, as noted by Cohen et al. (2011, p. 402). The Cornell Critical Thinking Skills Test Level X was piloted in this study with 30 Grade 11 learners from Edenvale Success College, a school in the same feeder zone as Dawnview High School. The pilot sample included 17 females and 13 males, with an average age of 17 years, who were enrolled in different academic streams. The participants in the sample were notified that the pilot test aimed to enhance the quality of the research instrument, and they were encouraged to provide feedback freely and seek clarification on any aspects of the instruments. Several concerns were raised by the participants during the piloting of the Cornell Critical Thinking Skills Test Level X, including the following: (a) the absence of contextual information on the climatic conditions of the hypothetical planet Nicoma, (b) inadequate time to complete the test, and (c) difficulty in understanding some of the language used in the test.

The climatic conditions of the hypothetical planet Nicoma were likened to that of North America, similar to what is experienced in some parts of South Africa. A brief section on these climatic conditions was included in the final instrument used in the study and explained to participants. While it is true that South Africa has diverse climate zones, there are no areas in South Africa that experience a climate that is identical to that of North America. However, some parts of South Africa have climates similar to those of some areas of North America. For example, the western parts of South Africa have a semi-arid climate comparable to some areas of the southwestern United States, such as Arizona or New Mexico.

Additionally, the southeastern parts of South Africa, such as KwaZulu-Natal, have a sub-tropical climate similar to parts of Florida or Louisiana in the United States. Nonetheless, it is essential to note that these similarities are not exact and that there are significant differences in the climate patterns between the two regions. The contextual background influences the assessment of thinking skills. Although the original time allotted for the test was 50 minutes, the final instrument was administered with a time limit of 60 minutes for the critical thinking skills test. This decision was in accordance with the test manual, which advises investigators to provide sufficient time for test takers to complete the assessment, so ultimately, it is the researcher's responsibility to determine a reasonable amount of time for the test (Ennis et al., 2005). To address the difficulty in comprehending some of the language used in the test, a qualified English home language educator with a minimum of ten years of experience in teaching English in Grades 10 to 12 was consulted. Upon further examination of the language used in the critical thinking skills test instrument, it was determined that the language level was appropriate for Grade 11 learners. Additionally, it was noted that comprehending complex language is a fundamental skill that contributes to the development of critical thinking abilities, as supported by Grosser and Lombard (2008, p. 1368); hence, no changes to the language of the test were implemented.

3.6 Data Generation Method

The method used to gather quantitative data for this study involved administering a survey to 116 participants enrolled in different academic subject streams. The survey was in the form of a Cornell Critical Thinking Skills Test Level X. A survey can collect data at a specific point to describe the nature of a behaviour at a particular point in time in a specific contextual setup efficiently and economically Cohen et al. (2011, p. 256) posits. A survey is also typically used to collect data that can be processed using descriptive methods, inferential tests, and data that can lead to assertions of correlations between variables, as well as to generate accurate instruments, as surveys allow for the piloting of a study process (Cohen et al., 2011).

On the 26th of April 2023, a total of 116 Grade 11 learners underwent the administration of the Cornell Critical Thinking Skills Test Level X. The participants took the test within their respective homeroom classes, which are designated classrooms managed by homeroom teachers responsible for attendance, announcements, and overall organisation of activities that take place in the classroom. Before the test was conducted, on the 14th of April 2023, a group of five Grade 11 homeroom teachers received training on administering the test. The training covered various aspects, including reading and explaining the instructions to the learners, demonstrating the test procedure through example questions from the test, communicating the one-hour time limit for the test, communicating the purpose for the test, instructing learners to use pseudo identification codes that they had been issued with instead of their names for confidentiality, emphasising standard test etiquettes such as maintaining silence, refraining from sharing stationery, and avoiding discussions about the questions and solutions among participants. The test session commenced at 8:30 a.m. across all classes, and by 9:30 a.m., all participants had completed their responses to the test questions. The homeroom teachers collected the learners' answer scripts and question papers. Subsequently, the researcher gathered all the answer scripts and marked and recorded each participant's score.

The qualitative data was gathered from a group of nine participants who were purposefully chosen using a stratified sampling method based on their performance on the critical thinking test, as already described in **Section 3.3** and **Table 3. 2** shows the distribution of participants interviewed. The participants in the focus group were interviewed using a structured interview schedule (**Appendix 8**), and data was collected in the form of observations and discussion outcomes from the focus group interviews, detailed in **Section 3.6.3**. The methods of generating data and research questions the data addresses are shown in **Table 3.3**.

Table 3. 3

Data Generation Plan and Research Questions Answered

Research Question	Source of Data
1. Is there a statistically significant difference in the critical thinking skills test performance of Grade 11 learners enrolled in different academic subject streams?	Grade 11 learners enrolled in different academic subject streams (conveniently sampled for the survey phase) completed the Cornell Critical Thinking Skills Test Level X.
2. What factors are related to the possession of critical thinking skills in Grade 11 learners enrolled in different academic subject streams?	Biographical information of participants, their enrolled academic stream, and the specific type of Mathematics they are undertaking.
3. How are these factors related to the possession of critical thinking skills by Grade 11 learners enrolled in different academic subject streams?	Stratified sampled participants in each academic subject stream were interviewed based on critical thinking skills test scores, gender, and academic subject stream.
4. Why are these factors perceived to be related to possessing critical thinking skills by Grade 11 learners enrolled in different academic subject streams?	

3.6.1 Cornell Critical Thinking Skills Test Level X

An adapted version of the Cornell Critical Thinking Skills Test Level X (see **Appendix 6**) was used in this study to determine the level of critical thinking skills of Grade 11 learners enrolled in different academic subject streams. The critical thinking skills test was developed by Robert H. Ennis and Jason Millman in 1985 (Ennis et al., 2005). The test consisted of 71 multiple-choice questions and was initially aimed at students in Grades 4 to Grade 12 (age range 9 to 18) (Ennis et al., 2005). The Level X test covers the following aspects: induction, deduction, observation, evaluation, interpretations, and credibility of responses. These discernible dispositions and abilities facilitate critical thinking processes (Ennis, 2016; Facione, 2015). The test was designed so that participants were expected to take approximately fifty minutes to answer the instrument's items. The test was initially developed for learners in the United States of America. The climatic conditions of the hypothetical planet Nicoma are compared to the subtropical temperate climatic conditions of South Africa to contextualise the Cornell Critical Thinking Skills Test Level X to the participants. The North American continent has a variety of climates, but most of the

continent has a temperate climate. Individuals' names in the original test were also changed to names familiar to participants. The critical thinking skills test scores were used to answer research question one.

3.6.2 Participants Biographic Data

The biographic data of the participants was collected from the Dawnview High School student information management system on the 14th of April, 2023. The data included information such as date of birth, home language, gender, address, and academic subjects in which they were enrolled. Prior to using this confidential data, permission was formally requested from the school management team. Authorisation to use the data was granted, as evidenced in the attached **Appendix 2**. Differences in the critical thinking skills of participants based on collected biographic information were analysed in this study, and findings are presented in Chapters 4 and 5.

3.6.3 Focus Group Interviews

According to Cohen et al. (2011, p. 209), an interview can be used as a strategy for collecting data from a defined group in a study that seeks to establish a relationship between variables by answering the *"how"* and *"why"* questions. The interview data-collecting strategy is also useful when the researcher has little or no control over participant behaviour or when behaviour cannot be controlled, as is the case with participants' critical thinking skills. The main intention of a focus group interview is to collect qualitative data that will provide a thick description of factors related to participants' behaviour in the words of the participants as recorded from focus group interviews (Cohen et al., 2011). It also allows for the integration of descriptions obtained from participants on perceptions of how behaviour is developed, with findings from the quantitative phase, hence producing an in-depth understanding of factors related to the possession of behaviour, such as critical thinking skills.

The researcher interviewed a sample of nine learners to obtain responses on what they perceive to be related to their critical thinking skills using the interview schedule provided in **Appendix 8**. The interviews were conducted on the 3rd of June, 2023. The

duration of the interview was one hour and 30 minutes. The researcher transcribed all participants' responses; the transcript is provided in **Appendix 9**. A narrative summary of the collected qualitative data is provided in **Section 5.1.**

Quantitative data in the form of critical thinking test scores were combined with biographic data and interview responses collected from interviewing a group of nine participants, and this provided a deeper understanding of the factors that are related to the possession of critical thinking skills by Grade 11 learners enrolled in different academic subject streams.

3.7 Data Transformation and Analysis

The Cornell Critical Thinking Skills Test Level X manual's marking scheme (see **Appendix 7**) was used to mark the tests. The method used to record test scores was to count the number of correct answers. Participants' scores were then entered into a data analysis software, SPSS 28, along with biographic data such as gender, home language, age, area of residence, and academic group in which they are enrolled. A numeric coding method was employed for various levels of these independent variables to manage nominal data within the independent variables appropriately. The specific coding scheme elaborated in **Table 3.4** enhanced the precision of data capture and subsequent analysis. To preserve the confidentiality and anonymity of participants, each participant was assigned a random identification code number ranging from 1 to 116. Furthermore, participants were grouped into distinct academic subject streams as part of the data transformation process. The subject groupings were informed by organising learning fields and subjects in accordance with the National Policy Pertaining to the Programme and Promotion Requirements of the National Curriculum Statement described by the Department of Basic Education (2021, p. 53).

Table 3. 4

Coding Scheme for Independent Variables

Independent Variable	Level	Code
Gender	female	1
	male	2
Academic Subject Stream	Human Sciences and Social Sciences	1
	Commerce and Business	2
	Science and Technology	3
Type of Mathematics	Mathematics Core	1
	Mathematical Literacy	2
Home Language	IsiZulu	1
	SeTswana	2
	English	3
	Tshivenda	4
	SeSotho	5
	XiTsonga	6
	IsiXhosa	7
	Sepedi	8
	SiSwati	9
Area of Residence	Primrose	1
	Germiston	2
	Tembisa	3
	Vosloorus	4
	Malvern	5
	Midrand	6
	Katlehong	7
	Elandsfontein	8
	Bedfordview	9

As part of the descriptive analysis of quantitative data, various statistics were computed for the test scores of Grades 11 learners' critical thinking skills. These statistics include the mean, mode, median, standard deviation, variance, and confidence intervals. An analysis of variance test was conducted to ascertain whether there were any statistically significant variations in participants' performance on the critical thinking skills test. This investigation aimed to identify potential relationships stemming from factors like academic grouping, gender, home language, and area of residence with learners' possession of critical thinking skills. Additionally, differences in critical thinking skills test performance, attributed to the specific Mathematics type in which participants were enrolled, were examined using a *t*-test statistic. Detailed outcomes of the tests described above are presented in Chapters 4 and 5.

The qualitative phase involved the process of transforming the collected data. This was done by transcribing the responses given by participants during the interviews using

Microsoft Word. The detailed transcript can be found in **Appendix 9**. After transcription, the data was imported into NVivo (Release 1.7.1), a specialised software designed to facilitate the organisation and analysis of qualitative data.

Within NVivo, the transcribed data was organised according to the participants from whom it was gathered. Each participant's transcript was carefully read, and 40 codes were generated during this process. These codes were labels that captured specific ideas, concepts, or sentiments in the data. Through a refining process, these codes were then grouped to form eight overarching themes. These themes, which encapsulate the key concepts and patterns identified in the data, are outlined in detail in **Appendix 10**. A narrative presentation has been included in Chapter 5 to provide a coherent representation of these themes. This narrative elucidates the significance and implications of the identified themes, offering a comprehensive understanding of the qualitative data analysis conducted in the study on the factors that are perceived to be related to participants' critical thinking skills.

3.8 Validity and Reliability

3.8.1 Validity

The degree to which an instrument can accurately measure what it claims to be capable of measuring under specified standard conditions is referred to as its validity, as Cohen et al. (2018, p. 23) affirm. Content validity measures how the test items fairly and comprehensively stimulate indicators of a construct that the test claims to be able to measure (Cohen et al., 2018). An instrument with valid content allows for the collection of valid responses that aid in answering the research questions (Ennis et al., 2005). Construct validity combines evidence from an instrument's content and criterion validity (Patten & Newhart, 2018). Criterion validity measures how well a specific instrument conforms to the theoretical context in which it is used, as well as the elimination of extraneous factors that could falsify an understanding or explanation of a construct.

The main instrument in this study was the Cornell Critical Thinking Skills Test Level X (Ennis et al., 2005). The test's content consists of questions based on induction (25 items), deduction (24 items), observations (24 items), credibility (24 items), and assumptions (10

items), and these are operationalised dispositions and abilities that are indicators of critical thinking as a construct (Ennis et al., 1987; Facione, 2015). The critical thinking skills test instrument's creator, Robert H. Ennis, is a critical thinking testing expert to the point where some scholars refer to him as *"the father of critical thinking,"* and items included in the test have been extensively discussed by members of the Illinois Critical Thinking Project to improve content validity (Ennis et al., 2005, p. 21). The inclusion of items was generally agreed upon, and a detailed discussion of the answers is provided in the test manual to increase the degree of content validity with defensible answers (Ennis et al., 2005, p. 42). The rationale for the concept of critical thinking was derived from Smith (1953), who stated,

> *"Now if we set about finding out what... [a] statement means and determining whether to accept or reject it, we would be engaged in thinking which, for lack of a better term, we shall call critical thinking."*

In this study, the researcher defines critical thinking as reasonable and reflective thinking that allows one to decide what to believe or do, as Ennis et al. (2005, p. 1) argued.

Threats to validity in the qualitative phase of the proposed study were minimised by collecting data from participants in their natural classroom settings, where participants usually engage in learning purposes, and data was presented in terms of the participant's responses. A balance was established between participants' views of factors that are perceived to be related to possessing critical thinking skills and researchers' views of what critical thinking skills entail through triangulation. Data was collected using the Cornell Critical Thinking Skills Test Level X and the focus group interview. Threats to validity were also minimised by paying attention to threats to rhizomatic legitimation during the thematic coding of qualitative data from participants, and this allowed for factual accuracy and honesty in reporting. A thick description of variables also limited threats to validity. In this study, the dependent variable is the critical thinking skills of Grade 11 learners, whilst this investigation encompasses a range of independent variables, notably subject groupings, gender, participants' home language, area of residence, and the specific type of Mathematics in which participants were enrolled.

3.8.2 Reliability

The reliability of a test is the extent to which the test can be depended upon to give the same results repeatedly (Cohen et al., 2018; Ennis et al., 2005, p. 20; Mertens, 2019). The Spearman-Brown test is commonly used to assess test reliability, as noted by Ennis et al. (2005, p. 20). In this study, the Cornell Critical Thinking Skills Test scores for each participant were divided into two unequal halves, and the Spearman-Brown coefficient was calculated, yielding a coefficient value of .948 for unequal lengths. The range for correlation values for the Cornell Critical Thinking Skills Test Level X, when used in other studies, usually ranges from .67 to .90. Ennis et al. (2005, p. 20) point out hence, a value of .948 obtained in the study signifies that the test instrument can be relied upon to give the same results as the split half scores highly correlate with each other. The researcher also calculated the correlation between scores in each section with the total score and checked the reliability of the Cornell Critical Thinking Skills Test Level X using the Pearson's r and Spearman Rho tests for correlation between variables. The choice of the two statistical tests was informed by the normality of the scores for each section and the total score for the test. In determining normality, the Kolmogorov-Smirnov test was computed since there were only 116 participants, and the test is robust for small samples (Mishra et al., 2019, p. 90; Thode, 2002). Using the Kolmogorov-Smirnov test, the normality of data is assumed when $p > .05$. The results from the Kolmogorov-Smirnov. The test for normality results is presented in **Table 3.5**.

Table 3. 5

Kolmogorov-Smirnov Test for Normality for Sections of the Cornell Critical Thinking Skills Test Level X

Variable	Kolmogorov-Smirnov		
	Stat	df	p
Cornell Critical Test Total Score	0.99	116	.429
Induction Score	0.98	116	.177
Deduction Score	0.96	116	.001[a]
Observation	0.98	116	.073
Credibility Score	0.98	116	.078
Assumption Score	0.11	116	.001[a]

[a]p < .05 distribution significantly deviates from normality.

In cases where the score distribution deviated from normality (deduction score and assumption score), the correlation with the total score was computed using Spearman's rho test, a non-parametric test; otherwise, Pearson's r test is used. According to Dancey and Reidy (2017, p. 517), correlation coefficients for normal distributions are calculated using a parametric test such as Pearson's r. In contrast, correlation coefficients for non-normal distributions are calculated using a non-parametric test such as Spearman's rho test. The coefficient correlations are shown in **Table 3.6**.

Table 3. 6

Correlation Coefficients Between Total Score and Subsections of Critical Thinking Skills Test Scores

Variable		1	2	3	4	5	6
1	Cornell Critical Thinking Test Score	1	.749	.809	.790	.769*	.588*
2	Induction Score		1	.331	.569	.583*	.200*
3	Deduction Score			1	.420	.398*	.844*
4	Observation Score				1	.998*	.217*
5	Credibility score					1	.225*
6	Assumption Score						1

*Spearman's rho Test Statistic Used

According to Ennis et al. (2005, p. 18), the correlation coefficients between section score and test total score range from .55 to .71, and the correlation coefficient values in the study ranged from .59 to .79, indicating that the Cornell Critical Thinking Skills Test Level X

consistently produces comparable results for each section in relation to the total score hence internal reliability was assumed.

3.9 Conclusion

This chapter delves into an in-depth exploration of the research methodology employed within this study. The guiding philosophical framework for this research was the pragmatic paradigm, which examines the nature of reality from objective and subjective perspectives. This pragmatic worldview significantly influenced the adoption of an explanatory sequential mixed methods design. This design facilitated the acquisition of quantitative data by administering the Cornell Critical Thinking Skills Test Level X to a conveniently selected sample of 116 Grade 11 learners enrolled in different academic subject streams. In addition to the quantitative data, a subjective understanding was sought by conducting interviews with a purposively chosen group of nine participants. These interviews provided insights into the factors related to possessing critical thinking skills by participants enrolled in different academic subject streams.

Furthermore, participant biographical data was collected from the Dawnview High School student information management system with the school management's permission. This biographical information was correlated with participants' performance in the critical thinking skills test. This correlation analysis aimed to discern the perceived impact of these biographical factors on possessing critical thinking skills. Ethical considerations, specifically the protection of participants' identities, were carefully addressed in this chapter. Moreover, potential threats to the study's validity were acknowledged and discussed, while reliability tests were conducted for the research instrument. Chapters 4 and 5, the subsequent sections of the study, will present the quantitative and qualitative data collection findings, respectively.

CHAPTER 4

QUANTITATIVE RESULTS

4.1 Presentation of Quantitative Results

The primary objective of this study was to investigate and understand the differences in critical thinking skills among Grade 11 learners enrolled in different academic subject streams. Additionally, the study aimed to explore the factors that influenced the development of critical thinking skills in these learners. To accomplish the objectives of this study, the researcher conducted a comparative inferential analysis of test scores measuring critical thinking skills among learners from different academic subject streams. Furthermore, the researcher examined differences in participants' critical thinking skills test scores based on gender, Mathematics group, area of residence, and recognised spoken home language. This section provides detailed information about the participants' critical thinking skills test scores, including their biographic data, and presents the results of various statistical analyses performed on the data.

4.1.1 Participants' Biographical Data

The study had a total of 116 participants. The participants comprised 73 female (62.93%) and 43 male (37.07%) learners. The average age of all participants was 17.32 years, ranging from 16 to 21 years. Male participants' average age was slightly higher at 17.69 years compared to female participants' average age of 17.15 years. Participants were spread across three academic subject streams. The number of participants in each academic subject stream was as follows: the number of participants enrolled in the Human Sciences and Social Services academic subject stream was n = 32 (27.59%). The number of participants enrolled in the Commerce and Business academic subject stream was n = 54 (46.55%). The number of participants enrolled in the Science and Technology academic subject stream was n = 30 (28.86%). Participants were also spread across two types of Mathematics subject groups: the Core Mathematics grouping and the Mathematical Literacy grouping. The total number of participants enrolled in Grade 11 Core Mathematics was n = 38 (32.76%), while the number of participants enrolled in the Mathematical Literacy group was n = 78 (67.24%). Located in

Primrose, Dawnview High School had most of the Grade 11 learners, n = 60 (51.72%), living in Primrose. Isizulu was the participants' most used spoken home language, with n = 36 (31.03%). A summary of the distribution of participants into separate groups based on the gender of participants is provided in **Table 4.1**.

Table 4. 1

Participants Enrolled in Different Academic Subject Streams Biographic Data

	Gender			
Age	Female	Male	n	%
16	16	9	25	21.55
17	41	12	53	45.69
18	8	13	21	18.10
19	6	5	11	9.48
20	1	4	5	4.31
21	1	0	1	0.87
Mean Age	17.15	17.60	17.32	
Academic Subject Stream	Female	Male	n	%
Commerce and Business	32	22	54	46.55
Science and Technology	21	9	30	25.86
Human Sciences and Social Services	20	12	32	27.59
Mathematics Group	Female	Male	n	%
Core Mathematics	27	11	38	32.76
Mathematical literacy	46	32	78	67.24
Area of Residence	Female	Male	n	%
Primrose	31	29	60	51.72
Germiston	18	3	21	18.10
Tembisa	2	3	5	4.31
Vosloorus	5	0	5	4.31
Malvern	3	3	6	5.17
Midrand	1	0	1	0.86
Elandsfontein	3	2	5	4.31
Katlehong	10	2	12	10.36
Bedfordview	0	1	1	0.86
Home language	Female	Male	n	%
Isizulu	26	10	36	31.03
SeTswana	4	4	8	6.90
English	6	2	8	6.90
TshiVenda	4	4	8	6.90
SeSotho	9	11	20	17.24
XiTsonga	1	1	2	1.72
SePedi	13	4	17	14.66
IsiXhosa	10	6	16	13.79
SiSwati	0	1	1	0.86

4.1.2 Comparative Analysis of Critical Thinking Skills Test Scores Between Learners in Different Academic Subject Streams

The study utilised the Cornell Critical Thinking Skills Test Level X to measure participants' performance by counting the number of correct answers. The test consisted of 71 items, and **Table 4.2** presents an overview of participants' scores categorised by gender and academic subject stream.

Table 4. 2

Descriptive Statistics of Critical Thinking Skills Test Scores Based on Gender and Academic Subject Stream

Dependent Variable: Critical Thinking Skills Test Scores				
Gender	Academic Subject Stream	Mean	Std. Deviation	n
female	Human Sciences and Social Services	24.8	7.9	20
	Commerce and Business	30.0	9.0	32
	Science and Technology	37.5	7.0	21
	Total	30.8	9.4	73
male	Human Sciences and Social Services	31.0	8.3	12
	Commerce and Business	27.6	9.2	22
	Science and Technology	36.8	7.9	9
	Total	30.5	9.2	43
combined	Human Sciences and Social Services	27.1	8.5	32
	Commerce and Business	29.0	9.1	54
	Science and Technology	37.3	7.1	30
	Total	30.7	9.3	116

Figure 4.1 illustrates the differences in mean scores among participants, categorised by gender and the academic subject stream in which they are enrolled. Notably, the difference in critical thinking skills test scores based on gender is particularly pronounced among participants enrolled in the Human Sciences and Social Services academic stream, compared to those in other academic subject streams. Considering all the study participants (N = 116), the mean score in the Cornell Critical Thinking Skills Test Level X was 30.7, with a standard deviation of 9.3. Among the female participants, n = 73 (63%), the average score on the test was 30.8, with a standard deviation of 9.4. For male participants, n = 43 (37%), the average score was slightly lower at 30.5, with a standard deviation = 9.2. Notably, female participants (n = 21) in the Science and Technology academic stream achieved the highest mean score of

37.5 with a standard deviation of 7.0, the highest among all the groups. Conversely, the lowest mean score was observed among female participants, n = 20, in the Human Sciences and Social Services academic stream, with a mean score of 24.8 and a standard deviation of 7.9.

Figure 4. 1

Estimated Marginal Means of Critical Thinking Skills Test Scores Based on Gender and Academic Subject Stream

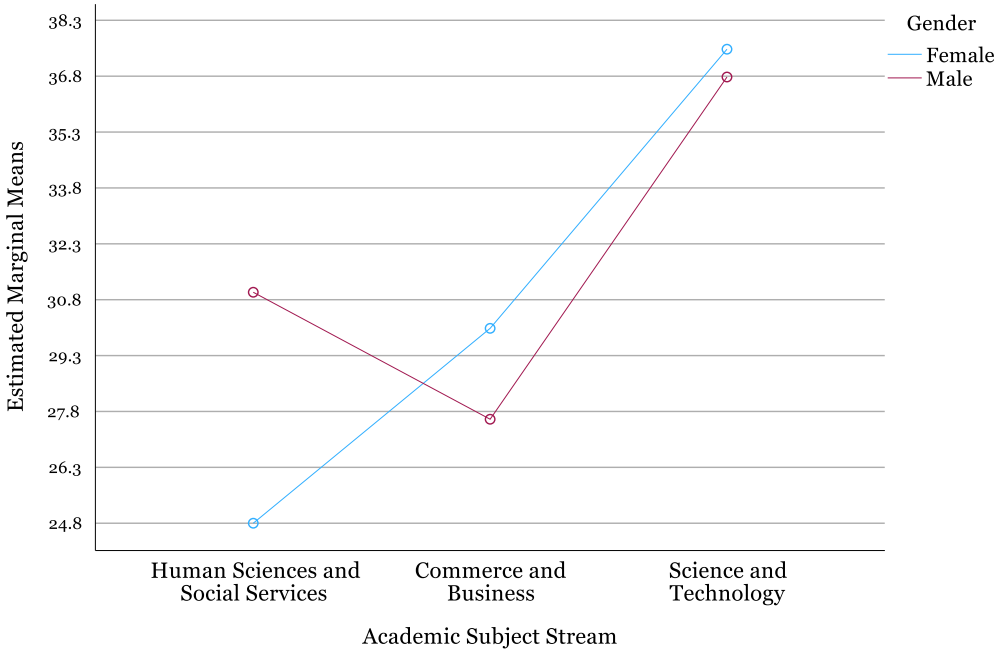


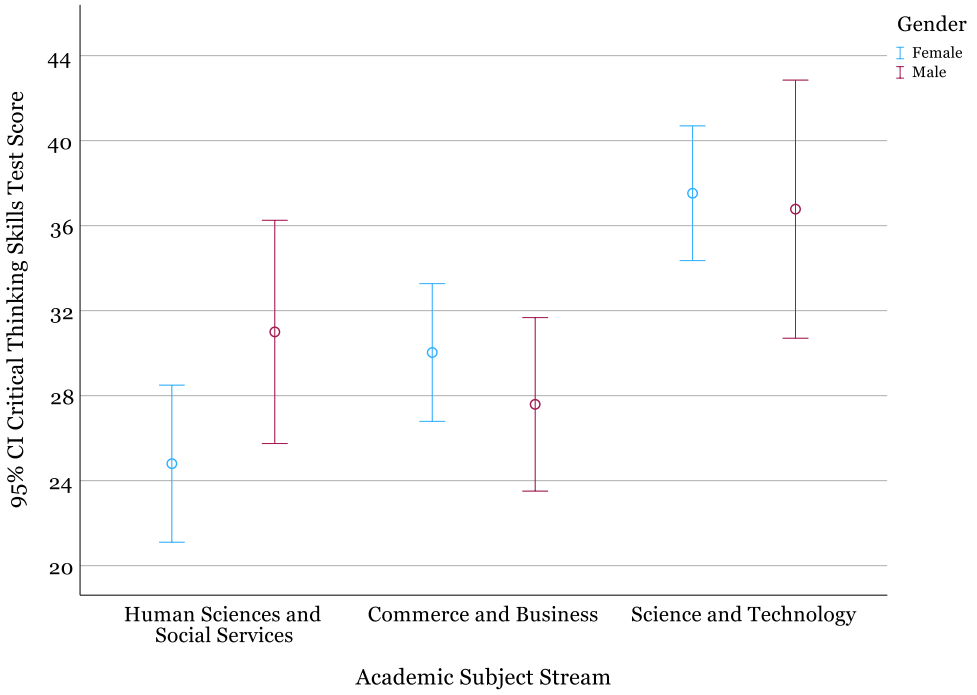
Figure 4.2 visually illustrates error bars representing the study participants' critical thinking skills test scores. These error bars were instrumental in portraying the 95% confidence intervals used to estimate the range of critical thinking skills test scores for Grade 11 learners. These confidence intervals facilitated the establishment of a range within which the population mean score for this test, based on data gathered from a sample of Grade 11 learners, could be reasonably estimated, as noted by Dancey and Reidy (2017, p. 111). Specifically, this study's 95% confidence interval extended from a lower bound score of 24.1 to an upper bound score of 30.2.

Upon closer examination of the confidence intervals concerning differences in critical thinking skills test scores between male and female participants, it was evident that there was

a significant overlap between these intervals. This overlapping led to the conclusion that no statistically significant differences existed in the mean scores between the two genders. This conclusion was further reinforced by the results of an analysis of variance, which will be elaborated upon in greater detail in the subsequent sections.

Figure 4. 2

Error Bars for Critical Thinking Skills Test Scores Based on Participants' Gender and Academic Stream

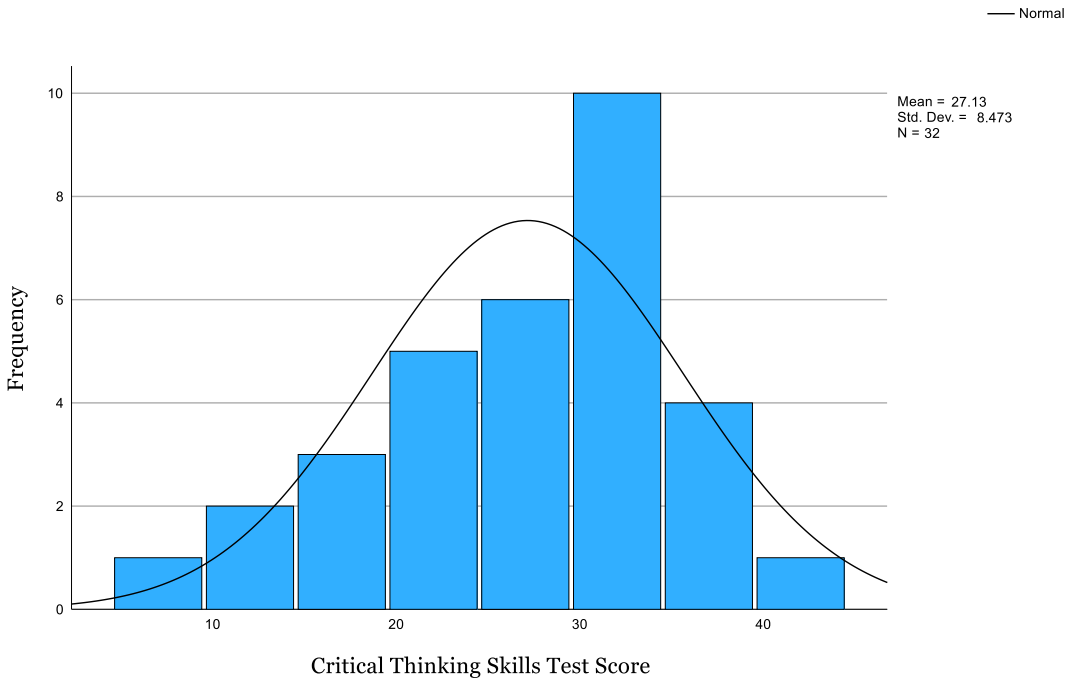


However, when considering the confidence intervals for participants belonging to the Science and Technology academic subject stream compared to the confidence intervals of the other two subject streams, a notable lack of substantial overlap of error bars was apparent. This disparity in the overlap of error bars was interpreted as indicative of actual differences in mean scores among participants based on their academic subject streams. This interpretation was further corroborated by the outcomes of an analysis of variance, which will be discussed in greater detail in this section. The interpretations concerning the presence or absence of overlap in error bars are guided by recommendations outlined by Dancey and Reidy (2017, pp. 122-123) regarding their significance.

The median critical thinking skills test score for Human Sciences and Social Service learners was 29.0. The collected scores varied from seven to 42.0. The most common score among participants in the Human Sciences and Social Service academic subject stream was 32.0. The distribution of critical thinking skills test scores for participants enrolled in the Human Sciences and Social Service subjects' stream is illustrated in **Figure 4.3**.

Figure 4. 3

Critical Thinking Skills Test Score Distribution for Human Sciences and Social Services Learners



Statistical analysis of these scores revealed a negative skewness with a value of -0.63 and a standard error of 0.41. According to Dancey and Reidy (2017, p. 83), skewness levels nearing 1 or -1 indicate a deviation from normalcy, meaning that typical inferential analytic procedures should be avoided.

Table 4.3 presents the *p*-values obtained from the Kolmogorov-Smirnov and Shapiro-Wilk tests for normality based on gender and academic subject stream. Before computing inferential statistical analyses, the normality of critical thinking skills test scores for learners enrolled in various academic subject streams and gender groups was determined. The Shapiro-Wilk test, widely used for its robustness and application to sample

sizes less than 50, and the Kolmogorov-Smirnov test for normality for sample sizes more than 50 were used in this study to test for normality (Mishra et al., 2019, p. 70; Thode, 2002). For the Shapiro-Wilk and Kolmogorov-Smirnov tests, the null hypothesis asserts that the data is drawn from a normally distributed sample of scores. The null hypothesis is accepted when the *p*-value is greater than .05, indicating that the data is normally distributed.

Table 4. 3

Test for Normality for Critical Thinking Skills Test Scores Based on Gender and Academic Subject Stream

Dependent Variable: Critical Thinking Skills Test Scores						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
Gender	Statistic	df	Sig.	Statistic	df	Sig.
Female	0.08	73	**.200***	0.98	73	**.304**
Male	0.09	43	**.200***	0.98	43	**.725**
Academic Subject Grouping	Statistic	df	Sig.	Statistic	df	Sig.
Human Sciences and Social Services	0.15	32	**.064**	0.95	32	**.187**
Commerce and Business	0.08	54	**.200***	0.99	54	**.819**
Science and Technology	0.09	30	**.200***	0.96	30	**.401**

*. This is the lower bound of true significance.
a. Lilliefors Significance Correction

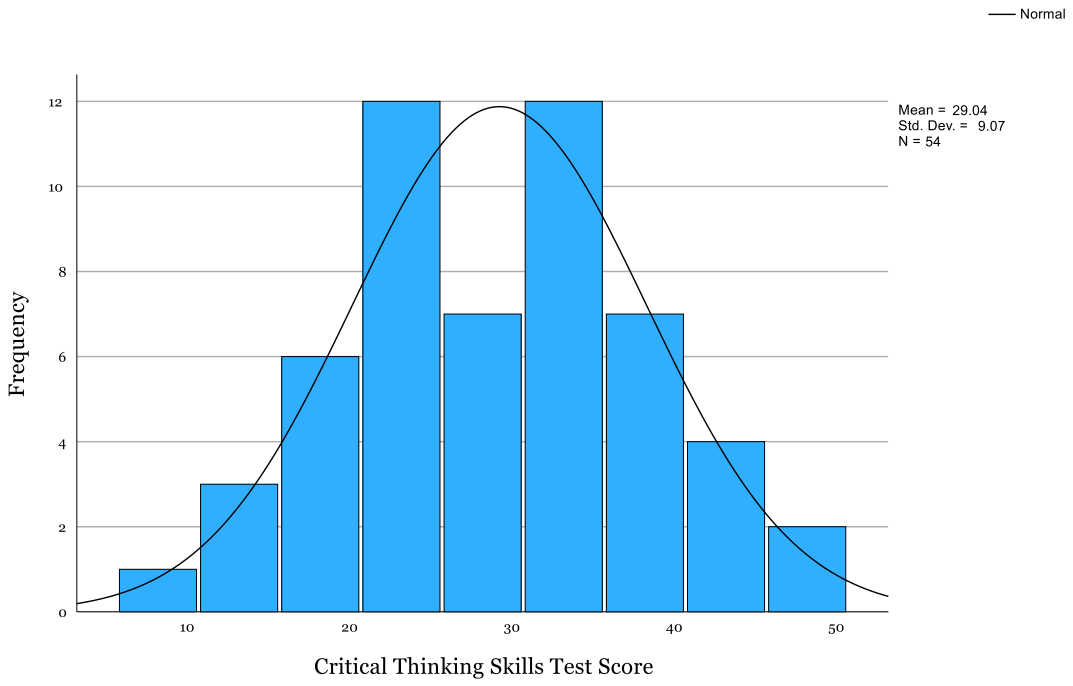
The critical thinking skills test scores for Human Sciences and Social Services academic subject stream participants were normally distributed. This conclusion was reached using the Shapiro-Wilk normality test, which provided a *p*-value of .187 ($p > .05$). The kurtosis value of -0.02, with a standard error of 0.81, demonstrated that the scores had a platykurtic distribution. Dancey and Reidy (2017) highlight that this suggests a few extreme values, leading to a potentially flatter peak around the mean.

In the context of the learners enrolled in the Commerce and Business subject stream, the median score on the critical thinking skills test was 29.0. With a 95% confidence interval for the mean, the lower bound for the confidence interval was 26.6, and the upper bound was 31.5. The critical thinking skills test scores ranged from a minimum of eight to a maximum of 48.0. The distribution of scores for these participants in the Commerce and Business

academic subject stream shows positive skewness, indicated by a skewness value of 0.09 with a standard error of 0.33. The score distribution provided in **Figure 4.4** also displays bimodal tendencies, with a score of 23.0 and a score of 33.0, having a frequency of 12. The distribution follows a normal distribution, as suggested by the Kolmogorov-Smirnov test of normality for more than 50 learners (n = 54), yielding a p-value of .200 (p >.05). The kurtosis value of -0.41 points to platykurtic characteristics, showing a flatter distribution of scores around the mean score rather than a more peaked distribution.

Figure 4. 4

Critical Thinking Skills Test Score Distribution for Commerce and Business Learners

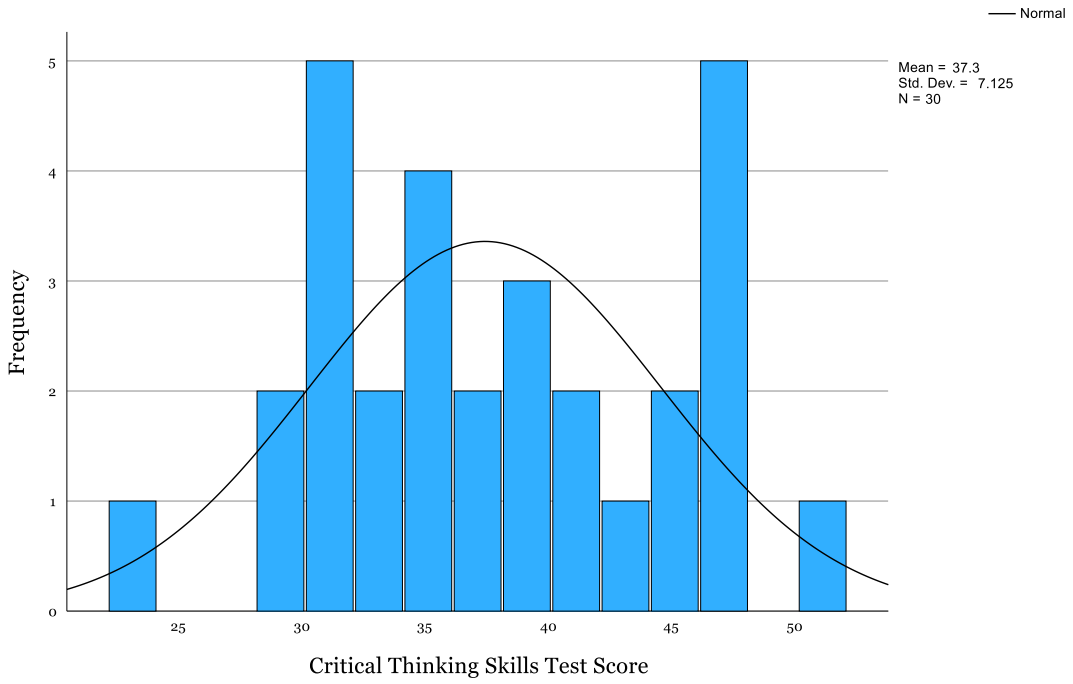


Participants enrolled in the Science and Technology academic stream achieved scores ranging from a minimum of 23.0 to the largest score of 53.0, with a median score of 36.5. Notably, the score distribution was bimodal and exhibited two peaks at 31.0 and 47.0 with a frequency of four. With a 95% confidence interval for the mean, the critical thinking skills test scores were estimated to have a lower bound score of 34.6 and an upper bound of 40.0. **Figure 4.5** illustrates the score distribution of Science and Technology learners, and it follows a positively skewed pattern, evident by a skewness value of 0.14 with a standard error of 0.43. Furthermore, the distribution displayed a platykurtic shape with a kurtosis value of -

0.84 and a standard error of 0.83. Employing the Shapiro-Wilk test, the normality test revealed that the participants' scores in the Science and Technology stream (n = 30) adhered to a normal distribution, supported by a p-value of .401 (p > .05).

Figure 4. 5

Critical Thinking Skills Test Score Distribution for Science and Technology Learners



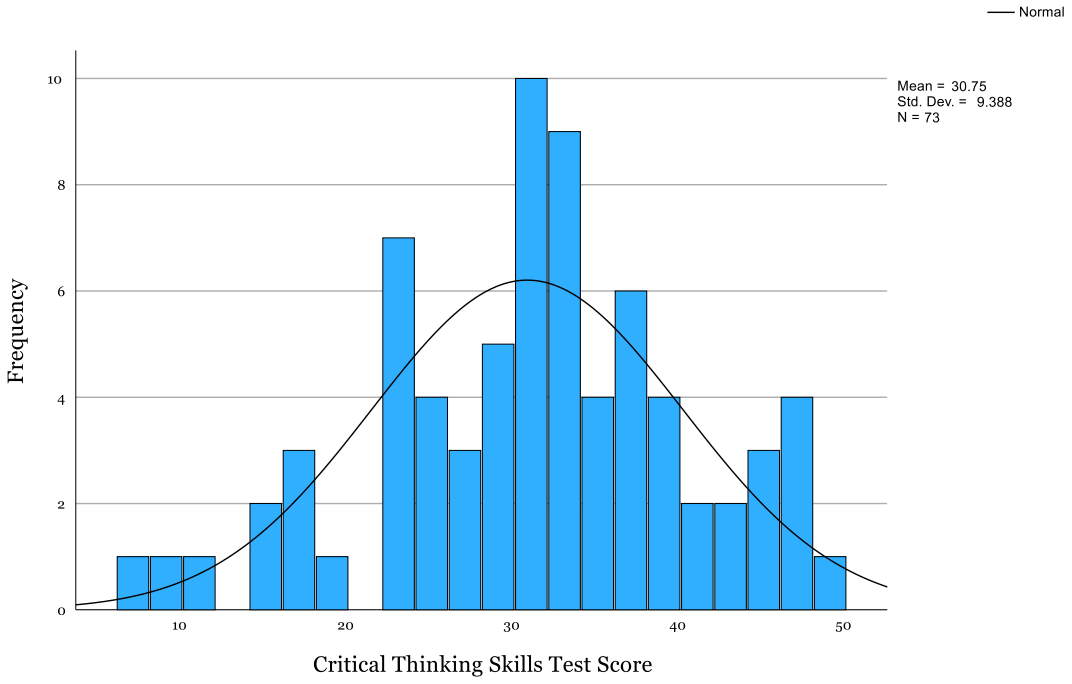
In the analysis of critical thinking skills test scores for Grade 11 female participants, the recorded scores ranged from a minimum of seven to a maximum of 49.0. The median score for the female participants was found to be 31.0. The mean score was 30.8, while the standard deviation was 9.4. While examining the mean score at a 95% confidence interval, the lower bound was established at 28.6 and the upper bound at 32.9. The modal score for female participants was 31.0, and ten female participants obtained it.

The distribution of critical thinking skills test scores among the Grade 11 female participants displayed a negative skewness, denoted by a skewness value of -0.32 and a standard error of 0.28. This negative skewness implies that the tail of the distribution extended towards the lower scores. Moreover, the critical thinking skills test scores of the female participants (n = 73) showed a normal distribution, substantiated by the results of the Kolmogorov-Smirnov normality test, which yielded a p-value of .200 (p >.05). The visual

representation of the score distribution for the female participants is illustrated in **Figure 4.6**. Furthermore, the kurtosis value was computed at -0.01 with a standard error of 0.56, signifying a platykurtic distribution. This type of distribution shows that the tails are less extreme than a normal distribution.

Figure 4. 6

Critical Thinking Skills Test Score Distribution for Female Learners

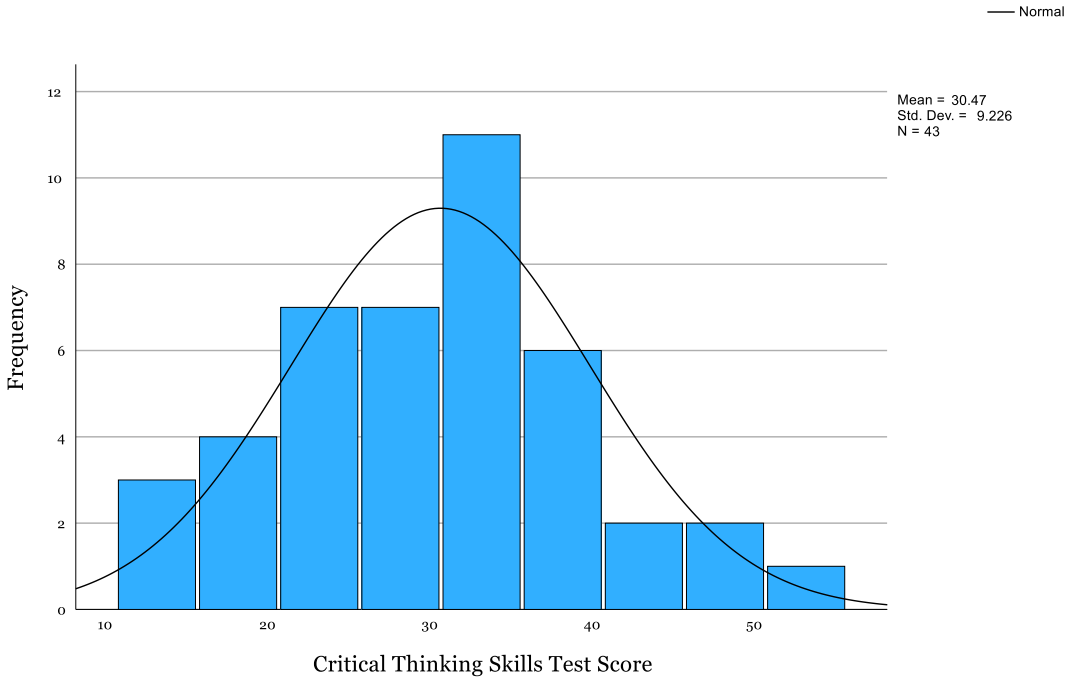


The mean score of the Grade 11 male participants enrolled in different academic subject streams was 30.5, with a standard deviation of 9.2. Among these participants, the median score was 31.0, while the mode score in the critical thinking skills test was 33.0, occurring with a frequency of 11 participants. Analysing the mean score using a 95% confidence interval resulted in a range between 27.63 and 33.30 for the confidence interval.

Scores of these male participants ranged from a low score of 13.00 to the highest score of 53.00. Male learners' scores followed a normal distribution, supported by a p-value of .725 (p >.05) from the Shapiro-Wilk test for normality. **Figure 4.7** illustrates the distribution of male participant scores, depicting a platykurtic distribution characterised by a kurtosis of -0.44 and a standard error of 0.71. Furthermore, these scores displayed positive skewness, indicated by a skewness value of 0.12 with a standard error of 0.36.

Figure 4. 7

Critical Thinking Skills Test Score Distribution for Male Learners



To determine if there were significant differences in the performance of Grade 11 learners in different academic subject streams and genders on the critical thinking skills test, a factorial 3×2 ANOVA test was conducted. The factorial 3×2 ANOVA is a parametric test used to examine the effect of multiple predictor variables on a single outcome variable (Dancey & Reidy, 2017, p. 333). This test allowed for investigating the effects of academic subject stream and gender on critical thinking test scores and the interaction between gender and academic subject stream in influencing test performance.

In the ANOVA test, a *p*-value greater than .05 suggests no statistically significant differences in the mean scores among the compared groups. Conversely, if the *p*-value is smaller than .05, it indicates statistically significant differences in the mean scores between the groups under investigation (Dancey & Reidy, 2017). The results of the ANOVA on participants' critical thinking skills test scores are presented in **Table 4.4**.

Table 4. 4

ANOVA Results for Determining Differences in Participant Critical Thinking Skills Test Scores Due to Gender and Academic Subject Stream

Dependent Variable: Critical Thinking Skills Test Scores							
Source	Sum of Squares	df	Mean Square	F	Sig.	Partial η^2	Power
Gender	24.6	1	24.6	0.35	.554	.003	.09
Academic Subject Stream	1466.20	2	733.1	10.49	**.000**	**.160**	.99
Gender * Academic Subject Stream	365.73	2	182.9	2.62	.078	.045	.51

a. R Squared = .225 (Adjusted R Squared = .19)
b. Computed using alpha = .05

The factorial 3×2 ANOVA revealed statistically significant differences in mean scores among learners enrolled in different academic subject streams in the Cornell Critical Thinking Skills Test Level X, with F (2,110) = 10.49; p = .001 (p < .05). However, the effect size was small, with a partial η^2 of .16. This indicates that 16% of the variation in critical thinking skills test scores can be attributed to the enrolment of participants in different academic subject streams. In contrast, the influence of gender on participants' scores in a critical thinking skills test did not show statistically significant results F (1,114) = 0.35; p = .554, p > .05).

However, when the estimated mean difference plots in **Figure 4.1** are examined, a notable disparity emerges in the scores for critical thinking skills between male and female participants enrolled in the Human Sciences and Social Services subject stream, revealing a substantial mean difference of 6.2. Furthermore, the interaction between gender and academic subject stream did not have a statistically significant effect on participants' critical thinking skills test scores in this study, with F (2,110) = 2.62; p = .078 (p > .05).

A post hoc test was conducted to determine the specific locations of differences in critical thinking skills among participants based on the academic subject stream. According to Mertens (2014, p. 498), the purpose of a post hoc test after conducting an ANOVA is to identify the significance of differences and pinpoint where those differences exist. This study used the Tukey honest significant difference (HSD) post hoc test. This test is commonly

employed when conducting an extensive comparison and is considered conservative in reducing the risk of Type I errors (Cohen et al., 2018, p. 783; Dancey & Reidy, 2017, p. 309). The Tukey test assumes equal variances in scores among the groups being compared (Cohen et al., 2018, p. 783). Levene's test for equality was used to determine the homogeneity of variance in the critical thinking skills test scores. Homogeneity of variance is assumed when the *p*-value is greater than .05, as the test's null hypothesis states that data homogeneity is assumed (Dancey & Reidy, 2017, p. 203).In this study, the assumption of homogeneity of variance for the critical thinking skills test scores was assumed, as the *p*-value obtained from Levene's test was .82 ($p > .05$), with a Levene statistic of 0.44. The results of the Tukey post hoc test are presented in **Table 4.5**.

Table 4. 5

Tukey Post hoc Test Results

Dependent Variable: Critical Thinking Skills Test Score							
	(I) Academic Subject Stream	(J) Academic Subject Stream	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Tukey HSD	Human Sciences and Social Services	Commerce and Business	1.9	1.87	.563	-2.52	6.34
		Science and Technology	10.2*	2.13	**.000**	5.13	15.22
	Commerce and Business	Human Sciences and Social Services	1.9	1.87	.563	-2.52	6.34
		Science and Technology	8.3*	1.90	**.000**	3.74	12.79
	Science and Technology	Human Sciences and Social Services	10.2*	2.13	**.000**	5.13	15.22
		Commerce and Business	8.3*	1.90	**.000**	3.74	12.79

Based on observed means.
The error term is Mean Square (Error) = 69.89.
*. The mean difference is significant at the .05 level.

The Tukey post hoc test confirmed a statistically significant difference in critical thinking skills test scores between learners in the Science and Technology and Commerce and Business subjects. The *p*-value was .001 ($p < .05$), indicating a significant difference in mean critical thinking skills of 8.3 with a standard error of 1.90. The effect size (*d*) was also

large, with a value of 1.02. According to Dancey and Reidy (2017, p. 221), following the guidelines of Cohen (1988), an effect size (*d*) greater than or equal to 0.8 is considered a large effect size. The Tukey post hoc test also indicated a statistically significant difference in the critical thinking skills test scores between learners enrolled in the Science and Technology and Human Sciences and Social Services academic subject streams. The *p*-value obtained was .001 ($p > .05$), signifying a significant difference in mean critical thinking skills scores of 10.2 with a standard error of 2.13, and the effect size (*d*) was large, with a value of 1.30.

However, no statistically significant differences were found between the Commerce and Business academic and Human Sciences and Social Services academic subjects. The Tukey post hoc test revealed a *p*-value of .563 ($p > .05$), indicating no significant difference between these two groups. Specifically, participants in the Science and Technology stream (Mean Score = 37.3, *SD* = 7.1) performed better than those in the Commerce and Business stream (Mean Score = 29.0, *SD* = 9.1) and the Human Sciences and Social Services stream (Mean Score = 27.1, *SD* = 8.5).

4.1.3 Comparative Analysis of Critical Thinking Skills Test Scores Based on Participants' Recognised Spoken Home Language.

In this study, the participants were categorised into five groups depending on the language spoken at their homes. Within South Africa, there are a total of 11 official spoken languages. These languages, excluding English and Afrikaans, are divided into four main groups: Nguni languages, Sotho languages, Venda, and Tsonga languages, as explained in **Section 2.7** of the study. The distribution of participants among these language groups is as follows: Nguni languages *n*=53 (45.69%), Sotho languages *n*=45 (38.79%), Tsonga Language *n*=2 (1.72%), Venda language *n*=8 (6.90%), and English language *n*=8 (6.90%). The highest score on the critical thinking skills test was by a learner who spoke the Sotho language, with a score of 53.0.

On the other hand, the lowest score of 7.0 was recorded from a learner who spoke a Nguni language. The learners' critical thinking skills test scores, categorised based on their

recognised spoken home language, can be found in **Table 4.6**. Estimated marginal mean plots showing differences in participants' critical thinking skills test scores based on gender and participants' recognised spoken home language are presented in **Figure 4.8**.

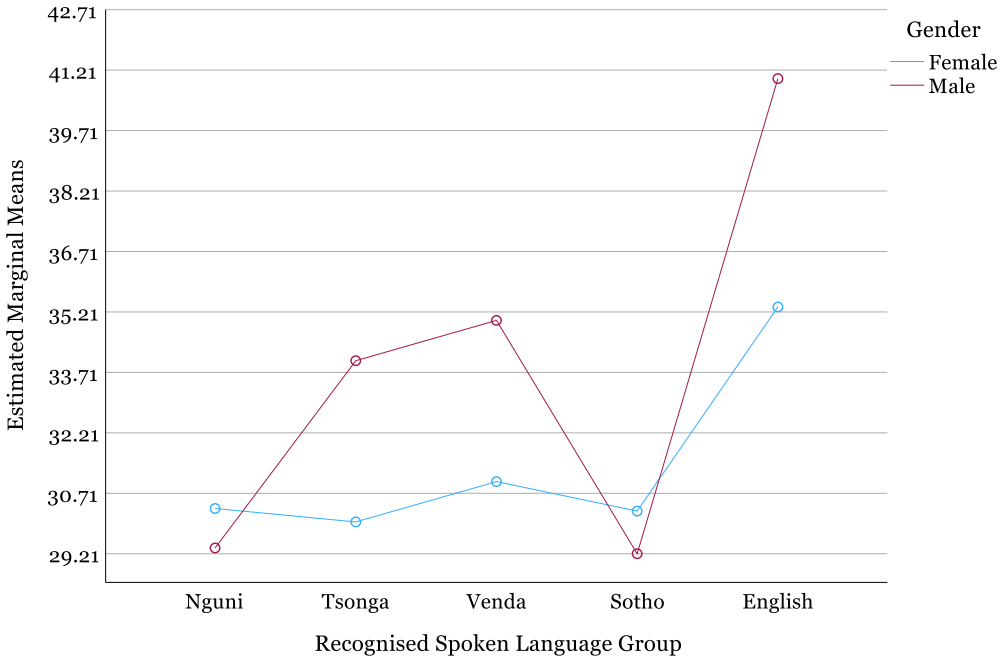
Table 4. 6

Scores on the Critical Thinking Skills Test Categorised by Participants' Spoken Home Language Group

Recognised Spoken Home Language Group	Mean Score	*SD*	*n*
Nguni	30.0	9.3	53
Sotho	29.8	9.3	43
Tsonga	32.0	2.8	2
Venda	33.0	8.4	8
English	36.8	5.8	8

Figure 4. 8

Estimated Marginal Means of Critical Thinking Skills Test Scores Based on Gender and Participants Spoken Home Language



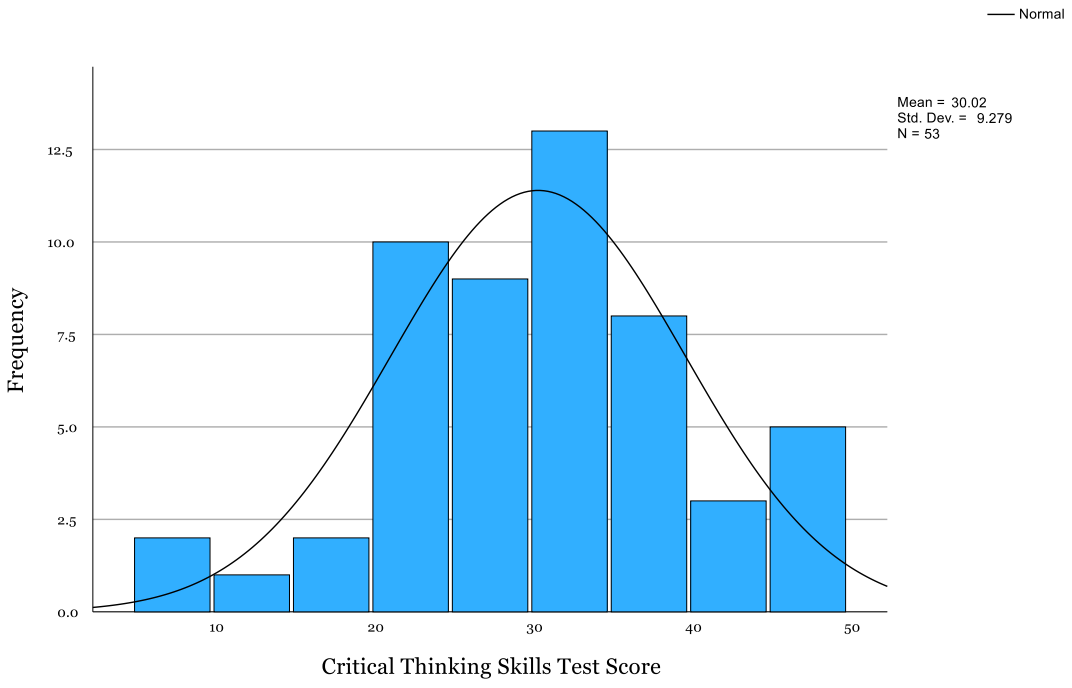
Among the participants, those who employed English as their primary spoken language at home exhibited the highest average score of 36.8, with a standard deviation =

5.8. In contrast, the lowest average score of 29.8 with a standard deviation of 9.9 was registered among individuals who communicated using Sotho languages.

Regarding Nguni language speakers, the test's highest recorded score was 47.0. Employing the Kolmogorov-Smirnov test to assess normality, it was observed that the scores of participants using Nguni languages were distributed normally, with a *p*-value of .200 ($p > .05$). Notably, these scores displayed a negative skewness, evident through a skewness value of -0.22 with a standard error of 0.33. The distribution of scores is visually depicted in **Figure 4.9**. The median score for Nguni language-speaking participants was 30.0, and the frequent score obtained by these participants was 32.0.

Figure 4. 9

Distribution of Critical Thinking Skills Test Scores for learners in the Spoken Home Language Grouping of Nguni languages

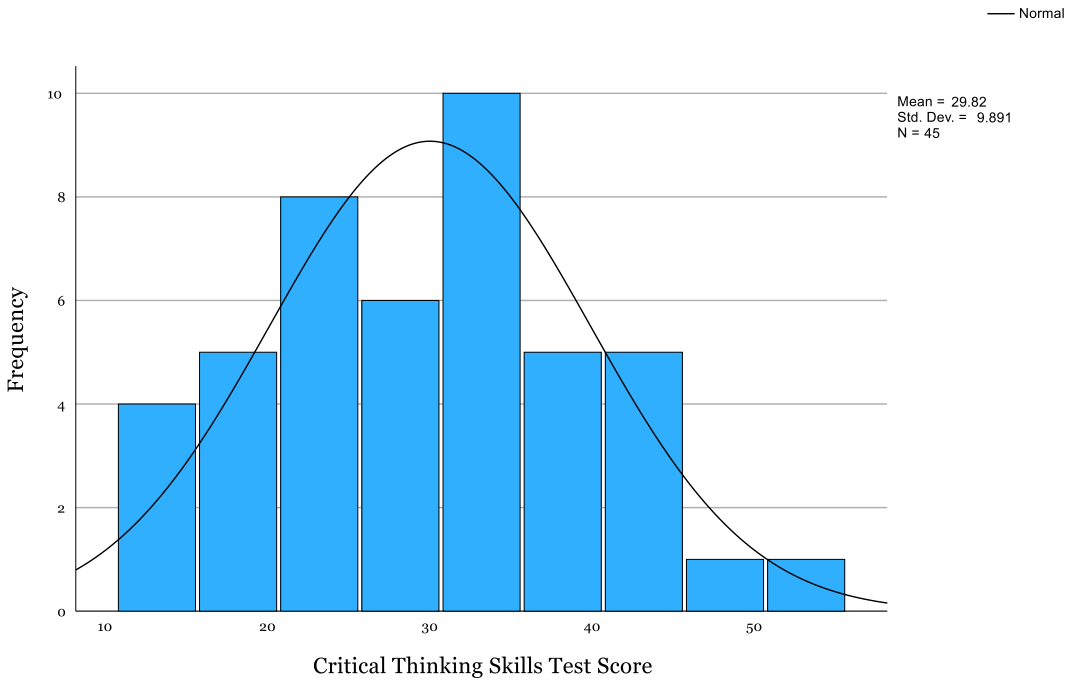


A learner using Sotho languages achieved the highest score of 53.0, and the lowest score of 13.0 on the Critical Thinking Skills Test was recorded for the Sotho-speaking learners. Applying the Shapiro-Wilk test to evaluate normality, the scores displayed a normal distribution, as supported by a *p*-value of .428 ($p > .05$). The distribution of test scores among these individuals who spoke Sotho exhibited positive skewness, evidenced by a

skewness value of 0.20 and a standard error of 0.35. The median score for these learners was calculated to be 30.0, with the most frequently attained score by Sotho-speaking participants also being 30.0. A visual representation of the score distribution in the Critical Thinking Skills Test for learners who used Sotho languages as their home language is depicted in **Figure 4.10**.

Figure 4. 10

Distribution of Critical Thinking Skills Test Scores for learners in the Spoken Home Language Grouping of Sotho languages



After conducting an ANOVA test to investigate whether the home language spoken by participants significantly influenced their scores in a critical thinking skills test, the results indicated that the participants' home language did not exert a statistically significant influence on their critical thinking skills test scores. This conclusion is supported by the obtained statistics: F (4,106) = 1.27; p = .288 (p > .05).

4.1.4 Comparative Analysis of Critical Thinking Skills Test Scores Between Learners Enrolled in Different Mathematics Groups

The descriptive distribution of participants' scores based on the type of Mathematics they were enrolled in can be found in **Table 4.7**. This section presents data on the

differences in learners' critical thinking skills test scores based on gender and the type of Mathematics they were enrolled in. The participants were spread into two groups: the Core Mathematics group, consisting of *n*=38 (32.76%) participants, and the Mathematical Literacy group, composed of *n*=78 (67.24%) participants. The participants enrolled in Core Mathematics achieved a mean score of 37.6 on the Cornell Critical Thinking Skills Test Level X, with a standard deviation of 7.3. In contrast, those enrolled in Mathematical Literacy scored a mean score of 27.0, with a standard deviation of 8.2.

Male participants in the Core Mathematics group (*n*=11) had the highest mean score in the critical thinking skills test of 38.0, with a standard deviation = 7.7. On the other hand, female participants enrolled in the Mathematical Literacy group (*n*=46) obtained the lowest mean score of 26.8, with a standard deviation of 8.6. In summary, male participants in Core Mathematics had the highest mean score, while female participants in the Mathematical Literacy group had the lowest mean score.

Table 4. 7

Descriptive Statistics of Critical Thinking Skills Test Scores Based on Core Mathematics and Mathematical Literacy

Dependent Variable: Critical Thinking Skills Test Scores				
Gender		Mean	Std. Deviation	*n*
female	Core Mathematics	37.5	7.2	27
	Mathematical Literacy	26.8	8.2	46
	Total	30.8	9.4	73
male	Core Mathematics	38.0	7.7	11
	Mathematical Literacy	27.9	8.3	32
	Total	30.5	9.2	43
combined	Core Mathematics	37.6	7.3	38
	Mathematical Literacy	27.2	8.2	78
	Total	30.7	9.3	116

The estimated marginal means of test scores from the Critical Thinking Skills Test, categorised by the participants' enrolled Mathematics type, indicate that both male and female participants who were enrolled in core Mathematics exhibited notably higher mean scores than participants enrolled in Mathematical Literacy. This contrast in the critical

thinking skills test mean scores is visually represented in **Figure 4.11**, and the error plots in **Figure 4.12**.

Figure 4. 11

Estimated Marginal Means of Critical Thinking Skills Test Scores Based on Type of Mathematics Participants Were Enrolled

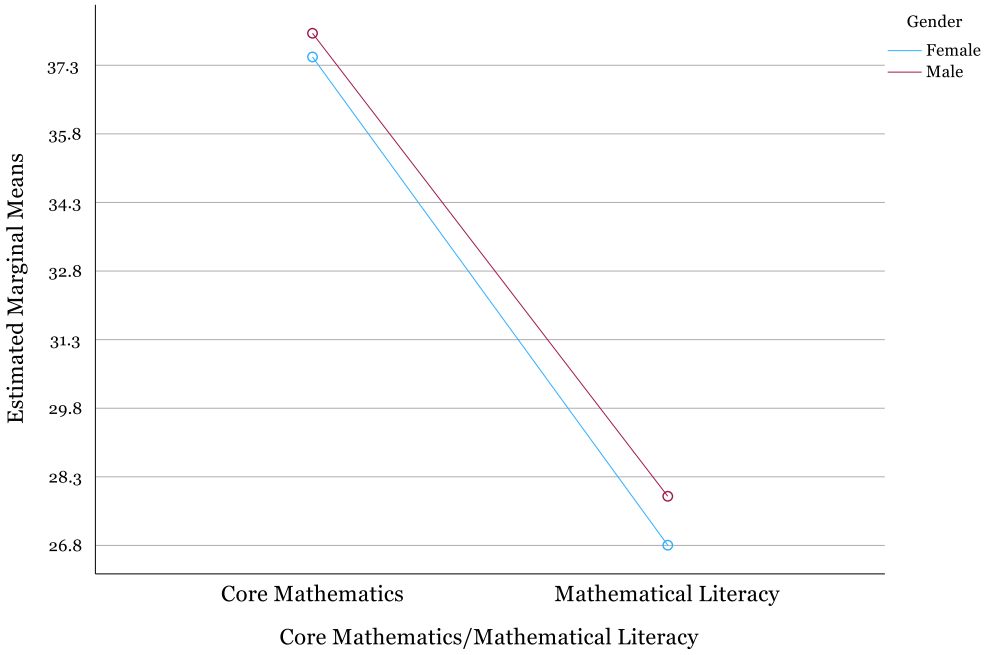
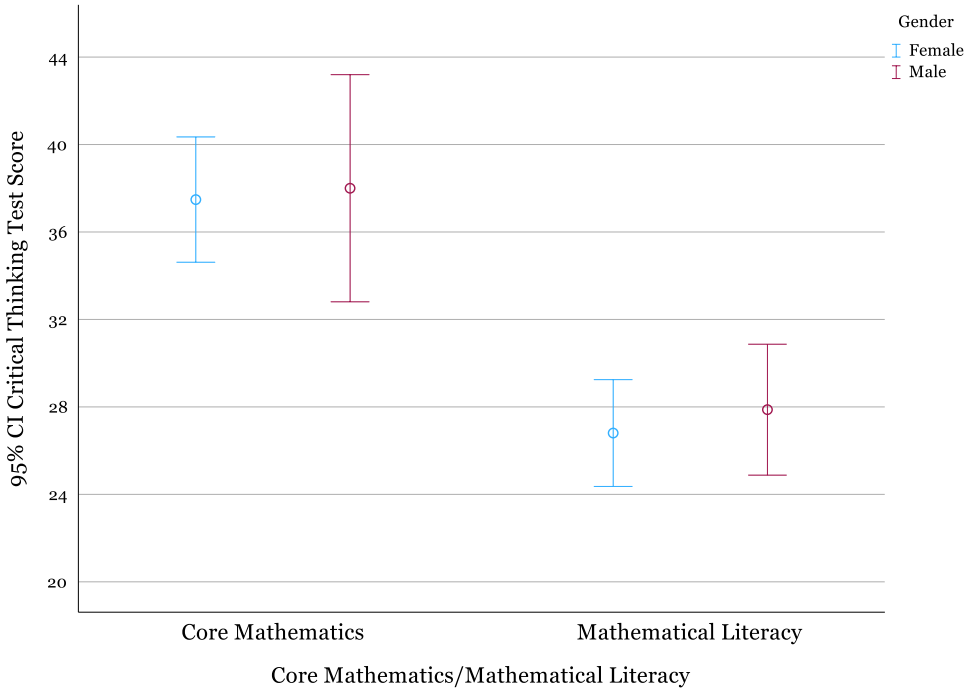


Figure 4.12 reveals no significant overlapping of confidence intervals for learners enrolled in Core Mathematics and those enrolled in Mathematical Literacy. This indicates significant differences in the mean scores for the critical thinking skills test. However, the confidence intervals of learners based on gender in their Mathematics grouping significantly overlap, suggesting that there are no significant differences in mean scores based on gender for participants in a Mathematics-type group.

Figure 4. 12

Error Plots for Critical Thinking Skills Test Scores Based on Participants Gender and Type of Mathematics



The distribution of critical thinking skills test scores for Grade 11 learners enrolled in Core Mathematics is presented in **Figure 4.13**. The modal score was 47.0, with a frequency of six. The lowest score for participants enrolled in Core Mathematics was 23.0, the highest was 53.0, and the median was 37.5. The participants enrolled in Core Mathematics critical thinking skills test scores were also positively skewed, with a skewness value of 0.01 and a standard error of 0.38. The distribution was also platykurtic with a kurtosis value of -0.95 with a standard error of 0.75. The distribution of scores for the 38 learners enrolled in the Core Mathematics group was a normal distribution, as indicated by a p-value of .315 (p> .05) obtained from the Shapiro-Wilk test of normality.

Figure 4. 13

Core Mathematics Learners Critical Thinking Skills Test Score Distribution

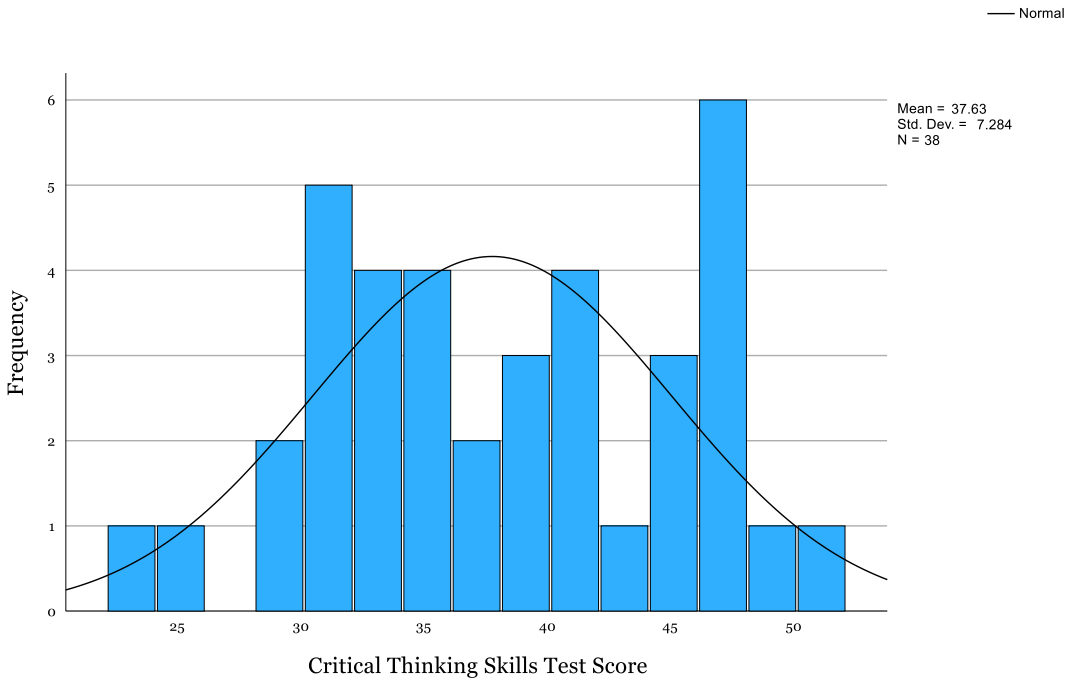
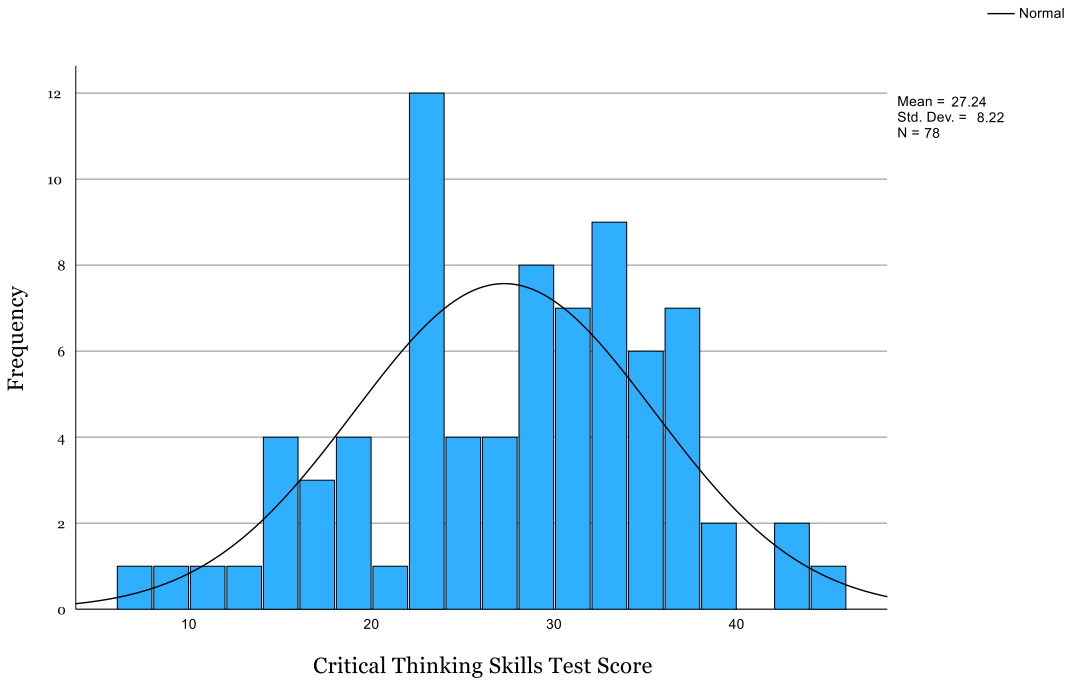


Figure 4.14 is a distribution of scores of participants enrolled in the Mathematical Literacy group. A Kolmogorov-Smirnov test for normality was conducted to assess the distribution of critical thinking scores among participants enrolled in Mathematical literacy. The normality for scores test indicated that the critical thinking skills test scores for the Mathematical Literacy group were normally distributed with a *p*-value = .064 ($p > .05$). The median score for Mathematical Literacy learners was 29.0, ranging from seven to a high score of 45.0. Mathematical Literacy learners had a modal score of 23.0 with a frequency of 12. The scores were negatively skewed, with a skewness value of -0.30 and a standard error of 0.27. When considering the mean score of 27.2 with a standard deviation of 8.2, a confidence interval of 95% was determined. The lower bound of 25.4 and upper bound of 29.1 was revealed for this confidence interval. A platykurtic distribution was also realised for these scores, with a kurtosis value of -0.30 and a standard error of 0.54.

Figure 4. 14

Mathematical Literacy Learners Critical Thinking Skills Test Score Distribution



A *t-test* was performed to determine if there was a statistically significant difference in critical thinking skills between participants enrolled in Core Mathematics and Mathematical Literacy. Before conducting the *t*-test, Levene's test for homogeneity of variance was conducted, which indicated that the critical thinking test scores between the two groups assumed homogeneity of variance ($p = .483$, $p > .05$).

The *t*-test results revealed a statistically significant difference in critical thinking skills test scores between participants enrolled in Core Mathematics and Mathematical literacy, with the following values: $t\ (114) = 6.62$; $p = .001$ ($p < .05$), and Cohen's *d* effect size of 1.31. This confirms that the Core Mathematics group participants outperformed those in the Mathematical Literacy group in the Cornell Critical Thinking Skills Test Level X, and the mean difference between the two groups was 10.4 with a standard error = 1.57.

4.1.5 Comparative Analysis of Critical Thinking Skills Test Scores Between Learners Residing in Different Areas

The researcher also compared critical thinking skills test scores among Grade 11 learners residing in different areas in this study. The largest group of participants, consisting

of 60 learners (51.72%), lived in Primrose. Their mean score on the critical thinking skills test was 29.7, with a standard deviation = 9.4. The second largest cohort, comprising 21 Grade 11 learners (18.10%), enrolled at Dawnview High School, and resided in Germiston. The learners residing in Germiston achieved a mean score of 33.1 on the critical thinking skills test, with a standard deviation of 7.5. The remaining Grade 11 learners enrolled at Dawnview High School were from various areas, including Tembisa, Vosloorus, Malvern, Elandsfontein, and Katlehong. These areas consisted of low-income earners, as discussed in **Section 3.3.2**. Due to their low participant count, conducting meaningful statistical analysis for each area was impossible. Therefore, the participants from these areas, *n*=35 (30.17%), were grouped. The mean score for this combined group on the critical thinking skills test was 30.9, with a standard deviation = 10.0. **Table 4.8** summarises participants' critical thinking skills test scores based on area of residence.

Table 4. 8

Descriptive Statistics of Critical Thinking Skills Test Scores Based on Area of Residence

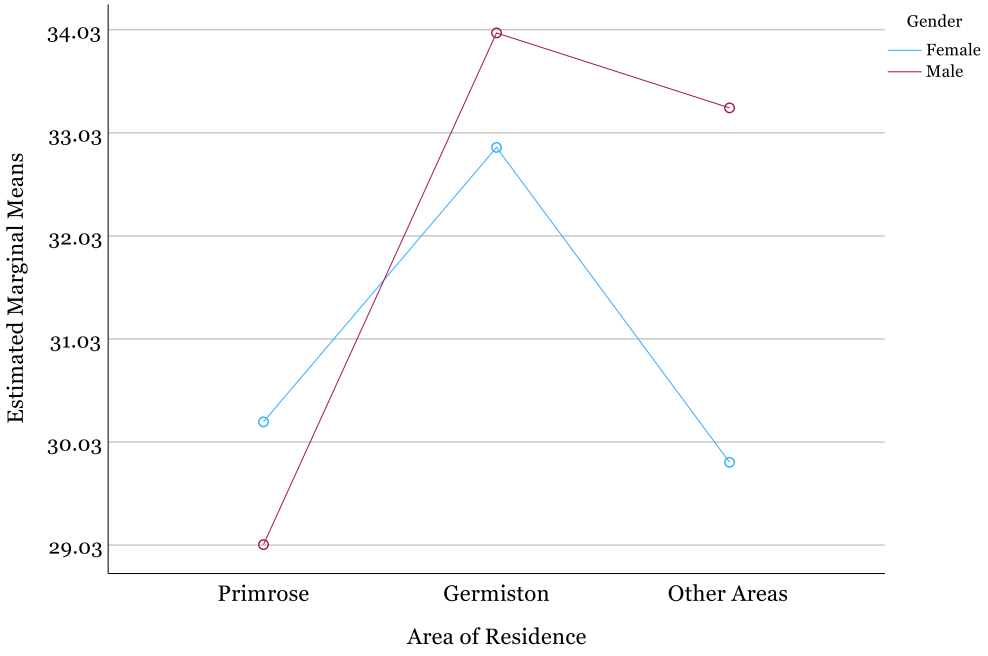
Dependent Variable: Critical Thinking Skills Test Score				
Gender	Area of Residence	Mean	Std. Deviation	*n*
female	Primrose	30.2	9.6	31
	Germiston	32.9	8.1	18
	Other Areas	29.8	10.1	24
	Total	30.8	9.4	73
male	Primrose	29.0	9.3	29
	Germiston	34.0	2.6	3
	Other Areas	33.3	9.9	11
	Total	30.5	9.2	43
combined	Primrose	29.7	9.4	60
	Germiston	33.1	7.5	21
	Other Areas	30.9	10.0	35
	Total	30.7	9.3	116

Among male learners in Grade 11 living in Germiston, the mean score was 34.0, accompanied by a standard deviation of 2.5, and it was the highest mean score when the area of residence was considered. In contrast, the lowest average score was observed among male participants residing in Primrose, standing at 29.0, with a higher standard deviation of 9.2. A visual representation of the contrasting estimated means of learners, categorised by their

residential areas, can be found in **Figure 4.15**. The mean scores show a noticeable difference when examining participants from different areas of residence, with male participants demonstrating better performance than their female counterparts in the category of other areas of residence.

Figure 4. 15

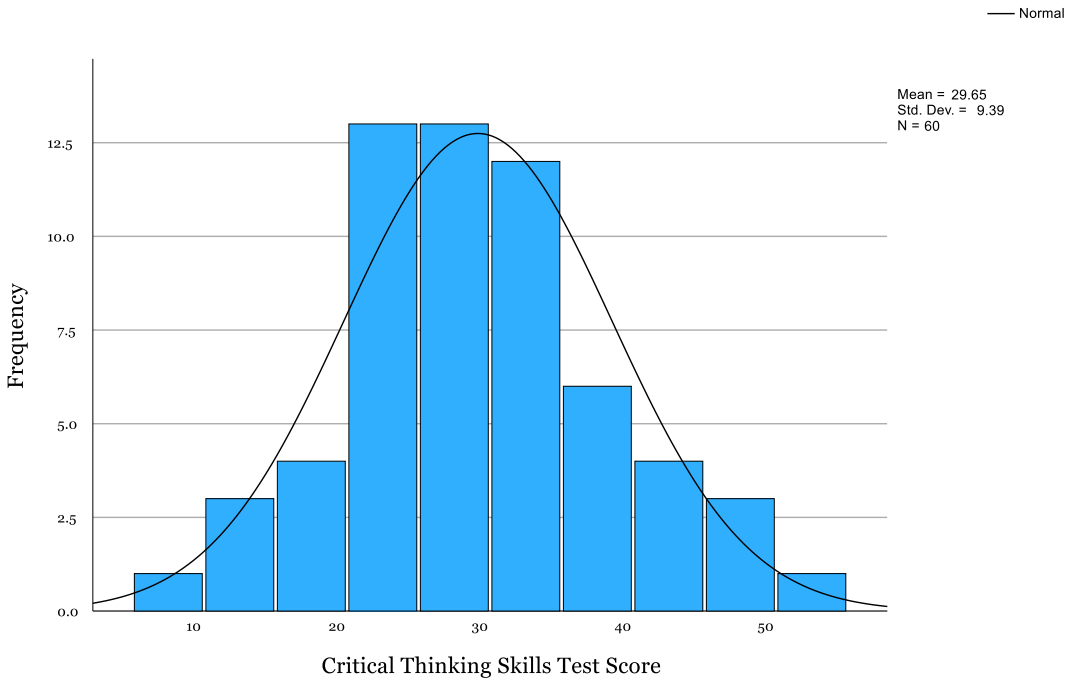
Estimated Marginal Means Based on Area of Residence



Grade 11 learners who lived in Primrose achieved a median score of 29.0. The most commonly occurring scores were 23.0 and 28.0, each appearing 13 times in the dataset. The scores of participants residing in Primrose encompassed a broad range, starting from a minimum score of eight and extending to a maximum score of 51.00. The distribution of these scores has been graphically represented in **Figure 4.16**. Notably, this distribution displayed positive skewness, quantified by a skewness value of 0.17 and a standard error of 0.31.

Figure 4. 16

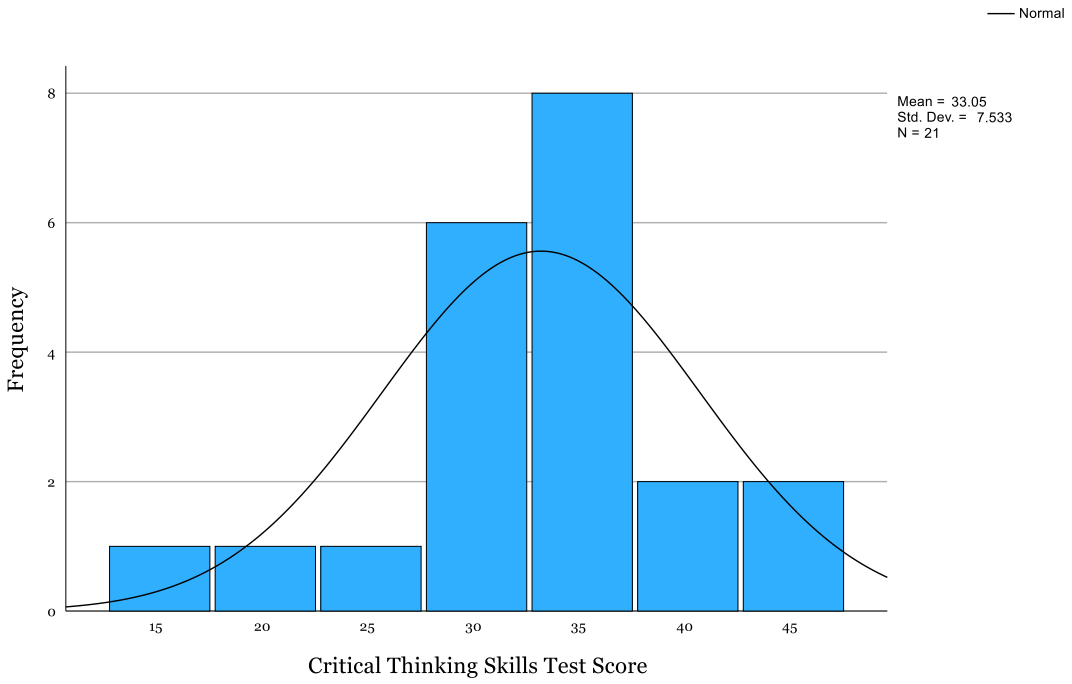
Critical Thinking Skills Test Score Distribution for Learners Residing in Primrose



Twenty-one participants resided in Germiston, and their critical thinking skills test score distribution is shown in **Figure 4.17**. The scores exhibited a negative skewness of -0.68 with a standard error of 0.50. The median score for the critical thinking skills test was 34.0, and the scores ranged from a minimum of seven to a maximum of 49.0. Notably, the most frequent score was 35.0, occurring eight times.

Figure 4. 17

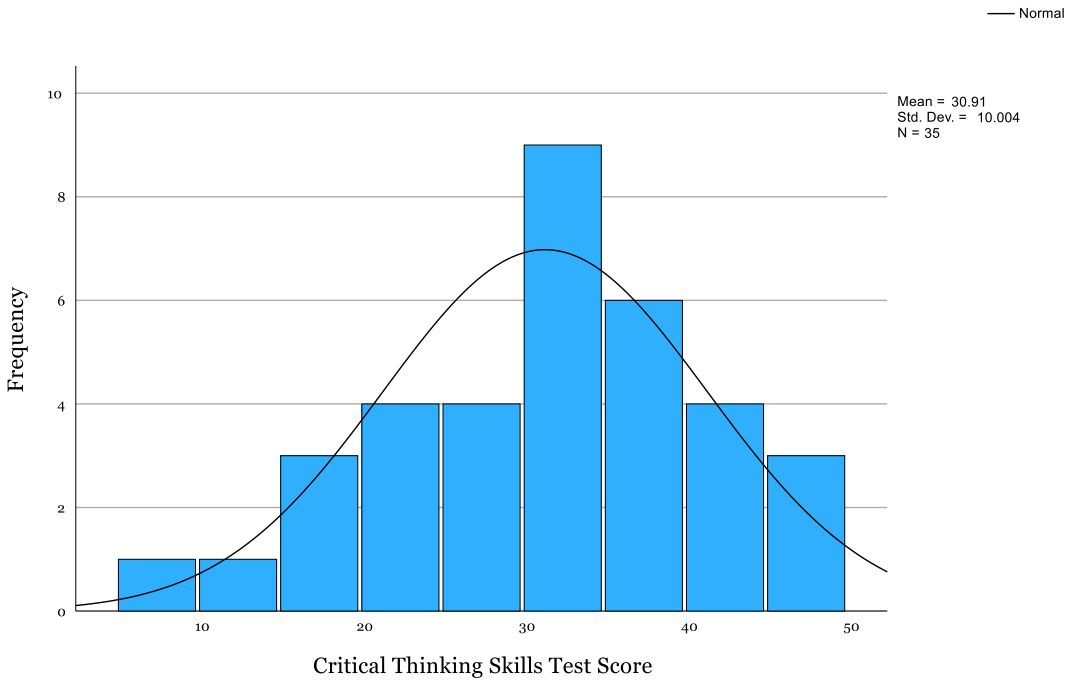
Critical Thinking Skills Test Score Distribution for Learners Residing in Germiston



Due to the limited number of learners in specific areas of residence, namely Tembisa (*n*=5), Vosloorus (*n*=5), Malvern (*n*=6), Midrand (*n*=1), Elandsfontein (*n*=5), Katlehong (*n*=12), and Bedfordview (*n*=1), a decision was made by the researcher to consolidate these learners into a single group referred to as the *"other areas"* group. This amalgamation was undertaken to facilitate robust statistical analysis, aligning with the guideline presented by Creswell and Creswell (2018), suggesting a minimum of 30 participants for meaningful statistical assessment. The resultant *"other areas"* group encompassed 35 participants (35.17%), 11 males and 24 females. The calculated mean score for this amalgamated group was 30.9, with a standard deviation of 10.0. In line with prior discussion, the median score was 32.0, and the mode exhibited a frequency of nine instances with a score of 32.0. An examination of the distribution of critical thinking skills test scores for the learners from these other areas of residence is depicted in **Figure 4.18**. The scores displayed a negative skewness of -0.40 and a standard error of 0.40. The range of critical thinking skills test scores for learners within the *"other areas"* group spanned from a minimum of seven to a maximum of 49.0.

Figure 4. 18

Critical Thinking Skills Test Score Distribution for Learners Residing in Other Areas



The normality test, specifically the Kolmogorov-Smirnov test, revealed that the critical thinking skills test scores for participants residing in Primrose followed a normal distribution. The *p*-value in the normality test obtained for participants living in Primrose (*n*=68) was equal to .200 ($p > .05$). Additionally, the *p*-value obtained from the Shapiro-Wilk test for normality was .59 for the critical thinking skills test scores of participants residing in the other combined areas (*n*=35) and for participants living in Germiston (*n*=21) the *p*-value obtained was .266. When the *p*-value is greater than .05 in the Kolmogorov-Smirnov and Shapiro-Wilk test for normality, it suggests that the scores are normally distributed; therefore, the test scores for learners residing in Germiston and the other areas were normally distributed.

Based on the ANOVA test results presented in **Table 4.9**, it was determined that the area of residence of the participants had no statistically significant impact on their critical thinking skills test scores. The ANOVA test yielded the following result: $F(2,110) = 0.95$; $p = .388$ ($p > .05$). A *p*-value greater than .05 indicates that the area of residence does not have a significant effect on the critical thinking skills test scores. It was also noted that there was no

significant effect on critical thinking skills test scores due to gender and area of residence combined.

Table 4. 9

ANOVA Results for Determining Differences in Participant Critical Thinking Skills Test Scores Based on Area of Residence

Dependent Variable: Critical Thinking Skills Test Score							
Source	Sum of Squares	df	Mean Square	*F*	Sig.	Partial η^2	Observed Power
Gender	19.1	1	19.2	0.22	.641	.002	.075
Area of Residence	167.0	2	83.5	0.95	.388	.017	.212
Gender * Area of Residence	108.9	2	54.4	0.62	.539	.011	.152

b. Computed using alpha = .05

4.2 Comparing Critical Thinking Skills Aspects based on Gender, Academic Subject Categories, Mathematics Group, Residential Area, and Home Language

As previously discussed in **Section 2.11**, the Cornell Critical Thinking Skills Test Level X comprises a total of 71 items, which are categorised into five distinct groups. These categories include inductive reasoning (25 items), deductive reasoning (24 items), observation items (24 items), assumption items (24 items), and credibility of judgement items (10 items). In the following section, results concerning differences in learner proficiency across these dimensions in the critical thinking skills test based on factors such as gender, academic subject grouping, Mathematics group, home language, and the participants' area of residence are also presented.

4.2.1 Inductive Reasoning Items Comparative Analysis

Inductive reasoning, which involves drawing logical conclusions from observations (Ennis et al., 2005), was assessed in this study. When analysing the data, it was found that there were no statistically significant differences in the inductive reasoning scores among participants based on gender. This conclusion was drawn from a *t*-test statistic with a t (114) = .84 and a p-value of .404 ($p > .05$). Specifically, the mean score for female learners in inductive reasoning items was 12.6, with a standard deviation of 3.2. In contrast, male

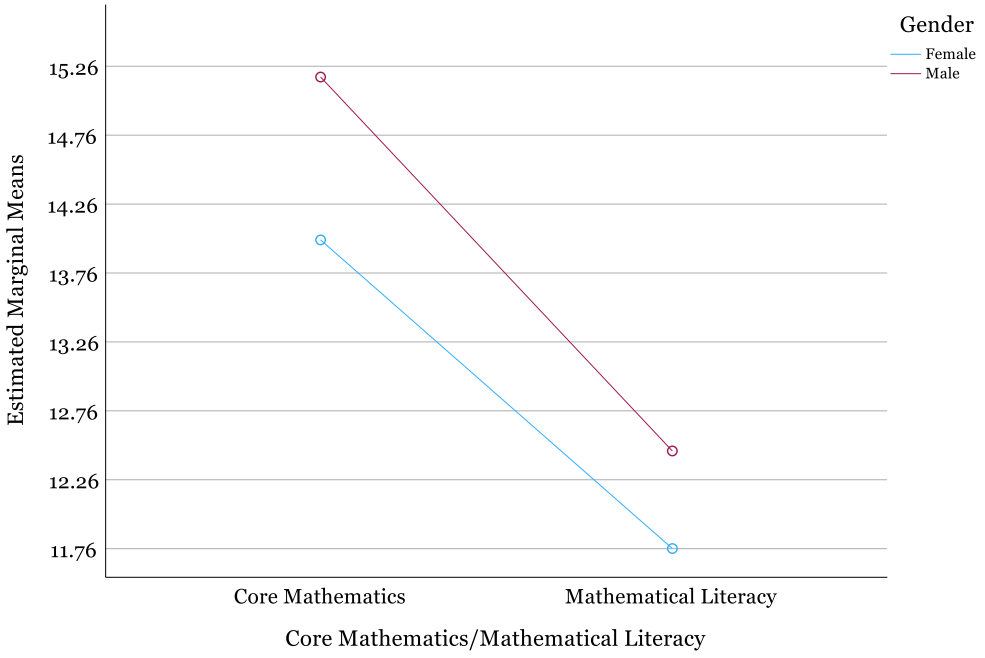
learners had a mean score of 13.1, with a standard deviation of 4.1 and a mean difference = 0.6.

However, when considering the type of Mathematics grouping participants enrolled in, Core Mathematics learners (n=38) had a mean inductive reasoning score of 14.3, with a standard deviation = 3.0. In contrast, those enrolled in Mathematical Literacy (n=78) had a mean score of 12.1, with a standard deviation = 3.6. An independent sample t-test yielded t (114) = 3.40 and a p-value of .001 ($p < .05$), indicating a moderate effect (Cohen's d value = 0.67) of the Mathematics group participants were enrolled on their inductive reasoning scores. This suggests that learners in Core Mathematics outperformed their counterparts in Mathematical Literacy in inductive reasoning items. **Figure 4.19** visually represents the estimated marginal means plot for inductive reasoning scores based on the Mathematics group, highlighting the statistical significance of the difference and mean difference of 2.3 with a standard error of 0.67 realised between these participants.

When applying an ANOVA test for independent samples, no statistically significant differences were identified in participants' inductive reasoning mean scores based on the academic subject groups they were enrolled in. The inferential analysis yielded F (2,110) = 2.52 with a p-value of .085.

Figure 4. 19

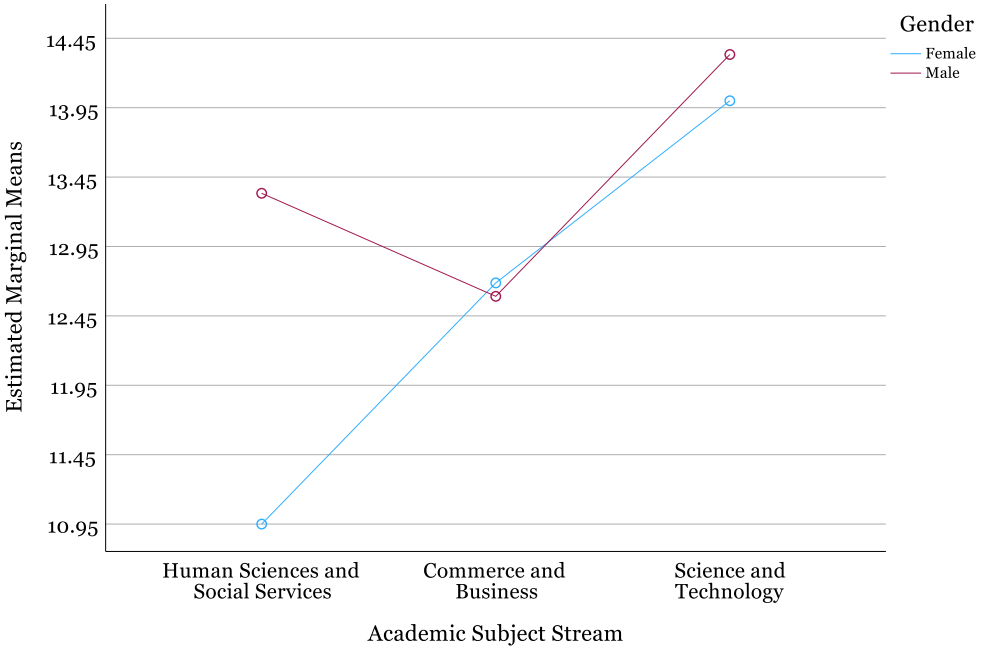
Estimated Marginal Means for Inductive Reasoning Scores Based on Mathematics Group



To provide further context, participants enrolled in Human Sciences and Social Services had a mean inductive reasoning score of 11.8 (*SD*=3.6). In contrast, those in the Commerce and Business academic subject stream had a mean score of 12.7 (*SD*=3.7). On the other hand, participants in the Science and Technology stream achieved a mean inductive reasoning score of 14.1 (*SD*=3.0). **Figure 4.20** visually represents the estimated marginal means of inductive reasoning scores based on academic subject groups.

Figure 4. 20

Estimated Marginal Means of Inductive Reasoning Scores Based on Academic Subject Streams



An inferential analysis of the variance test revealed that neither the participants' areas of residence nor their home language had a statistically significant effect on their inductive reasoning scores. The ANOVA results showed an F (2,110) = 1.87 and a p-value of .160 (p > .05) for inductive reasoning items scores based on the area of residence. The interaction of gender and area of residence of participants as predictor variables on inductive items score was also not statistically significant as revealed by F (2,110) = 1.09; p =.339 (p > .05). Similarly, for inductive reasoning items scores based on participants' home language, the test yielded F (4,106) = 1.88, with a p-value of .119 (p >.05). The interaction of gender and participant spoken home language did also not yield a statistically significant result F (4,106) = 0.10; p = .982 (p > .05). For a detailed breakdown of mean inductive reasoning scores among participants grouped by their area of residence and home language, **Table 4.10** is provided.

Table 4. 10

Inductive Reasoning Items Mean Scores of Participants Based on Area of Residence and Home Language

Dependent Variable: Inductive Reasoning Items Score				
Recognised Language Group	Area of Residence	Mean	Std. Deviation	*n*
Nguni	Primrose	12.5	3.3	30
	Germiston	12.7	3.0	6
	Other Areas	13.8	4.0	17
	Total	12.9	3.5	53
Tsonga	Primrose	14.0	0.0	1
	Other Areas	14.0	0.0	1
	Total	14.0	0.0	2
Venda	Primrose	14.3	0.6	3
	Germiston	13.5	0.7	2
	Other Areas	13.7	2.9	3
	Total	13.9	1.6	8
Sotho	Primrose	11.1	4.0	21
	Germiston	13.6	2.1	10
	Other Areas	12.0	4.1	14
	Total	12.0	3.8	45
English	Primrose	15.6	4.1	5
	Germiston	14.7	2.3	3
	Total	15.3	3.4	8
Total	Primrose	12.4	3.7	60
	Germiston	13.5	2.3	21
	Other Areas	13.1	3.9	35
	Total	12.8	3.6	116

4.2.2 Deductive Reasoning Items Comparative Analysis

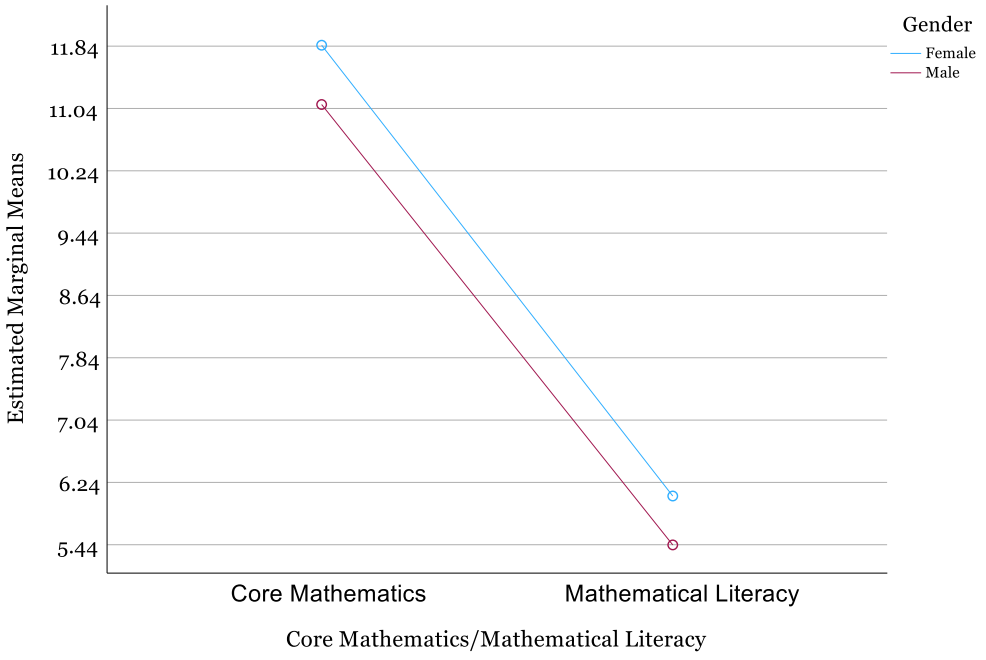
Deductive reasoning involves drawing logical conclusions based on inferences derived from premises, assumptions, and statements that are known to be valid (Ennis et al., 2005). This study found that gender did not have a statistically significant effect on the deductive reasoning scores of participants. Specifically, the mean deductive reasoning score for female participants was 8.2 (*SD*=5.0), while the mean deductive reasoning score for male participants was 6.9 (*SD*=5.0). An inferential *t*-test analysis indicated a $t\,(114) = 1.38$ with a *p*-value of .170, signifying no statistically significant difference in deductive reasoning scores based on the participants' gender.

However, when considering the Mathematics type grouping participants were enrolled in, Core Mathematics learners had a deductive reasoning item mean score of 11.6 (*SD*=3.8). In contrast, learners enrolled in Mathematical Literacy had a mean score of 5.8

(*SD*=4.4). An independent sample *t*-test demonstrated a statistically significant difference in deductive reasoning scores based on the Mathematics Group in which participants were enrolled, with a t (114) = 7.02, p-value = .001, and a Cohen's d-value of 1.39. This suggests that the deductive reasoning performance of Core Mathematics learners was better when compared to their peers in Mathematical Literacy. **Figure 4.21** presents the estimated marginal mean plots of deductive reasoning scores of participants based on the Mathematics group in which they are enrolled.

Figure 4. 21

Estimated Marginal Means of Deductive Reasoning Scores Based on Mathematics Group



There was a statistically significant but moderate difference in deductive reasoning scores among participants based on the academic subject grouping in which they were enrolled. An analysis of variance (ANOVA) yielded an F (2,110) = 12.77 and a p-value of .001. The partial η^2 value was .188, indicating that 18.8% of the variations in deductive reasoning scores could be attributed to the participants' academic subject group.

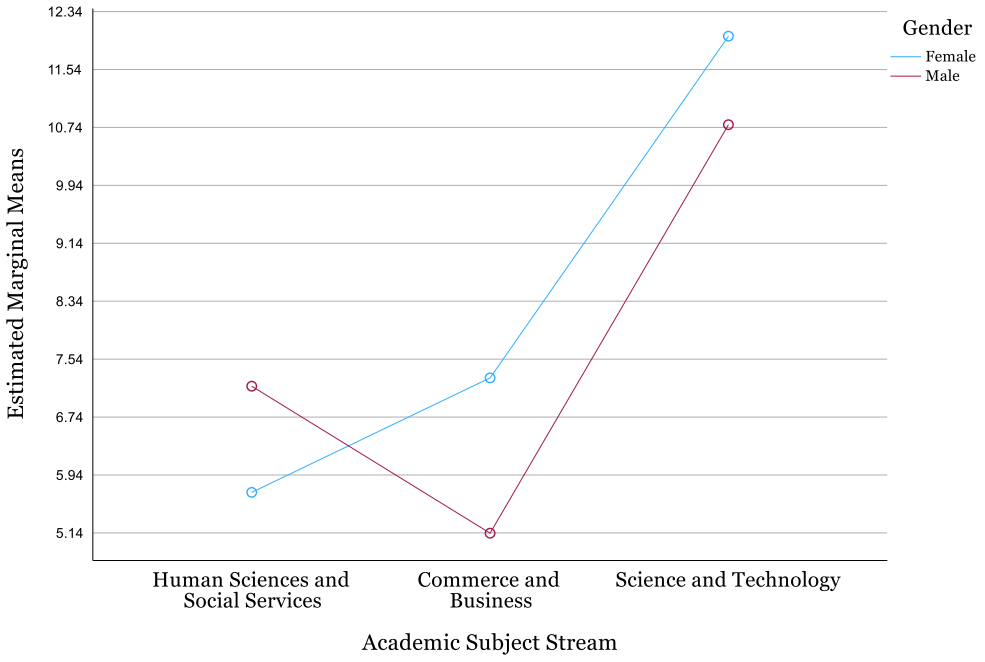
The mean deductive reasoning score for participants in the Science and Technology academic subject stream was notably high at 11.6 (*SD*=3.8). Participants in the Human

Sciences and Social Services and Commerce and Business academic subject streams had mean deductive scores of 6.3 (*SD*=4.3) and 6.4 (*SD*=4.9), respectively.

Furthermore, a post hoc Tukey analysis revealed no significant difference in deductive reasoning scores between participants in the Human Sciences and Social Services and Commerce and Business subject streams. The estimated marginal mean plots of participants categorised by their academic subject stream are presented in **Figure 4.22**.

Figure 4. 22

Estimated Marginal Means of Deductive Reasoning Scores Based on Academic Subject Stream



The study found that neither the participants' area of residence nor the home language had a statistically significant influence on their deductive reasoning items scores. An analysis of variance was conducted to assess the influence of these factors on deductive reasoning scores. The analysis of variance showed that for the area of residence, the F (2,110) = 1.78, and the corresponding p-value was .174 ($p > .05$). Similarly, for the home language spoken by participants, the analysis revealed an F value (2,110) = 0.87 with a p-value of .484 ($p > .05$). These findings indicate that neither the geographical area of residence nor the home language spoken by participants had a statistically significant effect on their deductive

reasoning scores. **Table 4.11** provides participants' mean scores in deductive reasoning items categorised by area of residence and home language, further supporting the conclusion that these factors did not significantly impact deductive reasoning scores.

Table 4. 11

Deductive Reasoning Items Mean Scores of Participants Based on Area of Residence and Home Language

Dependent Variable: Deductive Reasoning Items Scores				
Area of Residence	Recognised Home Language Group	Mean	Std. Deviation	*n*
Primrose	Nguni	7.1	5.0	30
	Tsonga	10.0	0.0	1
	Venda	2.7	2.3	3
	Sotho	6.7	5.1	21
	English	10.8	3.6	5
	Total	7.1	5.0	60
Germiston	Nguni	7.7	7.1	6
	Venda	13.0	4.2	2
	Sotho	9.1	3.8	10
	English	10.3	2.9	3
	Total	9.2	4.8	21
Other Areas	Nguni	7.5	4.5	17
	Tsonga	12.0	0.0	1
	Venda	7.3	6.4	3
	Sotho	8.2	5.8	14
	Total	7.9	5.0	35
Total	Nguni	7.3	5.0	53
	Tsonga	11.0	1.4	2
	Venda	7.0	5.8	8
	Sotho	7.7	5.1	45
	English	10.6	3.2	8
	Total	7.7	5.0	116

4.2.3 Observation Items Comparative Analysis

The Cornell Critical Thinking Skills Test Level X includes observation items that assess critical thinking skills by providing instances where inductive inferences are based. An analysis was conducted to investigate whether participants' gender had a statistically significant influence on their scores in the observation items of the test. Using a *t*-test, it was determined that participants' gender did not exert a statistically significant influence on their

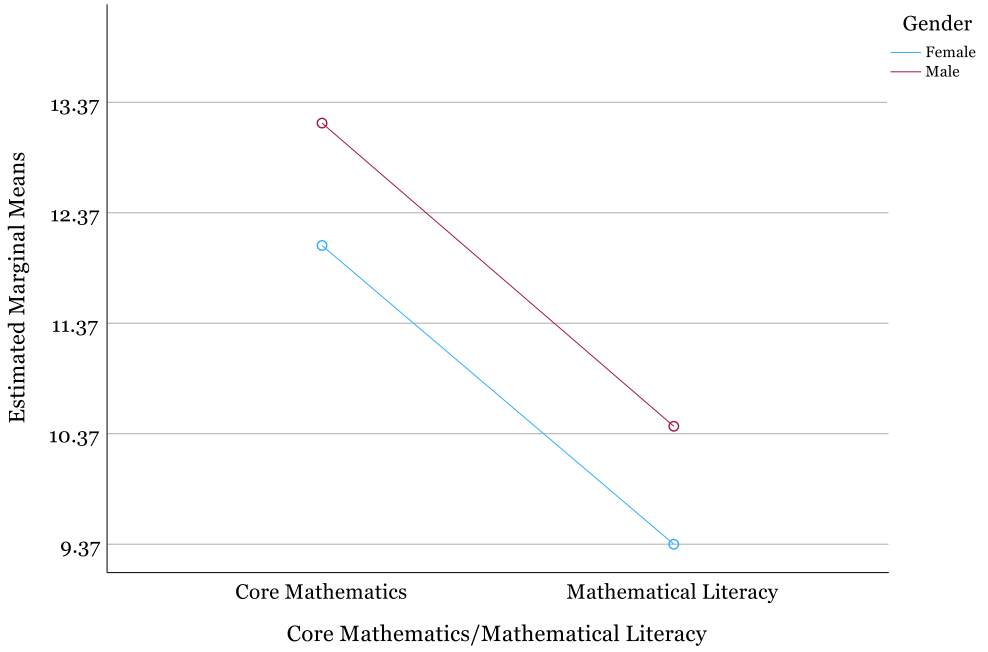
scores in the observation items. The *t*-test yielded the following results: t (114) = 1.15 and a *p*-value of .253 ($p > .05$). Specifically, the mean score for female participants in the observation items was 10.4, with a standard deviation of 3.7, while male participants had a mean score of 11.1, with a standard deviation of 3.1. These findings suggest no significant difference in the observation item scores between female and male participants.

As previously mentioned, participants were categorised into two groups based on their Mathematics Group: Core Mathematics (n=38) and Mathematical Literacy (n=78). To assess how the Mathematics Group enrolment influenced participants' scores on the observation items of the critical thinking skills test, a *t*-test was conducted. The inferential *t*-test yielded a statistically significant result with a t (114) = 3.98 and a *p*-value of .001 ($p < .05$). Additionally, a Cohen's d value of 0.79 was calculated. According to Dancey and Reidy (2017, p. 221), an effect size of 0.8 is considered large and statistically significant. These findings indicate that the Mathematics Group in which participants were enrolled had a statistically significant effect on their scores in the Cornell Critical Thinking Skills Test Level X observation items.

Specifically, Grade 11 learners enrolled in Core Mathematics performed better in the observation items, with a mean score of 12.4 (SD=3.0), compared to their counterparts enrolled in Mathematical Literacy, whose mean score was 9.8 (SD=3.4), giving a mean difference of 2.4. **Figure 4. 23** provides estimated marginal means illustrating the extent of the difference in the mean scores of observation items among participants based on their Mathematics group enrolment.

Figure 4. 23

Estimated Marginal Means of Observation Items Based on the Mathematics Group



When examining the impact of the academic subject stream in which participants were enrolled on their scores in the observation items of the test, an analysis of variance (ANOVA) was conducted. The results of the ANOVA demonstrated that the academic subject stream did indeed have a statistically significant effect on the observation item scores. The ANOVA findings included an F (2,110) = 5.28 with a p-value of .006 ($p < .05$) and a partial η^2 value of .088. It is important to note that while the effect of the academic subject stream was statistically significant, it was minor, as only 8.8 % of the differences observed in the scores of the observation items could be attributed to the specific academic subject stream to which the learners were enrolled.

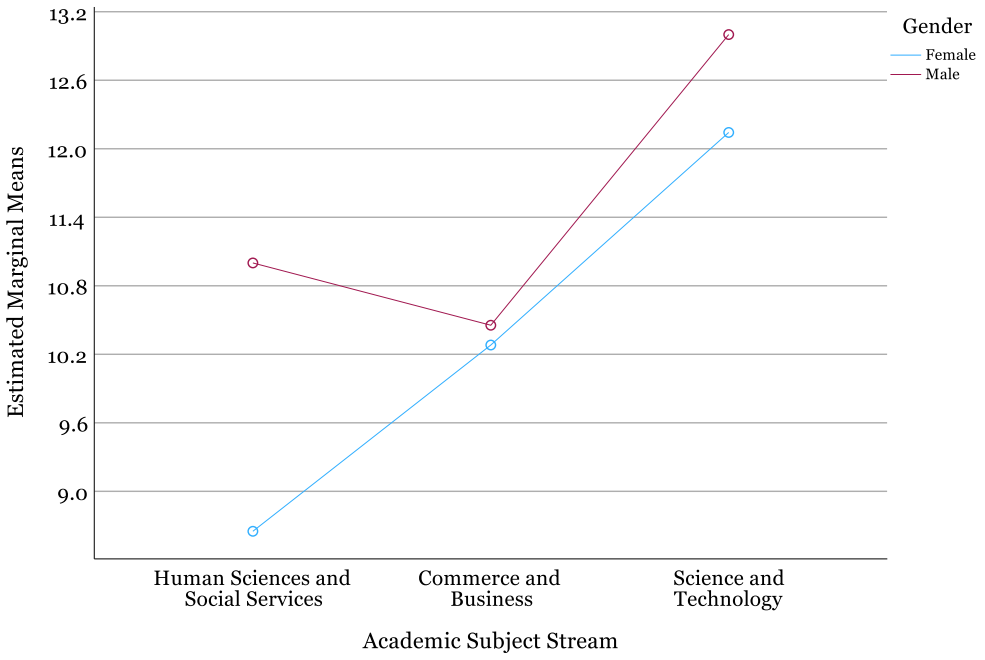
A post hoc Tukey analysis was conducted to pinpoint differences in participant observation item scores based on their academic subject streams. The analysis indicated that participants in the Science and Technology stream performed better than their peers in the Human Sciences and Social Services and those in the Commerce and Business stream. Specifically, participants in the Science and Technology stream achieved a mean score of 12.4 (SD=3.2) on the observation items, while participants in the Human Sciences and Social

Services stream scored an average of 9.5 (*SD*=3.8), and those in the Commerce and Business stream had an average score of 10.4 (*SD*=3.1).

Differences in participants' mean scores based on academic subject stream grouping are illustrated in **Figure 4.24**. These results suggest that the Science and Technology stream participants had higher observation item scores than their counterparts in the other two academic subject streams. Furthermore, the Tukey post hoc analysis demonstrated no statistically significant difference in the mean observation items scores between participants in the Human Sciences and Social Services stream and those in the Commerce and Business stream.

Figure 4. 24

Estimated Marginal Means of Observation Items Based on Academic Subject Stream



Results of an ANOVA test indicated that participants' scores on the Cornell Critical Thinking Skills Test Level X observation items were not significantly affected by their area of residence or their recognised home language. Specifically, the ANOVA yielded the following results: for the effect of area of residence on participants' scores in the observation items, an F (2,110) = 1.65 was obtained with a p-value of .197 ($p > .05$). Similarly, for the influence of participants' recognised home language on their observation item scores, an F (4,106) = 1.01

was obtained with a *p*-value of .405. The *p*-values for both variables exceeded the predetermined significance level of .05, indicating that neither area of residence nor recognised home language had a statistically significant influence on participants' scores in the observation items. **Table 4.12** summarises the participants' mean scores on the Critical Thinking Skills Test observation items, categorised by area of residence, and recognised spoken home language.

Table 4. 12

Observation Items Mean Scores of Participants Based on Area of Residence and Home Language

Dependent Variable: Observation Items Score				
Recognised Home Language Group	Area of Residence	Mean	Std. Deviation	*n*
Nguni	Primrose	10.4	3.9	30
	Germiston	9.8	3.0	6
	Other Areas	10.5	3.8	17
	Total	10.4	3.7	53
Tsonga	Primrose	7.0	0.0	1
	Other Areas	9.0	0.0	1
	Total	8.0	1.4	2
Venda	Primrose	13.3	2.9	3
	Germiston	12.5	3.5	2
	Other Areas	11.0	6.1	3
	Total	12.3	4.0	8
Sotho	Primrose	10.7	4.0	21
	Germiston	11.4	2.6	10
	Other Areas	10.0	2.9	14
	Total	10.6	3.4	45
English	Primrose	12.4	1.5	5
	Germiston	10.7	2.1	3
	Total	11.8	1.8	8
Total	Primrose	10.8	3.7	60
	Germiston	11.0	2.7	21
	Other Areas	10.3	3.5	35
	Total	10.7	3.5	116

4.2.4 Assumption Items Comparative Analysis

Assumption items form part of the Cornell Critical Thinking Skills Test Level X and assist in assessing individuals' competence in deductive reasoning by basing their deductive reasoning on valid premises, assumptions, and statements. The research findings indicate

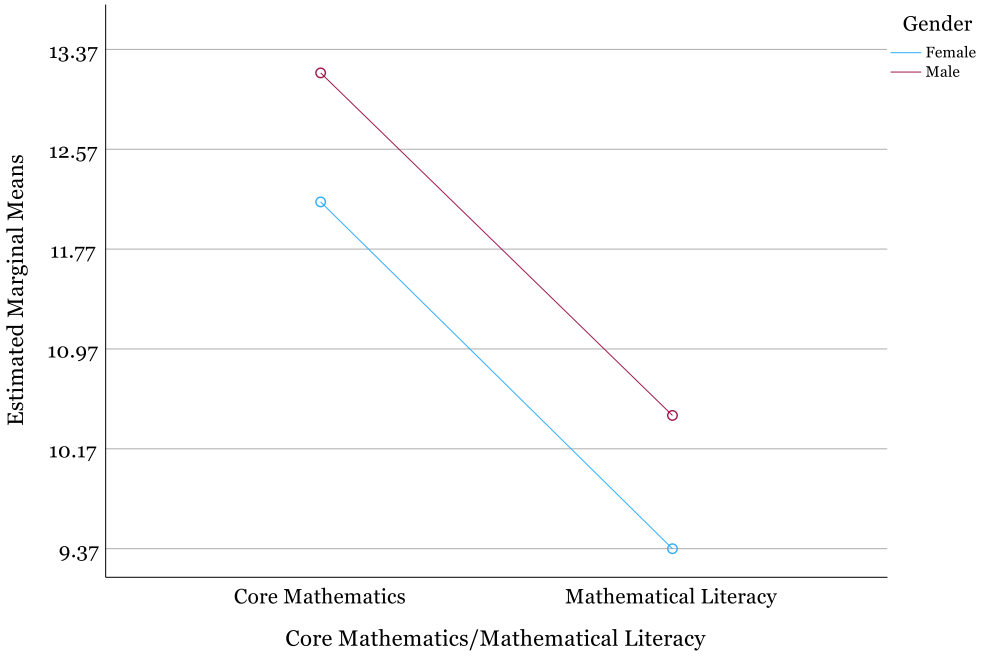
that gender did not play a statistically significant role in influencing participants' scores on the assumption items of the Critical Thinking Skills Test. To elaborate, the average score for female participants on the assumption items was 10.4, with a standard deviation of 3.7. In contrast, male participants had an average score of 11.1, with a standard deviation of 3.1. Employing a *t*-test revealed a t (114) = 1.10, and the corresponding *p*-value was .272 (p > .05). This outcome suggests that there was no statistically significant influence of gender on the scores of participants in the assumption items, further supporting the idea that gender was not a significant factor influencing participants' performance on assumption items of the test. The mean difference between the genders was 0.7, with a standard error = 0.67.

A *t*-test inferential analysis assessed whether the Mathematics Group in which participants were enrolled affected their assumption items scores. The results indicated a statistically significant effect of the Mathematics group on participants' assumption items scores. Specifically, the *t*-test value (114) = 4.06 with a *p*-value = .001 (p < .05), and Cohen's *d*-effect size = 0.80. The large Cohen's *d* effect size value indicated a substantial effect of the Mathematics group on assumption item scores. Participants enrolled in Core Mathematics achieved a mean score of 12.5 (*SD* = 3.0), and they performed significantly better compared to their peers enrolled in Mathematical Literacy, who had a mean score of 9.8 (*SD* = 3.4) in assumption items of the Cornell Critical Thinking Skills Test Level X. The mean difference between the Mathematical groupings was 3.6 with a standard error = 0.65.

To visually represent the estimated differences in assumption items, mean scores attributed to the Mathematics group in which learners were enrolled are illustrated in **Figure 4.25**. This figure depicts the notable variations in assumption item scores based on the Mathematics Group participants were enrolled in.

Figure 4. 25

Estimated Marginal Means of Assumption Items Based on Mathematics Group Enrolled



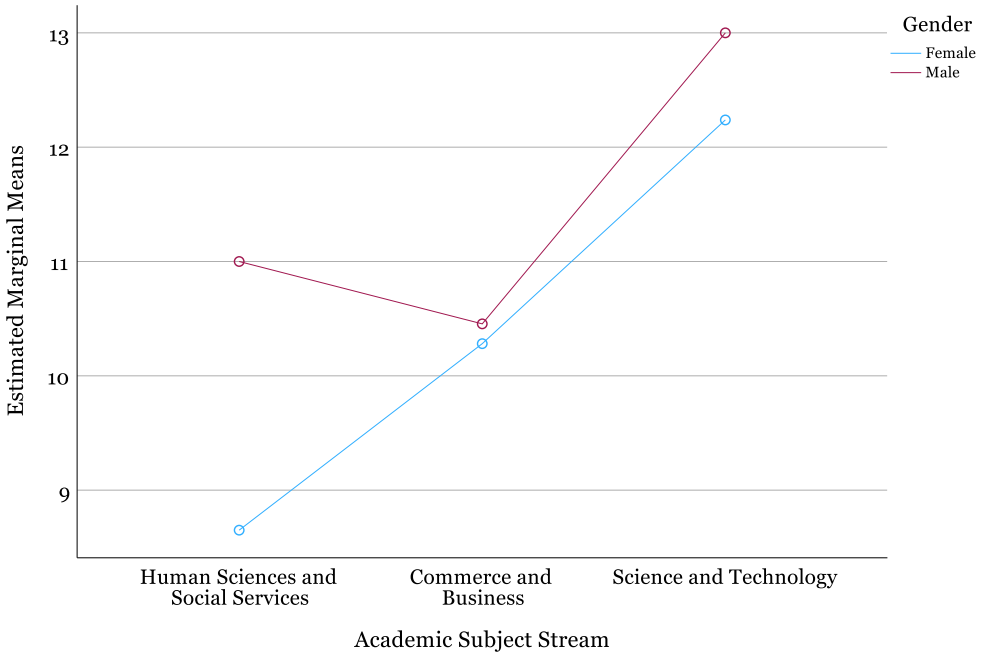
A comparative inferential analysis was conducted to examine the effect of the academic subject streams in which participants were enrolled on their scores related to assumption items in a critical thinking skills test. The mean assumption item score for learners in the Human Sciences and Social Services academic subject stream was 9.5 (*SD* = 3.8); for participants in the Commerce and Business subject stream, it was 10.4 (*SD* = 3.1); and for those in the Science and Technology academic subject stream, it was 12.5 (*SD* = 3.2). The mean score of all 116 participants in assumption items was 10.7 (*SD*=3.5)

An analysis of variance (ANOVA) examining the assumption item scores of participants across different academic subject streams revealed an F (2,110) = 5.47, with a p-value of .005 ($p < .05$). This indicates a statistically significant effect of the academic subject stream on assumption item scores, with a partial η^2 of .090, suggesting that 9% of the variance in assumption item scores can be attributed to the academic subject stream. To illustrate the extent of differences in assumption item scores among participants from

various academic subject streams, estimated marginal mean plots were generated in **Figure 4.26**.

Figure 4. 26

Estimated Marginal Means of Assumption Items Based on Academic Subject Stream



These plots visually represent the variations in assumption item scores based on the academic subject stream participants were enrolled in.

Further exploration was conducted to pinpoint where these differences in assumption item scores existed among participants in different academic subject streams using a post hoc Tukey analysis. This analysis revealed that participants enrolled in the Science and Technology stream performed significantly better than those in the Human Sciences and Social Services stream and those in the Commerce and Business stream. However, there was no statistically significant difference in assumption item scores between participants in the Commerce and Business academic subject stream and those in the Human Sciences and Social Services academic subject stream.

The participants' scores on the assumption items of the critical thinking skills test were statistically unaffected by the participants' area of residence or the recognised spoken home language. The analysis of variance revealed an F (2,110) = 0.35 with a p-value of .703

for assumption item scores based on participants' area of residence and an F (4,106) = 0.99 with a p-value of .418 for assumption item scores based on the home language of participants. It is important to note that both p-values obtained were greater than the predefined significance level of .05. A summary of the participants' assumption item scores based on the area of residence and recognised spoken home language is provided in **Table 4.13**.

Table 4. 13

Assumption Items Mean Scores of Participants Based on Area of Residence and Home Language

Dependent Variable: Assumption Items Scores				
Recognised Home Language Group	Area of Residence	Mean	Std. Deviation	*n*
Nguni	Primrose	10.4	3.9	30
	Germiston	9.8	3.0	6
	Other Areas	10.5	3.8	17
	Total	10.4	3.7	53
Tsonga	Primrose	7.0	0.0	1
	Other Areas	9.0	0.0	1
	Total	8.0	1.4	2
Venda	Primrose	13.3	2.9	3
	Germiston	12.5	3.5	2
	Other Areas	11.0	6.1	3
	Total	12.3	4.0	8
Sotho	Primrose	10.7	4.0	21
	Germiston	11.4	2.6	10
	Other Areas	10.1	3.1	14
	Total	10.7	3.4	45
English	Primrose	12.4	1.5	5
	Germiston	10.7	2.1	3
	Total	11.8	1.8	8
Total	Primrose	10.8	3.7	60
	Germiston	11.0	2.7	21
	Other Areas	10.4	3.6	35
	Total	10.7	3.5	116

4.2.5 Credibility of Judgements Items Comparative Analysis

Credibility in judgements refers to individuals' confidence, accuracy, and fairness in decision-making. Several factors, such as assumptions, observations, inductive reasoning,

and deductive reasoning, influence the credibility of judgements. In the context of this study, the Cornell Critical Thinking Skill Test Level X consists of 10 items that assess the credibility of judgements made by participants during the test.

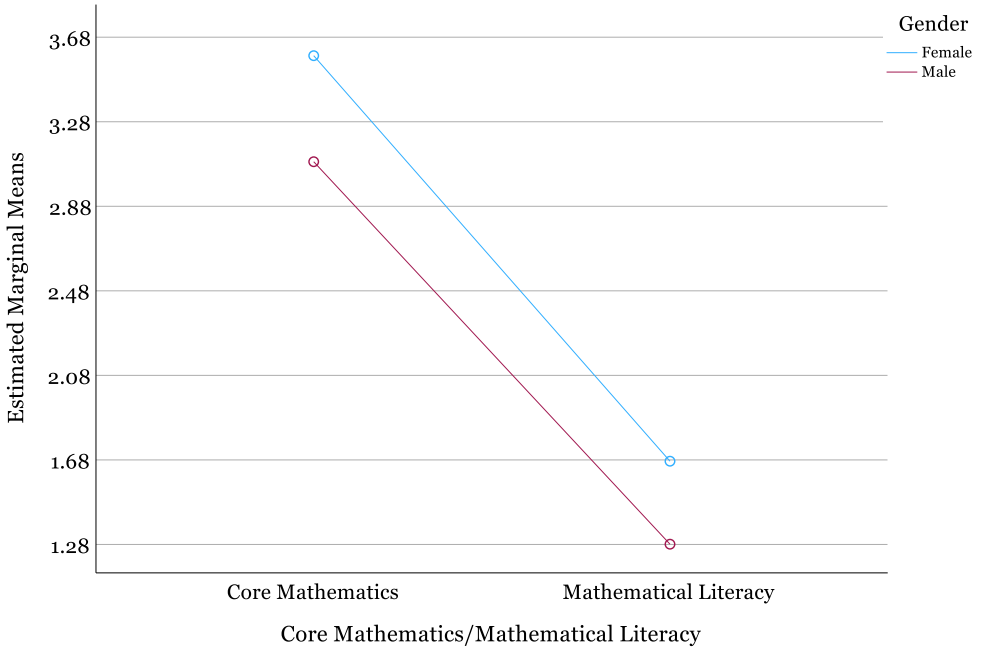
The study's findings show that the participants' gender did not have a statistically significant influence on their credibility of judgement scores. Specifically, female participants had a mean score of 2.4 (with a standard deviation of 1.9). In contrast, male participants had a mean score of 1.7 (with a standard deviation of 2.1) on the credibility of judgement items. An inferential analysis, specifically a *t*-test, was conducted, revealing a $t\ (114) = 1.68$ with a *p*-value of .095 ($p > .05$). This outcome suggests that there were no statistically significant differences in the credibility of judgement scores among participants based on their gender. The mean difference was 0.6, with a standard error = 0.38.

Participants were split into two groups based on the type of Mathematics they were enrolled in: Core Mathematics (n=38) and Mathematical literacy (n=78). A *t*-test analysis was computed, revealing a statistically significant effect of the Mathematics group on participants' credibility judgement scores. The t-value was 5.50 with 114 degrees of freedom, with a *p*-value of .001 ($p < .05$), indicating a significant difference. The effect size, Cohen's *d*, was found to be 1.09, which falls into the category of large effect size, according to Dancey and Reidy (2017).

To elaborate, learners enrolled in core Mathematics achieved a mean score of 3.5 (SD=1.7) in credibility judgement items, outperforming their counterparts in Mathematical Literacy, with a mean score of 1.5 (SD=1.8). **Figure 4.27** illustrates the difference in credibility judgement item scores for participants using estimated marginal means plots.

Figure 4. 27

Estimated Marginal Means of Credibility of Judgement Items Scores Based on Mathematics Group

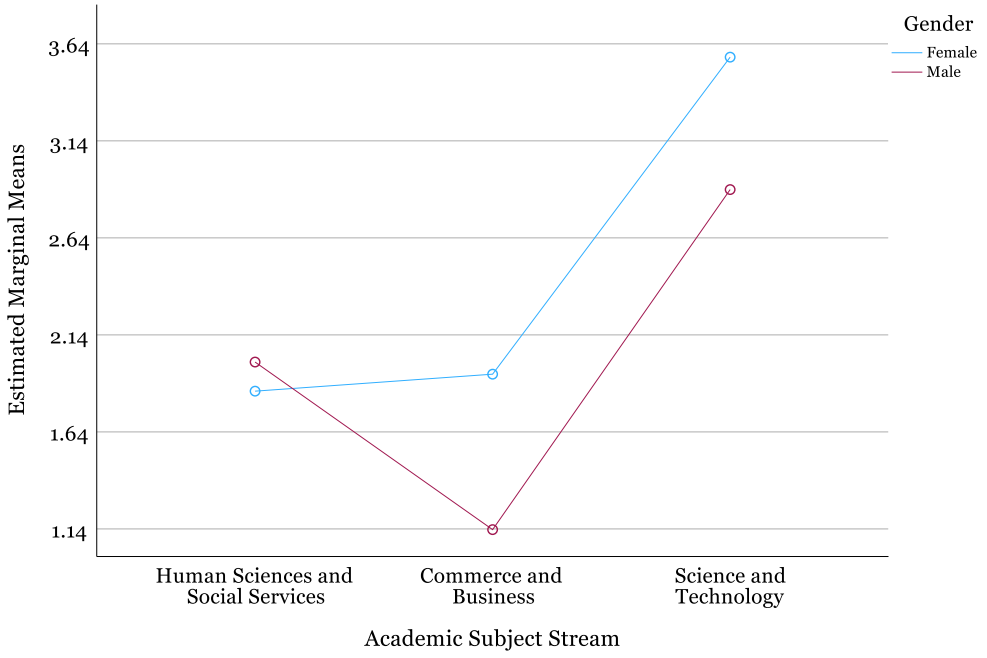


The study found that the academic subject stream in which participants were enrolled had a statistically significant influence on their scores for the credibility of judgement items. An analysis of variance (ANOVA) indicated an F (2,110) = 7.08 with a p-value of .001, suggesting that there was a significant effect ($p < .05$). The ANOVA also revealed a partial η^2 =.114, indicating that 11.4% of the variation in participants' credibility of judgement scores could be attributed to the academic subject stream in which they were enrolled. Specifically, participants in the Science and Technology academic subject stream had a mean score of 3.4 with a standard deviation of 1.8, and they outperformed their counterparts in the other two academic streams. However, a post hoc Tukey analysis, which aimed to determine whether there were significant differences in the credibility of judgement scores between participants enrolled in the Commerce and Business subject stream and those in the Human Sciences and Social Services streams, showed no significant difference in the mean scores between these two groups.

The mean score for credibility of judgement items for participants in the Human Sciences and Social Services stream was 1.9, with a standard deviation of 2.0, while the mean score for participants in the Commerce and Business subject stream was 1.6, with a standard deviation of 1.8. **Figure 4.28** illustrates the estimated marginal means of credibility of judgement scores for participants based on their academic subject stream, highlighting the degree of variance between the mean scores.

Figure 4. 28

Estimated Marginal Means of Credibility of Judgement Items Scores Based on Academic Subject Stream



The scores for participants' credibility of judgement items were unaffected by their area of residence or spoken home language. An analysis of variance yielded an F (4,106) = 1.96 with a p-value of .106 when examining the connection between participants' credibility of judgement items scores and their spoken home language. Similarly, when assessing the association between participants' area of residence and their credibility of judgement items scores, the inferential test results were as follows: F (2,110) = 0.03 with a p-value of .973. These results indicate a lack of statistically significant relationships between the credibility of

judgement item scores, the area of residence, and participants' home language. For a summary of the mean scores for the credibility of judgement items by participant area of residence and recognised spoken home language, **Table 4.14** is provided.

Table 4. 14

Credibility of Judgement Items Mean Scores of Participants Based on Area of Residence and Recognised Spoken Home Language

Dependent Variable: Credibility of Judgement Items Scores				
Recognised Spoken Home Language Group	Area of Residence	Mean	Std. Deviation	*n*
Nguni	Primrose	2.0	1.9	30
	Germiston	2.2	2.2	6
	Other Areas	1.7	1.8	17
	Total	1.9	1.9	53
Tsonga	Primrose	4.0	0.0	1
	Other Areas	5.0	0.0	1
	Total	4.5	0.7	2
Venda	Primrose	0.0	0.0	3
	Germiston	2.5	0.7	2
	Other Areas	1.7	1.5	3
	Total	1.3	1.4	8
Sotho	Primrose	2.1	2.3	21
	Germiston	2.7	1.8	10
	Other Areas	2.5	2.3	14
	Total	2.4	2.2	45
English	Primrose	3.0	2.1	5
	Germiston	2.7	0.6	3
	Total	2.9	1.6	8
Total	Primrose	2.1	2.1	60
	Germiston	2.5	1.7	21
	Other Areas	2.1	2.0	35
	Total	2.2	2.0	116

4.2.6 Conclusion

This study aimed to investigate the factors that affect the development of critical thinking skills in a group of 116 Grade 11 learners from different academic subject streams. The participants included 43 males and 73 females, with an average age of 17.32 years. Males

had a slightly higher average age of 17.69 compared to females, who had an average age of 17.15.

The learners were spread across three academic streams: 32 in Human Sciences and Social Services, 54 in Commerce and Business, and 30 in Science and Technology. They were also categorised based on their enrolment in different types of Mathematics: 38 in Core Mathematics and 78 in Mathematical Literacy. Most participants (n=60) lived in Primrose, a low-income residential area in Gauteng province, South Africa, in the Ekurhuleni Metropolitan.

The participants' commonly spoken home languages were predominantly Nguni languages, spoken by 53 participants. Notably, the language of instruction at Dawnview High School was English, and only eight participants had English as their home language. Other participants spoke Sotho languages (n=43), Venda language (n=2), and Tsonga language (n=8).

All participants completed the Cornell Critical Thinking Skills Test Level X, which comprised 71 items categorised into five groups: 25 inductive reasoning items, 24 deductive reasoning items, 24 observation items, 24 assumption items, and 10 credibility of judgement items.

When analysing the participants' scores on the Cornell Critical Thinking Skills Test Level X, the mean scores across academic subject streams were as follows: 27.1 (SD=8.5) for Human Sciences and Social Services, 29.0 (SD = 9.1) for Commerce and Business, and 37.3 (SD = 7.1) for Science and Technology. The overall mean score for all participants was 30.7 (SD = 9.3). Female participants had a mean score of 30.8 (SD = 9.4), while male participants scored an average of 30.5 (SD = 9.2).

An ANOVA was used to determine if there were significant differences in critical thinking skills test scores among participants in different academic subject groups. The analysis revealed statistically significant differences in critical thinking skills test performance across academic subject streams with F (2,110) = 10.49, p = .001, (p < .05), and

a partial η^2 = .160. This indicates that 16% of the variability in participants' critical thinking skills test scores can be attributed to their enrolment in specific academic subject streams.

A post hoc Tukey honest significant difference test was used to identify where these differences lay within the academic subject streams. The Tukey tests confirmed substantial differences in critical thinking skills test mean scores between participants in the Science and Technology stream compared to those in the Human Sciences and Social Services stream (p = .001; d = 1.30), signifying a mean difference = 10.2 with a standard error = 2.13 and between Science and Technology and Commerce and Business streams (p = .001; d = 1.02) signifying a mean difference = 8.3 with a standard error = 1.90. However, no statistically significant difference was found in critical thinking skills test scores between Human Sciences and Social Services and Commerce and Business streams (p = .563), and the mean difference was 1.9 with a standard error = 1.87. Gender did not show a statistically significant influence on differences in critical thinking skills test scores with F (1,114) = 0.35; p = .554, and the combined effect of gender and academic subject stream was also not statistically significant with F (2,110) = 2.62; p = .078.

Regarding the type of Mathematics, the participants were enrolled in, a t-test revealed a statistically significant difference in critical thinking skills test scores between learners enrolled in Core Mathematics and those in Mathematical Literacy with t (114) = 6.62; p = .001, Cohen's d = 1.31. An effect size of 1.31 is considered a significant effect; participants in Core Mathematics outperformed those in Mathematical Literacy, with mean scores of 37.6 (SD = 7.3) and 27.2 (SD = 8.2), respectively, and the mean difference between the Mathematical groupings was 10.4 with a standard error =1.57.

According to an ANOVA, participants' area of residence did not significantly influence their critical thinking skills scores, revealing an F (2,110) = 0.95; p = .388. The mean score for participants that resided in Primrose was 29.7 (SD = 9.4), the mean score for the 21 participants that resided in Germiston was 33.1 (SD = 7.5), whilst participants living in the *"Other areas"* had a mean score of 30.9 (SD = 10.0). The interaction between gender and

area of residence predictor variables did not have a combined statistically significant influence in participants' test scores F (2,110) = 0.62; p = .539 (p > .05). The mean score of participants residing in Germiston was higher than those living in Primrose and the *"Other areas."*

As participants were also spread into five spoken home language groupings, analysis was also computed to determine if the spoken home language by participants influenced the mean critical thinking skills test scores. The mean score for the Nguni language-speaking participants was 30.0 (*SD* = 9.3), the mean score for the Sotho languages speaking participants was 29.8 (*SD*=9.9), the mean score for Tsonga language-speaking participants was 32.0 (*SD* = 2.8), for Venda speaking participants their mean score was 33.0 (*SD* = 8.4) whilst the mean score for English speaking participants was 36.8 (*SD* = 5.8). An analysis of variance revealed no statistically significant differences in participants' critical thinking skills test scores based on the participants' spoken home language F (4,106) = 1.27 with a p-value = .285 (p > .05).

An analysis of inductive reasoning item scores reveals that the academic subject stream of participants had no statistically significant influence on the difference in participants' mean scores, whilst the type of Mathematics participants were enrolled in statistically significantly influenced the differences in participants' inductive reasoning items scores in the test. The mean score in inductive reasoning items for the Human Sciences and Social Services items was 11.8 (*SD* = 3,6), and for male participants enrolled in the Commerce and Business subject stream, their mean score was 12.7 (*SD*=3.7), whilst the mean score for learners enrolled in the Science and Technology stream was 14.1 (*SD* = 3.0) in inductive reasoning items. The mean score for all participants on inductive reasoning items was 12.8 (*SD* = 3.6). An analysis of variance revealed an F (2,110) = 2.52; p = .085 (p > .05).

An inferential t-test was conducted to examine the influence of the specific Mathematics grouping on participants' mean scores and differences in inductive reasoning items. The results showed a statistically significant difference, with a t (114) value of 3.40 and

a *p*-value of .001. The effect size, which was moderate at 0.67, indicated the statistical significance of this difference. Specifically, participants enrolled in Core Mathematics had a mean score of 14.3 (*SD* = 3.0) on the inductive reasoning items. In contrast, their counterparts in the Mathematical Literacy group had a lower mean score of 12.1 (*SD* = 3.6). The mean difference between these two Mathematical grouping mean scores was 2.3, with a standard error of 0.67.

Participants' gender, area of residence and spoken home language did not significantly influence the difference in participants' mean inductive reasoning scores. The mean score for female participants was 12.6 (*SD* = 3.2), while the mean score for male participants in the inductive reasoning score was 13.2 (*SD* = 4.1), slightly higher than for female participants. However, a *t*-test revealed that the mean difference in inductive reasoning item scores between genders was not statistically significant, with a $t\,(114) = 0.84$; $p = .404$ ($p > .05$). An inferential analysis using an analysis of variance test revealed that neither the participants' areas of residence nor their home language had a statistically significant effect on their inductive reasoning scores. The ANOVA results showed an $F\,(2,110) = 1.87$ and a *p*-value of .160 ($p > .05$) for inductive reasoning items scores based on the area of residence. The interaction of gender and area of residence of participants as predictor variables on inductive items score was also not statistically significant, as revealed by $F\,(2,110) = 1.09$; $p = .339$ ($p > .05$). Similarly, for inductive reasoning items scores based on participants' home language, the test yielded $F\,(4,106) = 1.88$, with a *p*-value of .119 ($p > .05$). The interaction of gender and participant spoken home language did also not yield a statistically significant result $F\,(4,106) = 0.10$; $p = .982$ ($p > .05$).

Participants' Mathematical grouping and the academic subject stream they were enrolled in had a statistically significant influence on differences observed in participants' deductive reasoning mean scores. When considering the 24 deductive reasoning items that formed part of the Cornell Critical Thinking Skills Level X, Core Mathematics learners had a mean score of 11.6 (*SD* = 3.8), whilst the mean score for the Mathematical Literacy learners

was 5.8 (*SD* = 4.4), and this represented a mean difference in mean scores between these Mathematics groupings of 5.8 with a standard error = 0.83. A *t*-test revealed a *t* (114) = 7.02; *p* = .001 with a large effect size of 1.39, signifying that Mathematical grouping had a statistically significant influence on deductive reasoning items. Core Mathematics learners performed better in contrast to their Mathematical Literacy counterparts.

Regarding the influence of academic subject grouping on the deductive reasoning items, an analysis of variance revealed an F (2,110) =12.77; p=.001 with a partial η^2 = .188. The partial η^2 value signified that 18.8% of the variance in participants' mean score difference in deductive reasoning items could be attributed to the academic grouping in which the participants are enrolled. The mean score for Science and Technology participants was 11.6 (*SD* = 3.8), which was significantly higher in comparison to the mean score of 6.3 (*SD*=4.3) observed for the Human Sciences and Social Services learners and also higher in comparison to the mean score of 6.4 (*SD* = 4.9) observed for learners enrolled in the Commerce and Business academic subject stream. However, the mean difference in deductive reasoning scores between the Commerce and Business learners was not significantly different from those of their Human Sciences and Social Services counterparts.

The area of residence, the spoken home language by participants, and gender did not significantly influence the differences observed in the deductive reasoning of participants. For female participants in deductive reasoning items, the mean score was 8.2 (*SD* = 5.0), while the mean score for participants in deductive reasoning items was 6.9 (*SD* = 5.0). This revealed a *t* value (114) = 1.38; p = .170 (p > .05). When considering the area of residence of the participants and the influence on deductive reasoning item score, an analysis of variance revealed F (2,110) = 1.78; p =.174, whilst in considering the influence of participants' spoken home language, the analysis of variance revealed F (4,106) = 0.87; p = .484, signifying a non-statistically significant influence.

The critical thinking skills test also comprises 24 items assessing individuals' observational skills competence. The Mathematical grouping that participants were

categorised in, and the academic subject stream participants were enrolled in were influential in providing a statistically significant difference in observation items' mean scores of participants based on these groups. A *t*-test inferential test on scores based on the Mathematics grouping revealed a t (114) = 3.98; p = .001 (p < .05) with a Cohen d value of 0.79. This result signified a significant effect of the influence of Mathematics grouping on participants' mean score differences in observation items scores. The mean score for Core Mathematics learners was 12.4 (*SD* = 3.0), whilst the mean score for the Mathematical Literacy learners was 9.8 (*SD* = 3.4), and the mean difference between the Mathematical grouping participants in observation items was 2.6 with a standard error = 0.65.

An analysis of variance computed using scores in observation items of participants enrolled in different academic subject streams revealed F (2,110) = 5.28; p = .006, with a partial η^2 = .088, signifying that 8.8% of the variance in the mean score of participants' observation items could be attributed to the academic stream in which the participants were enrolled. The mean score of Science and Technology participants was 12.4 (*SD* = 3.2), and this mean score was significantly higher in comparison to a mean score of 9.5 (*SD* = 3.8) observed for the Human Sciences and Social Service academic subject learners and a mean of 10.3 (*SD* = 3.1) realised for learners enrolled in the Consumer and Business subjects.

Analysis of assumption items scores based on participants' gender revealed a t (114) = 1.10, p = .272 (p > .05), signifying that gender did not influence statistically participants' mean scores in assumption items. The mean score for female participants was 10.4 (*SD* = 3.7), whilst the mean score for male participants was 11.1 (*SD* = 3.1). The mean difference was 0.7, with a standard error = 0.67.

However, the participants' Mathematical grouping and the academic subject stream had a statistically significant influence on assumption items scores as revealed by t (114) = 4.06; p = .001 (p <= .05) with a Cohen d = 0.80 signifying that Core Mathematics participants (mean score = 12.5, *SD* = 3.0) performed better in assumption items in comparison to their Mathematical Literacy counterparts (mean score =9.8, *SD* = 3.4). The

mean difference in assumption items between the two Mathematics groups was 2.6 with a standard error = 0.65. Regarding the influence of the academic subject stream, an F (2,110) = 5.47; p = .001 was revealed, with a partial η^2 = .090, signifying that 9% of the variance in assumption item scores can be attributed to the academic subject stream in which the participants were enrolled. Participants enrolled in the Science and Technology academic subject stream (mean score 12.5, *SD* = 3.2) performed better in assumption items than their counterparts in the Human Sciences and Social Services and Commerce and Business academic subjects. The mean score in assumption items for Human Sciences and Social Services participants was 9.5 (*SD*=3.8), whilst for the Commerce and Business participants was 10.4 (*SD* = 3.1). Participants' area of residence and spoken home language did not statistically influence assumption items scores, as evidenced by the following results: F (2,110) = 0.35; p = .703 (p > .05) and F (4,106) = 0.99; p = .418 (p < .05) respectively.

When the credibility of judgement scores was analysed, a t-test revealed that participants' gender did not have a statistically significant influence on differences in participants' scores. The result of the t-test was t (114) =1.68; p = .095 (p>.05). The mean score for female participants was 2.4 (*SD* = 1.9), whilst for male participants, the mean score was 1.7 (*SD* = 2.1), and this signified a mean difference of 0.6 with a standard error of 0.38.

The type of Mathematics and academic subject stream the participants were enrolled in had a statistically significant influence on differences observed in participants' mean scores on the credibility of judgement items. The mean score for the Core Mathematics learners was 3.5 (*SD* = 1.7), whilst the mean score for learners enrolled in Mathematical Literacy was 1.5 (*SD* = 1.8). This revealed a t-value (114) = 5.50, p = .001 (p < .05) with a large Cohen's d = 1.09. Regarding the academic subject stream, the participants were enrolled in an ANOVA test that revealed the following F (2,110) = 7.08; p = .001 (p < .05) with a partial η^2 = .114, signifying that 11.4% of differences in mean credibility of judgement items scores could be attributed to the academic subject the participants were enrolled in. The mean score for the Science and Technology learners was 3.4 (*SD* = 1.8), and these

learners performed significantly better when compared to their counterparts enrolled in the Human Sciences and Social Services academic subjects stream, whose mean score was 1.9 (*SD* = 2.0), and also better that their Commerce and Business academic subject stream counterparts with a mean score of 1.6 (*SD* = 1.8). There were no statistically significant differences in mean scores between Human Sciences and Social Services learners and those enrolled in the Commerce and Business academic subject stream. The area of residence and recognised spoken home language did not statistically significantly impact the mean differences in the credibility of judgement items score. This was evident from the results of the analysis of variance (ANOVA), where F (2,110) = 0.03 with a p-value of .973 ($p > 0.05$) for the area of residence, and F (4,106) = 1.96 with a p-value of .106 ($p > .05$) for the recognised spoken home language.

CHAPTER 5

QUALITATIVE RESULTS

5.1 Presentation of Findings from the Qualitative Phase of the Study

This section presents the findings derived from the qualitative phase of the study. Following the analysis of interview phase data, which the researcher transcribed, several factors perceived to be influencing the development of critical thinking skills in learners were identified from the focus group interviews. These factors include the choice of academic subject stream, community engagement, parental involvement, and differences in thinking skills among participants based on their enrolled academic subject group and other independent variables explored in this research.

5.1.1 Academic Subjects Stream Selection Processes

Future career aspirations primarily guided the participants' selection of academic subjects. However, some participants also emphasised personal interests and the desire to establish a robust conceptual knowledge and skills foundation. For instance, Participant 18 articulated, *"I also considered my future career goals. I have always been enthusiastic about pursuing a medical career, making biology a crucial subject for me."* This sentiment was also echoed by Participant 71, who stressed, *"Mathematics and English are often considered foundational subjects that enhance critical thinking, problem-solving, and communication skills. These skills are valuable in almost any profession, and I expect to use these skills when I start working,"* highlighting their intent to lay the groundwork for adaptable skills, diverse explorations, and a solid knowledge base through their Grade 11 subject choices.

Many participants sought guidance from their parents, guardians, and mentors in determining their academic subject streams. This consultation ensured that participants' academic subject stream aligned with their envisioned career paths. Participant 18 recounted, *"I consulted my teachers, mentors, and family members while choosing subjects.*

Their insights provided a broader perspective on the benefits and relevance of each science subject."

Interestingly, a subgroup of participants lacked the autonomy to select their academic subject streams, as the school dictated specific streams for them. Participant 136 shared the challenge of being assigned the Human Sciences and Social Services stream by the school and noted, "*Choosing subjects for social sciences was a challenging experience for me, primarily because the school selected them on my behalf."* Despite facing difficulties and lacking motivation due to this assignment to a subject stream, participant 136 mentioned that they have remained resilient and made the most of the situation.

Beyond mere career alignment, Participant 96 unveiled that their subject preferences were influenced by a higher purpose: comprehending and addressing societal inequalities and injustices and contributing to community betterment. Participant 96 said, *"I am grateful for the knowledge and skills I am gaining in social sciences subjects. In fact, education is a powerful tool that can help break the cycle of poverty, and I am determined to use it to create a better future for myself and my family."*

These accounts from the interviews highlighted that the choice and enrolment in academic subject streams were not always driven by the explicit intention to nurture critical thinking skills in individuals.

In summary, participants' decisions about the choice of academic subject stream they enrolled in were predominantly guided by career aspirations, personal interests, and the desire for foundational knowledge related to envisaged future careers. While seeking external guidance was expected, the interviews revealed cases where autonomy in subject selection was limited. Notably, a participant's quest for societal impact added depth to the subject choice narrative, highlighting diverse motivations beyond career prospects. Despite the prevalent notion that academic subjects can foster critical thinking, the interviews illuminated a broader array of driving factors learners consider when selecting an academic stream.

5.1.2 Gender-Influencing Critical Thinking Skills Abilities in Individuals

Different perspectives emerged regarding the relationship between gender and developing critical thinking skills. Participant 136 firmly believed that both boys and girls demonstrated similar thinking capabilities. This was reflected in their school's practice of mixing genders in classes and administering identical assessments. Participant 136 remarked, *"We think in the same way, Sir. That is why we are mixed in the classes at this school and write the same type of exams. No one is better at thinking between boys and girls."* However, contrasting viewpoints were present among other participants, particularly concerning male learners' behaviour and academic performance.

Participant 96 expressed that boys might not excel in critical thinking skills, attributing this to their perceived tendency to prioritise sports success, like becoming skilled soccer players, for financial gain. Participant 96 stressed, *"It is not that boys do not think, but it is better to forget about school and become a soccer player and make more money; all girls like money."* This perspective insinuated that male learners were more money-driven. Participant 40 reinforced this perspective by saying, *"If you look at some of the things men in this country do, it seems they do not think at all. You see them urinating everywhere, and these days, if you do not respond when they greet you, they beat you. People who think do not do that to others, and most men think that drinking alcohol is cool and do not want to look for jobs. Sir, even coming to school to them is a waste of time, so I think we, as women, are better thinkers,"* indicating that some men's actions, such as public urination and resorting to violence, displayed poor decision-making abilities. Participant 96 also suggested that men sometimes preferred drinking alcohol over seeking employment. According to them, women demonstrated superior thinking skills. Taking this a step further, Participant 135 explained, *"As boys, we always want to appear as we think a lot, but I do not think we are better than girls. If you look at my science class, there are only 8 or 10 boys who do physical sciences, and there are more than 30 girls in that class, so I think girls are better than boys."* In this, Participant 135 highlighted fewer male learners enrolled in the Science

and Technology academic subject stream than females in the same academic stream. To them, this implied that females had higher levels of critical thinking skills.

In essence, the study revealed a range of viewpoints about the connection between gender and critical thinking. While one participant believed all genders to be equal in their critical thinking skills and abilities, others pointed to perceived gender-based behaviours as indicators of differing critical thinking skills.

5.1.3 Defining Critical Thinking Skills

During the discussion on the definition of critical thinking skills, Participant 135 shared insights from their educator that highlighted the importance of recognising underlying assumptions as crucial components of critical thinking skills. Participant 135 emphasised that questioning assumptions is essential for uncovering misconceptions and facilitating well-informed choices. When the researcher probed further about questioning assumptions and what constitutes an assumption, Participant 71 responded by drawing a parallel to situations where people discuss someone's stories without proof, terming them as assumptions requiring evidence. This act of seeking evidence was described as questioning assumptions.

Additionally, Participant 71 contributed their perspective on critical thinking skills and noted*, "I think critical thinking skills refer to the ability to objectively analyse, evaluate, and interpret information or situations that you are given anywhere. Critical thinking also involves actively questioning ideas from others and, of course, your own ideas, considering different perspectives, and making reasoned judgements based on evidence."* Notably, Participant 71 emphasised the active involvement of questioning both external ideas and one's own while also considering diverse viewpoints. Participant 71 explained, "*This process culminates in making decisions grounded in evidence."* According to them, the development of critical thinking skills leads to improved troubleshooting abilities, decision-making, and the nurturing of independent thought.

Furthermore, Participant 71 argued that critical thinking is a crucial ability that enables individuals to scrutinise and resolve issues in their surroundings, including educational environments. Participant 71 stressed its pivotal role in tackling challenges, driving scientific exploration, and navigating decisions, particularly in fields like science and technology. In essence, Participant 71 underlined how critical thinking enhances problem-solving skills and empowers individuals to make informed choices based on evidence, playing a vital role in various aspects of life.

5.1.4 Comparison of Academic Intelligence and Critical Thinking Skills

During the qualitative phase of the study, participants drew attention to a significant difference between academic intelligence, which comes from focusing on a specific academic field, and critical thinking skills. One of the participants, Participant 5, pointed out that "*Academic intelligence often emphasises mastering the content, memorising facts, and performing well on standardised tests, often achieved through repetitive learning*." While Participant 5 noted that proficiency in academic intelligence is crucial for excelling in exams, the participant explained that it mainly demonstrates expertise in a particular academic subject without necessarily indicating strong critical thinking skills.

Another participant, Participant 71, shared similar views, elaborating that critical thinking involves abilities like questioning assumptions, assessing information, and interpreting data. Even if someone possesses academic intelligence, it does not automatically ensure proficiency in critical thinking skills. Participant 5 highlighted, *"Certain learners might excel academically but struggle with critical thinking, while others with lower academic achievements might possess remarkable critical thinking abilities."* Participant 71 also said, *"I am not suggesting that those skilled in math or science lack thinking skills, but it is not the same. Being able to think is an advantage, and then adding intelligence amplifies it. I wish I had that capability."*

In essence, participants in the study emphasised that excelling academically and having strong critical thinking skills are distinct qualities. Academic success involves

mastering subject-specific content and performing well on exams, while critical thinking involves questioning assumptions, evaluating information, and interpreting data effectively. These skills do not always go hand in hand; someone can excel academically without being a strong critical thinker, and vice versa.

5.1.5 Impact of Academic Subject Streams on the Development of Critical Thinking Skills

In the insightful discussion held during the focus group interview, participants expressed a unanimous sentiment that the development of critical thinking skills is a trait influenced by various academic subjects. Participant 135 highlighted the role of Business Studies in developing critical thinking skills by saying, "*Intricate analysis of real-world economic systems and policies, coupled with the formulation of theoretical solutions, serves as a catalyst for developing critical thinking skills."* The ability to analyse is a hallmark of this cognitive skill set.

Echoing this sentiment, Participant 40 shed light on the profound impact of Physical Sciences. Delving into the fundamental laws governing the universe necessitates analysing complex phenomena, applying mathematical principles, and forging logical connections. This scientific realm compels individuals to scrutinise cause-and-effect relationships, explore diverse avenues for solving problems, and assess the legitimacy of scientific models and theories. Herein lies a testament to the role of science and technology subjects in nurturing critical thinking abilities.

In the Human Sciences and Social Services academic stream, as exemplified by subjects like History and Geography, Participant 65 emphasised how historical analysis involves interpreting data from primary and secondary sources, challenging the veracity of historical narratives, and drawing insightful conclusions about the origins and repercussions of past events. This dynamic process often finds its expression in vigorous debates, providing a platform for refining critical thinking. In Geography, the art of deciphering maps emerges as a significant exercise that cultivates these skills.

Notably, learners pursuing Commerce and Business studies emphasised their exposure to methodologies for evaluating the repercussions of economic policies. This practical application underscores the capacity of academic disciplines to nurture critical thinking. Furthermore, proficiency in problem-solving, often exemplified in deciphering information from contextual cues, as commonly observed in Mathematics and scientific subjects, emerged as a pivotal component.

The consensus reached among participants during this enlightening discourse underscores the holistic nature of critical thinking development. Through diverse subjects spanning Business Studies, the sciences, History, Geography, and more, learners are equipped with multifaceted tools for analytical assessment, logical reasoning, and creative problem-solving, a testament to the far-reaching influence of academic education on the cultivation of critical thinking skills.

5.1.6 Parental Involvement in the Development of Critical Thinking Skills

Participants generally reached a consensus on the importance of parental involvement in shaping the development of critical thinking skills in their children. Participants in the focus group interviews recognised numerous ways in which this involvement could impact thinking abilities. One of the critical factors was parents setting a positive example by demonstrating thoughtful decision-making and engaging in open debates and discussions with their children.

Participant 135 highlighted the significance of parents exemplifying thoughtful thinking. Participant 135 mentioned that parents should not just impose punishments without considering the situation thoroughly but try to understand things from their children's perspective and acknowledge that mistakes are a part of growing up. This form of parental involvement extended to creating opportunities for children to practice their critical thinking skills and recognise that their thinking is influenced by their own life experiences, which may differ from the past experiences that shaped their parents' thinking skills.

Moreover, Participant 5 offered insights into another dimension of parental involvement—financial support. Participant 5 explained that parents providing resources like internet access could be seen as a way to facilitate their children's access to information for developing critical thinking skills. As Participant 5 put it, accessing the internet allowed them to find information on essential topics, which could be more dynamic than traditional book reading.

Parental financial involvement extended beyond just information access. It encompassed aspects such as ensuring proper nutrition, healthcare, and access to quality education. These provisions played a role in nurturing an environment conducive to developing critical thinking skills. In essence, participants collectively acknowledged that parental involvement, ranging from setting a thinking-oriented example to offering resources for information and overall well-being, played a vital role in fostering the development of critical thinking skills in young individuals.

5.1.7 Income Status of Individuals and its Influence on the Development of Critical Thinking Skills

The financial circumstances of an individual play a significant role in determining the resources accessible to them. This notion was highlighted by Participant 40, who identified it as a crucial factor influencing the development of critical thinking skills in individuals. Those with a favourable income status can access well-equipped educational institutions staffed by educators adept at nurturing critical thinking abilities. As Participant 40 noted, such schools often integrate disciplines like coding into their curriculum, recognised for their potential to influence the development of critical thinking skills.

Additionally, the ability to undergo specific medical procedures to enhance critical thinking abilities is more attainable for those with a favourable income status, as emphasised once again by Participant 40. When asked about the nature of medical procedures, the participant did not provide a specific procedure but mentioned the use of prescription pills such as Ritalin, usually prescribed to improve one’s concentration.

The development of critical thinking skills is also markedly shaped by one's life experiences, as these encounters mould one's perspectives when confronted with novel situations that demand such skills. Participant 96 mentioned, *"Being wealthy is an advantage. Have you seen some of the things we are asked about in the test? Some of us have never experienced them in tourism; they will ask you about time zones."* Participant 96 did not understand why some places have their own times, and he said, *"Nevertheless, there is this guy in our class who explained to me that he once went to another country and arrived there the previous day as our times are different or something like that. So, it is better for them as they experience many of these things as they have the money to travel everywhere."* This underscores that limited exposure to a range of experiences can detrimentally affect the development of critical thinking skills. However, the opportunity to partake in diverse experiences hinges on the individual's income status.

Interestingly, Participant 136 introduced a dissenting viewpoint. Participant 136 posited that a lack of economic resources catalyses individuals to engage in critical thinking, especially compared to their wealthier counterparts. Participant 136 observed that those in poverty develop an adeptness at critical thinking skills as they strive to break free from the cycle of poverty. This perspective contrasts with the idea that individuals of higher income status are inherently better critical thinkers.

Another intriguing angle was brought up by Participant 65, who noted that individuals with substantial incomes often command respect within their communities and remarked, "To me, all rich people think better than other people. Have you ever seen that when rich people say something or give someone advice on solving problems, everyone listens to them and agrees with them?" The opinions of those perceived to be rich and their solutions are held in high regard merely due to their elevated financial standing, projecting an image of them as adept critical thinkers. This highlights how perceptions of critical thinking can be influenced by socioeconomic status.

5.1.8 Community Involvement in the Development of Critical Thinking Skills

The importance of active community involvement in daily activities has been widely recognised among most interview participants. Focus group participants emphasised that this engagement significantly shapes individuals' critical thinking skills within these communities. A key insight from Participant 102 highlighted that communities fostering the positive development of thinking skills prioritises inclusivity, irrespective of gender, age, or race. This inclusive environment allows diverse individuals to bring unique problem-solving approaches to situations. Through communal discussions and exchanges, these diverse approaches transform into shared experiences that community members can incorporate into their thinking processes, thereby developing and enhancing their thinking skills.

Participant 71 underscored the impact of personal lessons and experiences acquired within their communities and cultural values on their thinking processes. This underscores the role of collective life experiences in nurturing and honing thinking skills. Furthermore, certain community members have expertise in critical domains such as education and healthcare. Participants saw interaction with these knowledgeable individuals as a way to ease the transfer of skills that can significantly influence the development of thinking skills in other community members.

Addressing prevailing community challenges, such as gender-based violence, drug abuse, crime, and poverty, can directly influence the decisions when selecting an academic subject stream for enrolment. Participant 96 strategically chose subjects he/she believed could enhance their critical thinking skills to cultivate problem-solving abilities that effectively address the issues impacting their communities.

Participating in community discussions, debates, and constructive exchanges of differing viewpoints was generally noted to impact the cultivation of critical thinking skills positively. However, Participant 135 brought attention to the influence of their life experiences, characterised by exposure to drugs and violence, which has led to unconventional problem-solving methods. This unique context also plays a role in shaping

how critical thinking skills develop. Participant 135 highlighted, *"In my area, problem-solving often involves actions like burning tyres, and I do not believe there is much critical thinking in that approach."*

In summary, the active engagement of community members in their daily activities is a driving force behind the development of critical thinking skills. The promotion of inclusivity, exchange of diverse viewpoints, and interaction with domain experts all contribute to enhancing these skills. However, unique life experiences and exposure to certain challenges can result in unconventional approaches to problem-solving, underscoring the complex interplay between community dynamics and the development of thinking skills.

5.1.9 Pedagogy for Critical Thinking Skills and the Influence of Participant Home Language

The educational system is strategically positioned to incorporate teaching methods to nurture learners' critical thinking abilities. This inclusion is crucial and can either be integrated into the academic subjects learners are enrolled in, as highlighted by Participant 102, or introduced through extracurricular activities, as suggested by Participant 18.

Participants' views vary regarding the language used for teaching and learning, particularly when fostering critical thinking skills. Some participants, like Participant 136, express a preference for teaching in their home language. However, there is a challenge posed by the language policy of Dawnview High School, which designates English as the official home language despite most participants (30.31%) speaking Isizulu at home, as shown in **Table 4. 1**. This language barrier and diversity in recognised home languages can hinder effective pedagogy for critical thinking skills.

Although using learners' home language is generally well-received, participant 18 notes a potential drawback related to collaboration and communication. Since critical thinking is closely tied to collaborative competence, it is vital to establish a common language for effective interaction and learning, especially considering the frequent mobility of individuals in today's urbanised world.

Participant 40 emphasises the importance of incorporating activities within schools that provide scenarios for learners to exercise their thinking skills. However, participant 65 suggests that this does not necessarily require a new subject; instead, workshops focused on enhancing critical thinking skills could be organised to alleviate the burden that can be caused by having the development of critical thinking skills as an additional subject. Moreover, participant 136 notes that certain educators might struggle to teach critical thinking skills effectively. Schools could involve external experts in critical thinking skills pedagogy as a solution.

In summary, the educational system has a unique opportunity to embed critical thinking skills development in its pedagogical approach. Balancing language considerations, collaboration needs, and practical skill-building methods will be pivotal in equipping learners with the vital skill of critical thinking.

5.1.10 Conclusion

The qualitative phase of the study highlighted that the participants' career aspirations strongly influenced their choice of academic subject streams. When selecting these subjects, their primary focus was acquiring conceptual knowledge and foundational skills aligned with their career goals. Notably, there was no mention of the intention to nurture and develop critical thinking skills. Participants sought guidance from mentors, parents, and guardians, and the advice the participants received was primarily geared toward aligning their academic subject streams with their career aspirations rather than emphasising the development of critical thinking abilities. Interestingly, participants' choice of academic subject streams was sometimes driven by their desire to address injustices and social inequalities they observed in their communities rather than solely aiming to develop critical thinking skills.

In some instances, the autonomy to choose their academic subject streams was taken away from the participants, especially for students who were academically challenged or repeating Grade 11, by the school management team who assigned them to specific streams,

notably the Human Sciences and Social Services subject stream which is perceived to be less academically challenging.

A few participants noted that gender was not a significant factor in their development of critical thinking skills. However, many participants observed that behaviours they encountered in their communities, particularly among male students, often reflected a lack of critical thinking in their actions.

Participants unanimously agreed that critical thinking skills manifested in individuals who excelled in analysing information, evaluating data, problem-solving, questioning assumptions, and making well-informed decisions. Academic excellence and possessing critical thinking skills were recognised as distinct qualities in individuals. Academic intelligence was defined as mastery of subject-specific content, while critical thinking skills encompassed the competence to analyse and interpret information, make decisions based on valid observations and assumptions, and question assumptions. Moreover, participants acknowledged that the subjects offered in different academic streams inherently provided opportunities for developing critical thinking skills. Subjects like History, Geography, English, Mathematics, Physical Sciences, Accounting and Business Studies, among others, were identified as requiring analytical skills, evaluative skills, inductive and deductive reasoning for academic excellence. Participants noted that these subjects offered them opportunities to practice and develop critical thinking skills through valid observations and assumptions within controlled environments.

Parental involvement was deemed a crucial component in fostering the development of critical thinking skills in participants. Parents were expected to be practical and demonstrate competence in their critical thinking skills, serving as role models for participants to emulate and develop their critical thinking skills. It was also noted that parents should provide opportunities for participants to showcase their critical thinking skills.

Additionally, financial support from parents and guardians played a significant role in nurturing critical thinking skills. This support extended to providing resources, nutrition, access to technology, well-resourced academic institutions, medical care, and basic necessities for participants. However, this support was challenging for many participants residing in low-income communities. Financial support was also recognised as vital in exposing individuals to various scenarios, helping them develop a broader understanding of how the world works, which some participants considered crucial for addressing novel problems.

Participants emphasised the importance of a community-based approach to foster critical thinking skills. Participants noted that communities valuing inclusivity and collaboration were better equipped to address pressing issues such as gender-based violence and the spread of drugs. Participants believed that by working together within their communities to tackle these problems, individuals could learn and develop critical thinking skills from more experienced community members.

Furthermore, participants recognised the value of diverse cultural perspectives within their communities. Participants pointed out that people from various cultural backgrounds bring unique Indigenous knowledge to problem-solving, which can benefit the community by enhancing their problem-solving abilities and critical thinking skills.

Incorporating educational institutions into this community approach, participants noted a deficiency in pedagogy specifically designed to nurture critical thinking skills. Participants emphasised the need for educators to receive training to integrate critical thinking skills instruction effectively across different academic subjects and disciplines.

During discussions about implementing this pedagogy, the issue of language and teaching methods arose. Some participants advocated for teaching critical thinking in their home languages, while others expressed concerns about the drawbacks of this approach, especially in a globalised and urbanised environment where people from diverse linguistic backgrounds constantly communicate and collaborate. Some participants recognised that

language could be a barrier to information-sharing, a fundamental aspect of developing critical thinking skills.

CHAPTER 6

DISCUSSION

The primary objective of this study was to discern the factors related to the critical thinking skills of Grade 11 learners enrolled in different academic subject streams. Moreover, the study sought to elucidate the mechanisms and reasons underlying how these factors are perceived to be related to the participants' critical thinking skills. This section comprehensively addresses the research questions by integrating quantitative data analysis results and qualitative data findings.

6.1 Academic Subject Stream and Mathematical Grouping Influencing the Development of Critical Thinking Skills (Research Question 1)

In addressing the research question, 'Is there a statistically significant difference in the critical thinking skills test performance of Grade 11 learners enrolled in different academic subject streams?', a notable discovery in this study was a statistically significant difference in Grade 11 learners' performance on a critical thinking skills test based on their academic subject streams. This finding echoes the conclusions drawn by other scholars, including Forawi (2016), Duran and Dökme (2016), and Wilmes and Siry (2018). Notably, students in the Science and Technology stream outperformed their peers in the Commerce and Business and Human Sciences and Social Services streams. Forawi (2016, p. 8) reported that a relationship between academic subject groupings and individuals' perceived possession of critical thinking skills can be attributed to processes experienced when learning in specific subject domains such as Science and Technology. Forawi (2016) explained that inquiry-based learning methods used in teaching Science and Technology were related to the possession of critical thinking skills by individuals enrolled in such academic groupings. Through inquiry-based learning, individuals develop critical thinking skills by logically establishing relationships between evidence from scientific investigations and explanations. This was also echoed by Duran and Dökme (2016), who reported that inquiry-based learning was significantly related to critical thinking skills processes, especially when the learning

methods are integrated into subject domain knowledge pedagogy, such as in Science and Technology. In South Africa, the pedagogy for the Science and Technology academic subject stream is guided by the objectives outlined in curriculum policy statements (Department of Basic Education, 2011c). The objectives outlined by the Department of Basic Education (2011c, p. 8) for Physical Sciences include designing investigations, drawing and evaluating conclusions, formulating models, hypothesising, identifying and controlling variables, inferring, observing, comparing, interpreting, predicting, problem-solving and reflective skills. These objectives can be effectively addressed through inquiry-based learning. The scientific inquiry approach utilised in teaching Science and Technology subjects also fosters open-mindedness, theory analysis, model-based problem-solving, peer interactions, and substantiating arguments with sound reasoning competencies that enhance metacognition and key indicators of critical thinking skills. The scientific inquiry teaching approach necessitates individuals to hypothesise, collaborate in their working groups, and be creative. These are abilities and dispositions that are related to the possession of critical thinking skills by individuals, as articulated by Ennis (2016). Thus, this approach could explain the differences in participants' critical thinking skills based on the academic subject stream in which they were enrolled. However, due to this study's low average critical thinking skills test scores, the notion of inquiry-based learning being implemented in classrooms is questionable. This study could not ascertain if pedagogy in different academic subject groupings was inquiry-based, as the Department of Education envisaged.

However, interview participants emphasised an interesting aspect: that all academic subject streams offer opportunities to develop the essential competencies required for critical thinking skills, similar to those in the Science and Technology stream. This observation raises questions about whether pedagogical methods aimed explicitly at nurturing critical thinking skills may be lacking in other academic subject streams, as some participants noted that some educators' inability to foster analytical skills, which are vital for critical thinking. LaPoint-O'Brien (2013, p. 3) noted that in some instances, teachers miss the focal point of

teaching, which is nurturing the development of critical thinking skills by mainly focusing on teaching for memorisation with few resources dedicated to developing critical thinking skills, and this could be argued to explain differences in critical thinking skills in participants as some teachers might not necessarily possess the skills to impact pedagogy aimed at fostering critical thinking skills in individuals.

Furthermore, the study explored how participants select their academic subject streams. Participants in the interview phase highlighted that their choices were primarily influenced by career aspirations and a desire to address community issues rather than a specific focus on developing critical thinking skills. Admission to particular subject streams is primarily based on academic performance in Grade 9 summative assessments, particularly for learners enrolling in the Science and Technology stream. Some scholars, such as Kettler (2014), Changwong et al. (2018), and Rodzalan and Saat (2015), have noted that academic achievement is closely related to an individual's critical thinking skills. Kettler (2014, p. 113), in a study that utilised the Cornel Critical Thinking Skills Test Level X among fourth-grade learners in Texas, reported that academically gifted learners performed significantly better when compared to their general education counterparts and the duration of exposure to the gifted learners learning program was not significantly related to achievement in the critical thinking skills test. Considering that enrolment in a particular academic subject stream is based on participants' Grade 9 summative assessments, it can be argued in this study that generally gifted learners tend to perform better in Grade 9 summative assessments, and their enrolment in the Science and Technology academic subject stream is independent of their performance in the assessment used in this study but related to their inert giftedness in analysing and solving problems.

Finally, the school management team assigned some academically weaker students to subjects that are perceived to be less academically demanding, such as the Human Sciences and Social Services stream. This could explain why the learners enrolled in the other academic subject streams did not perform as well in the Cornell Critical Thinking Skills Test

level X as their peers in the Science and Technology stream – they might not have been naturally gifted. Therefore, in this regard, variations in students' critical thinking skills could be attributed to differences in their natural giftedness in analysing, evaluating, and solving problems rather than the academic subject groupings in which they are enrolled.

One notable difference between learners in the Science and Technology stream and their peers in other subject streams is the compulsory inclusion of Core Mathematics in the former stream. In contrast, most of their peers in other streams predominantly enrol in Mathematical Literacy. Students in the Core Mathematics group performed better than those in the Mathematical Literacy group. These findings align with the work of Vong and Kaewurai (2017), who suggest that Mathematical activities such as Euclidean geometry, trigonometry, probability, calculus, and algebra stimulate the need to devise solutions and critically evaluate their credibility. Core Mathematics in the Further Education and Training curriculum in South Africa involves solving complex, non-routine problems requiring individuals to identify information gaps and apply mathematical concepts as stipulated in the Department of Basic Education (2011b, p. 9), where some of the main focus topics do include Euclidean geometry, trigonometry, probability, calculus, and algebra. This ability to identify information gaps is part of the knowledge construction strand of the critical thinking skill development framework (Heard et al., 2020), underpinning this study. Core Mathematics further deals with abstract concepts, strengthening inductive and deductive reasoning competencies grounded in observations and observations leading to logical reasoning and critical thinking, as noted by scholars such as Naidoo and Makonye (2022) and Wenglinsky (2004), whilst Mathematical literacy focuses primarily on the practical daily application of basic or routine arithmetic procedures, and this does not usually require the same depth of cognition that leads to the development of critical thinking skills.

6.2 Gender as a Factor Influencing Development of Critical Thinking Skills (Research Questions 2,3 and 4)

Regarding gender-based differences in critical thinking skills test performance, this study revealed no statistically significant impact based on gender. This result aligns with the findings of authors like Liu et al. (2019) and Peerbolte and Collins (2013), suggesting that an individual's gender does not inherently influence complex cognitive processes like critical thinking skills. In this study, considering that participants are exposed to the same curriculum in different academic streams and societal experiences are also similar regardless of their gender, it can be concluded that the gender roles of participants are not significant and do not influence differences in critical thinking skills. Liu et al. (2019) concurs that gender differences are unrelated to critical thinking abilities. In this study, all individuals, irrespective of gender, can develop the analytical, evaluative, and problem-solving skills necessary for critical thinking. Other scholars, such as Gallagher et al. (2000), have noted that males are likelier to use logic when working on equations and algebra, which are vital in developing thinking skills in non-conventional contexts. This was not the case in this study as no significant differences were identified in both types of mathematics; hence, gender does not appear to be related to the critical thinking abilities of individuals. Although the perception of the focus group interview participants was that male behaviours in their communities could be construed to indicate a lack of critical thinking skills, there was no evidence to support this assertion by participants.

6.3 Recognised Spoken Home Language as a Factor Related to Critical Thinking Skills of Learners Enrolled in Different Academic Subjects Streams (Research Questions 2,3 and 4)

In this study, the participants achieved a relatively low overall mean score of 30.65 (with a standard deviation of 9.289) on the Cornell Critical Thinking Skills Test Level X. To contextualise this score, it was compared to a mean of means score of 43.70 (with a standard deviation of means = 5.3) reported by Ennis et al. (2005) who collected data from 16

investigations involving Grade 10 to Grade 12 students in the United States. It is important to note that this comparison was necessary since no South African norm group was available for reference.

The lower performance of the participants in this study could be attributed to several factors, such as the language of instruction and the participants' socioeconomic status. Most participants hailed from low-income residential areas and primarily spoke African languages such as Nguni, Sotho, Tsonga, and Venda languages, while the language of instruction at Dawnview High School is English. This aligns with the observations of Grosser and Nel (2013), who noted that lack of proficiency in English and an individual's recognised home language negatively impacted participants' overall performance in a study examining the influence of language on critical thinking skills. Similarly, in this study, the language used for the test may have caused participants to struggle with some questions and expressing their ideas. Some learners had a perception that if pedagogy in the different academic subject domains was delivered in their home languages, it could benefit their thinking skills.

6.4 Socioeconomic Status as a Factor Related to Critical Thinking Skills of Learners Enrolled in Different Academic Subject Streams (Research Questions 2,3 and 4)

The participants' socioeconomic status may have played a significant role in developing critical thinking skills. Scholars like Gelerstein et al. (2016), Hernandez (2011) and Grantham-McGregor et al. (2007) have emphasised the influence of socioeconomic factors on the development of critical thinking skills. Gelerstein et al. (2016, p. 16) reported a statistically significant relationship between the socioeconomic status of individuals and the development of critical thinking skills. Socioeconomic status is primarily based on families' income, which governs resources available to individuals at home and schools deemed influential in developing critical thinking skills, such as nutritious, healthy food, information and technology resources and better health facilities. In low-income families, limited resources, including housing, food, clothing, and educational supplies, hinder the

development of academic skills, which are integral to critical thinking skills. The lack of resources due to low income, lack of parental support and community involvement stifles the development of critical thinking skills, as noted by Naidoo and Makonye (2022). The participants perceived the link between socioeconomic status and developing critical thinking skills as a crucial barrier. A significant number of those interviewed highlighted that their personal experiences directly impacted their critical thinking ability. Similarly, students from wealthier backgrounds noted that their access to resources like high-speed internet, international travel, and superior healthcare, afforded by their family's financial situation, significantly shaped their problem-solving abilities in new situations.

CHAPTER 7

CONCLUSION

7.1 Summary of Findings

This explanatory sequential mixed methods study sought to uncover and clarify factors related to the critical thinking skills of Grade 11 learners in different academic subject streams and, secondly, to attempt to explain how and why these factors are perceived by Grade 11 learners to be related to their critical thinking skills.

RQ1. Is there a statistically significant difference in the critical thinking skills test performance of Grade 11 learners enrolled in different academic subject streams?

The primary findings indicated a statistically significant difference in the performance of 116 participants on a critical thinking skills test, with outcomes varying based on their chosen academic subject stream and mathematical grouping. Notably, participants in the Science and Technology stream outperformed those in the Commerce, Business, Human Sciences, and Social Services streams. Participants enrolled in Core Mathematics also demonstrated statistically significant performance in a critical thinking skills test compared to those in Mathematical Literacy. Since most participants in the Science and Technology stream were enrolled in Core Mathematics, while most participants in the other streams took Mathematical Literacy, the difference observed between the different academic streams could be explained by the type of mathematics they were enrolled in. However, the participants interviewed in this study held a general perception that critical thinking skills are independent of the type of mathematics one is enrolled in, as the Department of Basic Education advocated for inquiry-based learning in both types of mathematics. All participants' average critical thinking skills test scores were generally low; therefore, this study could not ascertain the impact of enrolling in a specific type of mathematics grouping and subsequent relationship to better thinking skills.

Insights gleaned from focus group interviews revealed that participants often selected their academic subject streams based on career aspirations and the desire to acquire relevant conceptual and knowledge skills. However, parents, guardians, teachers, and community members heavily influenced this decision-making process. Many participants expressed a lack of autonomy in subject selection, with school management teams often assigning learners to specific streams based on Grade 9 academic achievements, with the more capable learners being supported to select Science and Technology. In cases where autonomy was limited, students tended to opt for perceived easier streams such as Commerce, Business, Human Sciences, and Social Service, which could partly account for their lower scores.

RQ2. What factors relate to the critical thinking skills of Grade 11 learners enrolled in different academic subject streams?

RQ3. How are these factors related to the critical thinking skills of Grade 11 learners enrolled in different academic subject streams?

RQ4. Why are these factors perceived to be related to the critical thinking skills of Grade 11 learners enrolled in different academic subject streams?

Surprisingly, factors such as gender, primary language spoken at home, and residential area did not have a significant impact on participants' performance in the Cornell Critical Thinking Skills Test Level X, although participants believed that their lived experiences within their communities influenced their problem-solving approaches and analytical abilities, both aspects of critical thinking.

Socioeconomic factors, particularly family income, were highlighted by participants as significant in determining the availability of resources essential for critical thinking skills development. Participants from low-income backgrounds reported experiencing deprivation of basic necessities like shelter, nutrition, healthcare, and educational materials, which they perceived as hindering their cognitive development, although the quantitative findings of this study do not directly support this. However, the study also noted a lower average test score among participants compared to meta-analysis data from similar studies, which could be

attributable to their home language, socioeconomic status, and limited access to resources necessary for fostering critical thinking skills.

7.2 Recommendations

Considering the evolving landscape of work and life in the 21st century, the Department of Basic Education is strategically positioned to advocate for pedagogical approaches that deliberately foster the growth of critical thinking skills alongside subject-specific conceptual knowledge. When guiding learners in choosing their academic pathways, it is essential to educate them about the significance of selecting subjects that impart domain-specific knowledge and nurture critical thinking abilities. With the rapid advancements in technology and automation, subject-specific knowledge alone is no longer sufficient. Therefore, educational systems should prioritise the cultivation of critical thinking skills by exposing individuals to scenarios that ignite critical thinking skills, dispositions, and abilities in individuals, such as evaluating information skills, deductive and inductive reasoning skills, and the ability to make credible judgements of decisions, that one would have made. Future research endeavours could delve into the impact of incorporating recognised home languages into pedagogical practices and teaching methodologies within academic subject streams to enhance the development of critical thinking skills. Additionally, there is a need to explore the creation of critical thinking skills assessments in recognised home languages, as language plays a pivotal role in shaping thought processes.

7.3 Implications

This study offers an overview of the present state of Grade 11 learners' critical thinking skills across various academic subject streams. The findings indicate that, in general, participants demonstrate notably low competencies in critical thinking. Educators are encouraged to utilise these findings to prioritise activities that foster critical thinking rather than those centred on rote memorisation. Additionally, integrating pedagogical approaches aligned with participants' home languages may enhance their ability to analyse situations effectively instead of navigating the challenges of code-switching, which currently

impedes critical thinking development. Addressing participants' interactions with their lived realities and available resources is essential, and community leaders should play a role in facilitating this aspect to positively influence individuals' critical thinking skills.

7.4 Limitations & Future Research

It is important to acknowledge that the absence of randomised sampling methods in this study restricts the applicability of the findings to the broader Grade 11 learner population. Future research should aim to utilise large, randomised samples in South Africa to establish a more universally relevant understanding of the factors influencing participants' critical thinking abilities.

Furthermore, this study did not thoroughly investigate how the type of mathematics participants were enrolled in might be linked to their critical thinking skills. Subsequent research should explicitly explore the relationship between the types of mathematics available to learners in the South African context and their cognitive abilities.

Although curriculum developers advocate for inquiry-based learning to foster critical thinking skills, this study did not examine whether pedagogy across different subject streams followed this approach. Therefore, differences in critical thinking test scores among learners in different academic streams cannot be solely attributed to the pedagogical methods employed. Future studies should investigate the implementation of inquiry-based learning in classrooms and its correlation with individuals' critical thinking abilities.

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APPENDICES

Appendix 1

Gatekeeper's Permission Letter

DAWNVIEW HIGH SCHOOL
TELEPHONE (011) 828-9014/5
E-mail: secretary@dawnviewhigh.co.za
G.D.E. EMIS NO. 700160291
DAWNVIEW
GERMISTON 1401
P O BOX 2034
PRIMROSE
1416

Darlington M Gorogodo (212539156)
School Of Education
Edgewood Campus
Date: 16/09/2022

Dear DM Gorogodo,

Ref: Permission to Conduct Study Titled: *"Factors Influencing the Development of Critical Thinking Skills of Grade 11 Learners Enrolled in Different Academic Subject Streams"* at Dawnview High School.

In response to your request to be granted permission to conduct a research study titled: *"Factors Influencing the Development of Critical Thinking Skills of Grade 11 Learners Enrolled in Different Academic Subject Streams"* at Dawnview High School. The Principal and the School Management Team have decided to grant Darlington M Gorogodo (212539156) permission to conduct a study at Dawnview High School. The following considerations should be adhered to by the researcher throughout the study.

1. Participation in the study is voluntary and participants can withdraw at any stage of the study without negative consequences.
2. Signed consent to participate in the study should be obtained from parents and guardians of Grade 11 learners and signed assent to voluntarily participate in the study should be obtained from the Grade 11 learners.
3. The study does not interfere with teaching and learning activities at Dawnview High School and only 90 minutes will be allocated for the study as agreed upon by the researcher.
4. The identity of all participants is to be kept anonymous and all collected data is to be kept confidential.

5. Dawnview High School reserves the right to have access to findings generated from the study and a copy of the final thesis is to be issued to the Principal of Dawnview High School before final submission to the University of KwaZulu Natal.
6. Participation in the study is purely for academic purposes and no financial benefits will be offered to participants.

Wishing you all the best in your studies.

Yours Faithfully

The Principal:

Mr Kolokoto [redacted] Date: 20/09/2022

Contact Number: 0832923077

The Deputy Principal:

M. K. Khomalo Date: 20/09/2022

Contact Number: 083 285 6074

School Management Team:

1. DR Kucherera [redacted] Date: 20/09/2022

Contact Number: .....

2. Mr Mxumi Mxumi Date: 20/09/2022

Contact Number: [redacted]

3. Mrs Matthews [redacted] Date: 20/09/2022

Contact Number: 0723705161

4. Mrs Julius [redacted] Date: 20/09/2022

Contact Number: [redacted]

GAUTENG DEPT. OF EDUCATION
DAWNVIEW HIGH SCHOOL
2022 -09- 20
TEL: (011) 820-3114/5
PO BOX 2034, PRIMROSE, 1416

Appendix 2

Authorisation to Use Participants' Biographic Data in Research Study

DAWNVIEW HIGH SCHOOL

TELEPHONE (011) 828 9014/5
E-mail: secretary@dawnviewhigh.co.za
G.D.E EMIS NO. 700160291
DAWNVIEW
GERMISTON 1401

P.O BOX 2034
PRIMROSE
1416

TO WHOM IT MAY CONCERM

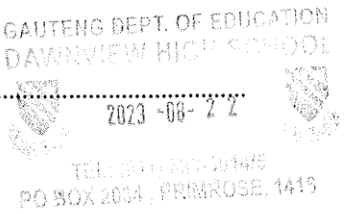
I hereby confirm that Mr. Darlington M Gorogodo, a candidate currently pursuing a master's degree in science education at the University of KwaZulu Natal, bearing the student identification number **212539156**, has been duly authorized to use biographical data pertaining to Grade 11 students who are enrolled at Dawnview High School. The retrieval of this data occurred on the **14th of April 2023**. The dataset includes the following information: learner date of birth, learner residential address, learner home language, and the subjects in which the learners are currently enrolled.

It is expressly granted that Mr. Darlington M Gorogodo may employ this gathered information solely for the purpose of conducting research titled: ***Factors Influencing the Development of Critical Thinking Skills in Grade 11 Learners Enrolled in Different Academic Subject Streams***. Sharing or granting access to this dataset to any other individuals is prohibited. To ensure the utmost confidentiality and anonymity of the students involved, it is strongly recommended that the researcher employs pseudonyms in lieu of actual learner names.

Warm regards,

M.K Khumalo

Deputy Principal



Appendix 3

Ethical Clearance

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

18 November 2022

Darlington Masimba Gorogodo (212539156)
School Of Education
Edgewood Campus

Dear DM Gorogodo,

Protocol reference number: HSSREC/00004869/2022
Project title: Factors influencing the development of critical thinking skills of grade 11 learners enrolled in different academic subject streams.
Degree: Masters

Approval Notification – Expedited Application

This letter serves to notify you that your application received on 07 October 2022 in connection with the above, was reviewed by the Humanities and Social Sciences Research Ethics Committee (HSSREC) and the protocol has been granted **FULL APPROVAL**.

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment/modification prior to its implementation. In case you have further queries, please quote the above reference number. PLEASE NOTE: Research data should be securely stored in the discipline/department for a period of 5 years.

This approval is valid until 18 November 2023.
To ensure uninterrupted approval of this study beyond the approval expiry date, a progress report must be submitted to the Research Office on the appropriate form 2 - 3 months before the expiry date. A close-out report to be submitted when study is finished.

HSSREC is registered with the South African National Research Ethics Council (REC-040414-040).

Yours sincerely,

[redacted]

Professor Dipane Hlalele (Chair)

/dd

Appendix 4

Parent Consent Form

LETTER TO PARENTS REQUESTING PERMISSION FOR CHILD TO PARTICIPATEIN A STUDY

Dear Parent/guardian

My name is Darlington M Gorogodo. I am a student at the University of KwaZulu Natal, currently studying towards a master's degree specialising in Science Education under the supervision of Dr T. Chirikure. I am also a Science and Mathematics Educator at Edenvale Success College. As a requirement for my degree, I will have to conduct a research study which explores factors that influence the development of critical thinking skills of Grade 11 learners under the title: *"Factors Related to the Critical Thinking Skills of Grade 11 Learners Enrolled in Different Academic Subject Streams."*

Your child is part of the targeted participants for the study. The primary purpose of this study is to explore how subject groupings into streams and other numerous factors influence the development of critical thinking skills of Grade 11 learners. To do so, I wish to administer a critical thinking skills test and questionnaire and interview the learners. This study's findings will help understand and explain the factors that influence the development of critical thinking skills. Furthermore, the findings of this study might help various stakeholders in education to understand and address the needto improve the critical thinking skills of individuals in the 21st century.

Therefore, I kindly request your child's participation in this study. There will be no interruption to your child's typical school programme. The school timetable will be followed. All data collected will be treated with confidentiality, and your child's name will not be mentioned anywhere in the thesis write-up.

The information and research data collected from learners will remain confidential and will not be used as school-based assessments. Your child will not be exposed to any

harm, risk, or danger by taking part in this study. Partaking in this study is voluntary, and there will be no negative consequences for refusing to participate.

If you have any questions/concerns or queries related to the study, you may contact me, Mr DM Gorogodo, Cell: 073 956 0375; email: darlingtongorogodo@gmail.com
or my supervisor: Dr Tamirirofa Chirikure
Tel: 0312603470; Email: chirikure@ukzn.ac.za
or UKZN's Research Ethics Committee:
HSSREC Research Office
Tel: 031 260 8350/4557/3587; Email: hssrec@ukzn.ac.za

Please show on the attached form whether you permit your child to participate in this study.

Yours Sincerely,

[redacted]73 956 0375

Email: darlingtongorogodo@gmail.com

PARENT/GUARDIAN CONSENT RETURN SLIP

I..... the parent/guardian of ....., acknowledge that I have read and understood the content of the request that you have sent to me clearly explaining the purpose and intentions of your research study, which is titled: *"Factors Related to the Critical Thinking Skills of Grade 11 Learners enrolled in Different Academic Subject Streams."*

- I understand the purpose and procedures of the study contained in the information sheet.
- I have been given an opportunity to ask questions about the study and have had answers given to my satisfaction.
- I understand that my child may withdraw without prejudice at any time and that their identification will remain anonymous throughout the study.
- I declare that my child's participation in this study is entirely voluntary and that they may withdraw at any time without affecting any of the benefits to which they are usually entitled.
- If I have any further questions/concerns or queries related to the study, I understand that I may contact the researcher, Mr DM Gorogodo, Cell: 073 956 0375; email:darlingtongorogodo@gmail.com
- If I have any questions or concerns about my child's rights as a study participant, or if I am concerned about an aspect of the study or the researcher, then I may contact:

The supervisor:

Dr Tamirirofa ChirikureTel: 0312603470

Email: chirikure@ukzn.ac.za

Or UKZN's Research Ethics Committee:

HSSREC Research Office Tel:

031 260 8350/4557/3587

Email: hssrec@ukzn.ac.za

I, therefore, give consent /do not give consent (please underline your choice) for my child to participate in your study.

(Please tick the appropriate box.)

	Yes	No
My child can be audio-recorded		

Parent/Guardian Signature: ..... Date: .....

Signature of Witness ..... Date: .....

Signature of Translator..... Date.....

(Where applicable)

Appendix 5

Learner Consent Form

LETTER TO LEARNERS REQUESTING CONSENT TO PARTICIPATE IN THE STUDY

Dear learner,

My name is Darlington M Gorogodo. I am a student at the University of KwaZulu Natal, currently studying towards a master's degree specialising in Science Education under the supervision of Dr T. Chirikure. I am also a Physical Sciences and Mathematics Educator at Edenvale Success College. As a requirement for my degree, I will have to conduct a research study which explores factors related to the development of critical thinking skills under the title: *"Factors Related to the Critical Thinking Skills of Grade 11 Learners Enrolled in Different Academic Subject Streams."* The primary purpose of this study is to explorehow subject groupings and various other factors influence the development of critical thinking skills in Grade 11 learners. To do so, I wish to administer a critical thinking skills test and a questionnaire and interview you as a learner.

This study's findings will help understand and explain factors influencing learners' critical thinking skills. Furthermore, the findings of this study might help various stakeholders in education to understand and address the shortage of individuals who possess critical thinking skills.

Therefore, I wish to invite you to participate in this study. There will be no interruption of your typical school programme. The school timetable will be followed. Your name will not be mentioned anywhere in the data analysis.

You will not be exposed to any harm, risk, or danger by participating in this study. Partaking in this study is entirely voluntary, and there will be no negative consequences for refusal to participate. Your responses will remain confidential. Your identity and the name of your school will not be revealed. A letter requesting permission will be sent to your parents, asking them to grant you permission to be involved in the study. You may withdraw from the study at any stage, even after giving consent. The summary of the findings will be made

available to you and your school and shared with policymakers. Please complete the attached assent form and return it to me.

Please do not hesitate to contact me, my supervisor, or the Research Ethics Committee if you have any queries or seek clarity about this research.

Thank you for your kind assistance.Yours Sincerely,

[redacted] | Email: darlingtongorogodo@gmail.comSupervisor:

Dr Tamirirofa Chirikure

Tel: 0312603470

Email: chirikure@ukzn.ac.za

UKZN's Research Ethics Committee:

HSSREC Research Office Tel: 031 260 8350/4557/3587 Email: hssrec@ukzn.ac.za

LEARNER'S CONSENT FORM RETURN SLIP

I……., agree/ do not agree to participate in the study entitled: *"Factors Related to the Critical Thinking Skills in Grade 11 Learners Enrolled in Different Academic Subject Streams"* by Mr D.M Gorogodo.

- I understand the purpose and procedures of the study contained in the information sheet.
- I have been given an opportunity to ask questions about the study and have had answers provided to my satisfaction.
- I declare that my participation in this study is entirely voluntary and that I may withdraw at any time without affecting any of the benefits I am usually entitled to.
- If I have any further questions/concerns or queries related to the study, I understand that I may contact the researcher, Mr DM Gorogodo, cell 073 956 0375; email:darlingtongorogodo@gmail.com
- If I have any questions or concerns about my rights as a study participant, or if I amconcerned about an aspect of the study or the researcher, then I may contact:

The supervisor:

Dr Tamirirofa Chirikure

[redacted]

Email: chirikure@ukzn.ac.za

Or UKZN's Research Ethics Committee:

HSSREC Research Office Tel:

[redacted]

Email: hssrec@ukzn.ac.za

I agree to (please tick in the appropriate box):

	Yes	No
Audio recording		

Learner's Signature: ..... Date.....

Researcher's Signature: ..... Date.....

Appendix 6

Cornell Critical Thinking Skills Test: Level X

CORNELL CRITICAL THINKING SKILLS TEST LEVEL X

GRADE 11 LEARNERS

Thank you for participating in this study that examines the Critical Thinking Skills of Grade 11learners enrolled in different academic subjects' pathways.

Your participation is appreciated and valued.

NAME: .....

SURNAME: .....

DATE: .....

SCORE: .....

INSTRUCTIONS

- This is a test to see how clearly and carefully you think.
- There are seventy-one items. You should be able to finish in the 50 minutes given, but be careful not to waste time.
- Avoid wild guessing, although it is acceptable to make shrewd guesses when you have good clues.
- There is one best answer to each item.
- CIRCLE YOUR ANSWER with a pencil on the answer sheet provided.
- Do not make any marks on this Question Paper.

EXPLORING IN NICOMA

The year is 2052. It is the middle of June. Imagine yourself being in the second group from Earth to land on the newly discovered planet Nicoma. Nothing has been heard from the first group, which landed on Nicoma two years earlier. Your group has been sent to make a report about what happened to the first group.

In this question paper, you will be told about some things learned on Nicoma by your group. Then, you will be given problems that call for clear thinking.

- Answer these problems as if the things you are told are true.
- Do not guess wildly at any answer.
- If you have no idea what the answer is, leave a blank.
- If you have a good idea, even though you are not positive, answer the problem.
- The test has four parts.
- In the first two parts, you must not go back to a problem once you have passed it.
- Now, wait until you are asked to begin.

SECTION I

WHAT HAPPENED TO THE FIRST GROUP?

The first job of your group is to find out what happened to the first group of explorers. Your group has landed on Nicoma and has just discovered the metal huts put up by the first group. From the outside, the huts appear to be in good condition. It is a warm day, and the sun is shining. The trees, rocks, grass, and birds make Nicoma appear like much of South Africa. You and the health officer are the first to arrive at the group of huts.You call out, but you get no answer.

The health officer suggests, *"Maybe they are all dead."* You try to find out if he is right.

Listed below are some facts you learn. You must decide whether each fact supports the health officer's idea or suggests that the health officer's idea is mistaken—or neither.For each fact, mark one of the following on the answer sheet provided:

A. This fact supports the health officer's idea that everyone in the first group is dead.

B. This fact goes against the health officer's idea.

C. Neither: this fact does not help us decide.

1. Here is an example of the kind of problem in this part of the test:

   You go into the first hut. Everything is covered by a thick layer of dust.

   Is this fact for or against the health officer's idea, or neither? It certainly is not enough toprove him right, but it does give some support. If a fact supports the health officer's idea,you should mark an A on your answer sheet. Mark A for Number 1.

2. Mark your answer for this next example:

   Other members of your group discovered the first group's rocket ship nearby.

   The answer is C. Knowing that the first group's rocket ship has been discovered does not help you decide one way or the other. Since this fact does not help you decide whether the health officer is right or wrong, C is correct.

GO ON TO THE NEXT PAGE.

Here is a list of facts. For each one, mark A, B, or C. If you have no idea which to mark, leave a blank and go on to the next one. Consider each fact in the order in which it is numbered. Work carefully, and do not return to a problem once you have passedit.

Reminder—mark as follows:

A. This fact supports the health officer's idea that they are all dead.

B. This fact goes against the health officer's idea.

C. Neither: this fact does not help us decide.

3. There are ten huts. You go into the second hut and again find that everything is covered by a thick layer of dust.
4. You go into the third hut. There is no dust on the cookstove.
5. You find a can opener by the cookstove in the third hut.
6. In the third hut, you find the daily record of a member of the first group. It was written by a man named John Mazibuko. The date of the last entry, July 2, 2050, is one monthafter the arrival of the first group.
7. You find that the two beds in the third hut are covered with a thick layer of dust.
8. You read the first entry in Mazibuko's record: *"June 2, 2050. We arrived today after a tiring trip. We put up the huts near our landing place."*
9. You read the second entry in Mazibuko's record: *"June 3, 2050. There is a plentiful supply of food. Ducks, squirrels, and deer are here and are easily caught."*
10. You read the third entry in Mazibuko's record: *"June 4, 2050. The water in the nearby stream has been tested by our health official. He says it is safe to drink. We are not drinking it yet. We are going to try it with some guinea pigs we brought from Earth."*
11. You read the last entry in the book: *"July 2, 2050. I am getting weaker and cannot hold out much longer."*

12. In different but shaky handwriting below the last entry, you read, *"John Mazibuko died the same day."*
13. The health officer has now looked in each of the ten huts. He reports that there is a thick layer of dust in each of them.
14. You examine the beds in each of the first three huts. You find that in each case, the blankets and sheets are removed from the beds and folded neatly in the carboards.

GO ON TO THE NEXT PAGE.

DO NOT GO BACK TO CHANGE OR GIVE AN ANSWER.

15. The health officer reports that the beds in all the other huts are in the same condition. The blankets and sheets are neatly folded in the carboards.

16. You notice a large heap of soil behind Mazibuko's hut. You examine it and find a stone with these words on it: *"John Mazibuko. July 2, 2050. He died as he lived—with honour."*

17. The first group's truck is missing.

18. In the tenth hut, you find a note dated March 15, 2052:
If anyone should come looking for us, we have all gone exploring in the truck. We plan to head in the direction of the sunrise. (Signed) Captain Moeme, Leader of the Nicoma Explorers.

19. You see a note added at the bottom:
P.S. We plan to be back within a week.

20. Eight members of your group get in one of your group's trucks and head in the east direction. You follow a rough, broad valley for thirty kilometres and find the first group's truck by a stream. The truck looks abandoned.

21. You find a note in the driver's seat:
Engine breakdown. We plan to hike downstream. Perhaps there is a large body of water in that direction. (Signed) Captain Moeme.

22. One of the eight, who is a mechanic, examines the truck's engine. He says that it is in bad condition.

23. You notice that the truck's front tyres are flat.

24. You start to drive downstream since the land is level and clear. After 15 kilometres of driving, you see smoke rising in the distance. As far as you know, there are no volcanoes on Nicoma.

25. You soon come to a cliff too steep for the truck, so all eight of you get out and walktoward the smoke.

GO ON TO THE NEXT PAGE.

DO NOT GO BACK TO CHANGE OR GIVE AN ANSWER.

SECTION II

EXAMINING THE VILLAGE ON NICOMA

It grows dark, so you camp overnight. You set out again in the morning. After walking for anhour, your party comes upon a village of stone huts. The village is empty. The sun is shiningbrightly. Reports are brought to you by other members since you are the leader of the party. You will be given the reports two at a time. Read both and then decide which, if either, ismore believable.

- If you think the first is more believable, mark A on your answer sheet.
- If you think the second is more believable, mark B.
- If you think the two are equally believable, mark C.

Here is an example (for each problem, the statements to decide about are underlined):

26. *A*. The auto mechanic investigates the stream by the village and reports, *"The water is not safe to drink."*

B. The health officer says, *"We cannot tell yet if the water is safe to drink."*

C. A and B are equally believable.

Mark an answer. The correct answer is B. The health officer should know more aboutwhether the water is safe to drink than the mechanic.

Here are some more pairs. Consider each pair in the order it is given. Do not go back to a problem once you have passed it. Remember to decide only about the statements that are underlined.

27. A. The health officer says, *"This water is safe to drink."*

B. Several others are soldiers. One of them says, *"This water supply is not safe."*

C. A and B are equally believable.

28. A. The mechanic says, *"The water looks clear."*

B. The health officer, after making tests, says, *"The water is safe to drink."*

C. A and B are equally believable.

29. A. One soldier looks at some smoke rising. The smoke appears to him to be just behind the largest stone hut, which is on a hill about one hundred meters away. He says, *"The smoke comes from a fire about 100 meters away."*

B. Another soldier, who has just been behind the largest stone hut, says, *"Oh no, the fire is much farther than that."*

C. A and B are equally believable.

GO ON TO THE NEXT PAGE.

30. A. The mechanic made a quick round of the stone huts and heard a noise in the nearest hut. *"There must be someone in that hut,"* he reports.

B. The health officer, who was in the nearest hut for several minutes, reports, *"Nobody is in that hut."*

C. A and B are equally believable.

31. *A.* After examining the nearest hut, the health officer says, *"The first group of explorers built that hut."*

B. The anthropologist (someone who studies the way different races and tribes of people live) also examined the nearest stone hut. He states, *"The first group probably did not build the hut."*

C. A and B are equally believable.

You take your group to the top of the hill behind the largest stone hut to see if you can tell where the smoke is coming from. In the distance, you see a group of about forty moving figures gathered around a smoky fire.

Your captain has offered a large reward to the person who first sees any one of the missing explorers. You would each like the honour of being the first to see them—if they are there. However, at the same time, you are careful because those figures around the fire may be dangerous. There are several pairs of binoculars in the group. The sun is still shining brightly. With binoculars, one can count the logs on the fire.

32. *A.* The mechanic, looking through his binoculars, says, *"They are tan-skinned creatures with furry spots."*

B. The anthropologist, looking through his binoculars, says, *"They do not have furry spots. They are wearing skins of animals."*

C. A and B are equally believable.

33. *A*. The mechanic says, *"I think <u>there are 40 of them.</u>"*

B. The anthropologist says, *"No, I think <u>there are only 37.</u>"*

C. A and B are equally believable.

34. *A*. The anthropologist says excitedly, *<u>"That is Captain Moeme there on the left by himself!"</u>*

B. Then the mechanic reports, *<u>"That is Sergeant Smith, who just stood up on the right."</u>*

C. A and B are equally believable.

35. *A.* One of the soldiers borrows the anthropologist's binoculars and says, *"Yes, that is Sergeant Smith on the right."*

B. At the same time, the health officer, who has borrowed the mechanic's binoculars, says, *"Yes, that is Sergeant Smith on the right."*

C. A and B are equally believable.

Now, if the man on the left is Captain Moeme, the reward goes to the anthropologist. If not, it goes to the mechanic.

36. A. The health officer then looks through his binoculars at the one on the left. *"That is not Captain Moeme,"* he says.

B. The anthropologist, who has his binoculars again, replies, *"Yes, it is."*

C. A and B are equally believable.

Then, the man at the left rejoins the group of figures, and another person takes his place.

37. *A.* The health officer says, *"That new one is not one of the explorers."*

B. The anthropologist agrees, *"You are right; he is not."*

C. A and B are equally believable.

38. *A.* The anthropologist continues, *"And look! There is Captain Moeme facing our way with his hand over his eyes. That is the same person as the one I called Captain Moeme before. I have been following him."*

B. The health officer says, *"Yes, that is Captain Moeme facing us now. However, he is notthe one who was over there on the left. That one is sitting down with his back to us. I have been following him, too."*

C. A and B are equally believable.

You ask them to see if they can agree on the number of beings in the group so that you can give an accurate report.

39.

A. The health officer has had practice counting large numbers of objects on microscope slides. He announces, *"There are exactly 39 figures in that group."* He has been using binoculars.

B. One soldier says, *"No, there are 38."* He also has been using binoculars.

C. A and B are equally believable.

GO ON TO THE NEXT PAGE.

DO NOT GO BACK TO CHANGE OR GIVE AN ANSWER.

40.

A. The mechanic takes his binoculars back from the health officer and makes a count. *"Yes, there are 39 of them,"* he says.

B. The soldier repeats, *"There are only 38."*

C. A and B are equally believable.

The people around the fire get up and start moving toward the village. You quickly take your small party to a place on a nearby hill. There you can see the village without being seen. You want to find out whether this is a friendly village, whether the explorers are prisoners, and how many explorers are left. The mechanic writes down what people say they see.

41.

A. One soldier counts the people as they move around in the village. He reports, *"Only 32 came back from the fire."*

B. Another soldier says, *"You must have missed two. I counted as they moved pastthe big hut, and thirty-four came back. I do not believe any of them came backanother way."*

C. A and B are equally believable.

42.

A. The anthropologist reports, *"One of them had a green hat when they returned from the fire. But he is the only one. I watched them carefully as theywent by the big hut."*

B. The health officer says, *"There are two with green hats. Firstly, I saw one on the left. Later, I saw one way over on the right."*

C. A and B are equally believable.

43. A. A soldier says, *"Five times in the last minute, that one in the green hat has talked to someone and pointed. Immediately, that person has run off in the direction he pointed."*

B. *"He must be the leader,"* adds another soldier.

C. A and B are equally believable.

44. A. *"Look, Captain Moeme and two other explorers are coming up to that one in the green hat, who is pointing to the big hut. The one in the green hat is ordering them to go in,"* the anthropologist says.

B. *"Here comes Sergeant Smith and one other explorer. The one in the green hatis pointing to the big hut. They are going in also,"* adds the anthropologist.

C. A and B are equally believable.

GO ON TO THE NEXT PAGE.

DO NOT GO BACK TO CHANGE OR GIVE AN ANSWER.

45. A. Several more groups of explorers enter the hut. The health officer asks the mechanic, who has been keeping a record, *"How many do you think are in there now? I have told you each time one went in. I think there are thirteen."*

B. The mechanic replies, *"According to my record, there are 14."*

C. A and B are equally believable.

46. A. The anthropologist states, *"That one with the green hat is going into the hut tothe right of the big hut. Three others are following him in."*

B. The health officer says, *"Look, here comes another with a green hat. So, the one in there is not the leader since there are two. Let us check the people whogo into that hut."*

C. A and B are equally believable.

47. *A.* The anthropologist has been describing the people as they go in, trying to get some idea of what they might be like. He states, *"I saw 18 people go into that hut."*

B. The mechanic disagrees, *"According to the record of what you have said, onlySeventeen went in."*

C. A and B are equally believable.

48. *A.* The anthropologist then looks over to the large hut and says, *"Do you see those two men? Perhaps they are guarding the explorers. Oh, look! They are changing positions. The one who is walking stops about fifteen meters from the door, and then the one standing by the door walks over to him."*

B. The health officer says, *"Yes, I have watched them make ten changes now. Butyou have the order wrong. The man by the door leaves his post before the onewho is walking reaches the place where they meet."*

C. A and B are equally believable.

49. *A.* The mechanic, who also has been watching, says, *"I think the health officer is right."*

B. The anthropologist says, *"I think he is wrong."*

C. A and B are equally believable.

50. *A.* One soldier says, *"Oh, look at the tall man. He has an odd way of walking. He brings his left hand across almost to his right shoulder before his left foot touches the ground."*

B. Another soldier replies, *"It is odd. I have been watching him for about five minutes, though, and you have the order backwards. He brings his left hand acrossafter his left foot touches the ground."*

C. A and B are equally believable.

SECTION III

WHAT CAN BE DONE?

With your party, you try to decide whether the villagers are friendly or not. If not, it may be necessary to rescue the explorers. You try to reason things out.

- In each of the problems in this part, you must decide what follows from the reasons given.
- That is, for each problem, suppose that what the person says is true.
- Then, decide what else would have to be true.

Mark A, B, or C, or leave it blank if you do not know. Consider each problem by itself. In thispart, it is all right to go back to a problem after you have passed it. Here is an example:

51. The mechanic says, *"If these beings are people from Earth, then they will welcome us. Certainly, they are people from Earth."*

Which follows?

A. These beings will not welcome us.

B. These beings are not from Earth.

C. These beings will welcome us.

Mark an answer. The correct answer is C. If what the mechanic said is true, then C must also be true. Go on to the rest. There is one best answer for each problem.

52. *"If these beings are from Earth, then another spaceship must have landed on Nicoma. These beings are definitely people from Earth."*

Which follows?

A. Another spaceship has landed on Nicoma.

B. These beings are not from Earth.

C. Another spaceship has not landed on Nicoma.

53. *"If these beings are from Earth, then another spaceship must have landed on Nicoma. However, no other spaceship has landed on Nicoma."*

Which follows?

A. Another spaceship has landed on Nicoma.

B. These beings are not from Earth.

C. These beings came here by mistake.

54. *"Whenever lookouts are used, the groups are unfriendly. Those two women are lookouts."*

Which follows?

A. The groups are friendly.

B. The groups are unfriendly.

C. If groups are unfriendly, lookouts are used.

55. *"All Earth people are able to talk. These are Earth people."*

Which follows?

A. They are able to talk.

B. They are unable to talk.

C. If people are able to talk, they are from Earth.

56. *"If a group of beings is greeted in a friendly manner, the group will be friendly. This group of beings is not friendly to the explorers."*

Which follows?

A. The explorers greeted them in a friendly manner.

B. The explorers did not greet them in a friendly manner.

C. This group of beings was unfriendly before the explorers met them.

57. *"If a group from Earth lands on a planet, the landing is announced throughout the world in newspapers. No landing on Nicoma was announced, except for our landingand the landing of our explorers."*

Which follows?

A. If the newspapers announce a landing, then there has been a landing.

B. The group of beings is from Earth.

C. The group of beings is not from Earth.

58. *"A group that is really unfriendly to outsiders will starve them. Our explorers certainly are not starved."*

Which follows?

A. Our explorers are really friendly.

B. The group of beings is really unfriendly to our explorers.

C. The group of beings is not really unfriendly to our explorers.

59. *"This group is friendly to our explorers. If a group is friendly to another group of beings, it will not put them in prison."*

Which follows?

A. Our explorers were not put in prison.

B. Our explorers were put in prison.

C. Unfriendly groups try to put each other in prison.

60. *"If a group is friendly to another group of beings, it will not put them in prison. A group that is not in prison would be out working on a day like this. Our explorers are not out working."*

Which follows?

A. The group is friendly to our explorers.

B. Unfriendly groups try to put each other in prison.

C. The group is unfriendly to our explorers.

61. *"There have been only two announcements of landings on Nicoma—our landing and the landing of our explorers. All landings of people from Earth on other planets are announced in the newspapers of Earth."*

Which follows?

A. The group of beings is not from Earth.

B. The group of beings is from Earth.

C. The newspapers never make mistakes.

62. *"Look! One of our explorers climbed out a window and started to run away. He stopped running and put his hands up when a sentry aimed a rifle at him and shouted. A friendly group would let its guests leave."*

Which follows?

A. Unfriendly groups put their guests in prison.

B. This group of beings is very careful.

C. This group of beings is unfriendly.

63. *"If we can talk to our explorers, we can find out for sure if these beings will make peace. We can talk to our explorers by sneaking in the back when the guards changeplaces."*

Which follows?

A. We can find out for sure if these beings will make peace.

B. We cannot find out for sure if these beings will make peace.

C. We cannot sneak in the back if the guards are very careful.

64. *"If they are from Earth, they are well armed. If they are well-armed, they must be taken by surprise. They are from Earth, which is certain."*

Which follows?

A. They are poorly armed.

B. They can be approached in peace.

C. We must surprise them.

65. *"If we attack them, we will kill some. If we kill some, we will lose information about Nicoma. Now, we must not lose any information about Nicoma."*

Which follows?

A. We must attack.

B. We must kill some of them.

C. We must not attack.

SECTION IV

REPORTING BACK AND DECIDING WHAT TO DO

After watching the village for about an hour, you lead your party back to the main camp. You send Sergeant Khumalo to report to the captain.

In making her report, she takes certain ideas for granted without actually saying them. They are part of the basis for her reasoning. Your job is to select ideas that she probably takes for granted in this reasoning. Here is an example:

66. *"The explorers cannot escape because they cannot break down the walls of the stone hut."*

Which one of the following is probably taken for granted?

A. The explorers can jump out the window.

B. The guards are alert.

C. All ways of escape, except through the walls, are impossible.

Mark an answer. The correct answer is C. Among the choices, C helps the reasoning the most.

There is one best answer to each of the following. Again, in this part, it is all right to return to a question after you have passed it.

67. *"Since our explorers are prisoners, we cannot talk to them without being discovered."*

Which one of the following is probably taken for granted?

A. In general, prisoners cannot be talked to unless their guards know about it.

B. In general, if we talk to people, they will tell others about it.

C. In general, if we talk to people, they will not tell others about it.

68. *"If we talk reasonably to those beings, they will release our explorers. After all, those beings are human beings, and the release of our explorers would help humanity."* Which is probably taken for granted?

A. When you talk reasonably to human beings, they will act in a way to help humanity.

B. Anything that human beings do is intended to help humanity.

C. You have to talk reasonably to human beings in order to get them to do something.

GO ON TO THE NEXT PAGE.

69. *"The shorter of the two people wearing green hats is a female. I know because I saw her long hair when she removed her hat."*

Which is probably taken for granted?

A. All females have long hair.

B. Only females have long hair.

C. A person wearing a green hat is likely to be a female.

70. *"Since about half of the villagers have very short hair, I think that at least half are male."*

Which is probably taken for granted?

A. Half is female.

B. All males have short hair.

C. Only males have short hair.

71. *"If at least half of them are men, then in a fight, we will have to fight at least half of them."*

Which is probably taken for granted?

A. Women are not fighters.

B. Men are fighters.

C. We cannot beat them all if they are all fighters.

72. *"We need not worry about more than 10 of them at a time since there are only 10 guns."*

Which is probably taken for granted?

A. Guns can hurt us.

B. Knives cannot hurt us.

C. Only guns can hurt us.

73. *"They have only ten guns. I know because each lookout had one gun, and eight guns were stacked in the middle of the village. That is all that could be seen."*

Which is probably taken for granted?

A. All the guns they have are in plain sight.

B. The eight stacked guns are loaded.

C. Guns are their only weapons.

74. *"The villagers did not have any scouts out. This I can tell because we saw none, and we looked carefully."*

Which is probably taken for granted?

A. Scouts are used only by people who want somebody to investigate for them.

B. Scouts can be seen by people who are alert for them.

C. If you see a scout, then that scout has been careless.

75. *"The villagers do not know we are here since there are no scouts out."*

Which is probably taken for granted?

A. If a group knows that another group which might be unfriendly is nearby, the group will have scouts out.

B. If there are scouts out, then the group from which they came knows that another group is nearby.

C. If a village sends out scouts, the villagers suspect trouble.

76. *"The villagers are not from Earth because we have not heard of any other landings on Nicoma by people from Earth."*

Which is probably taken for granted?

A. All landings on planets are announced.

B. All landings by Earth people on planets are announced to other explorers from Earth.

C. Explorers from Earth do not hear of landings by explorers from other planets.

END OF THE TEST

If you have time, you may go back and check over your answers, but only in the last two parts (problems 51 through 76).

Here is the rest of the story: The explorers decided to send a party to see whether the villagers would release the first group without a fight. Nevertheless, they also prepared for an attack in case one should be necessary. Fortunately, the villagers agreed to release the first group. When they learned that the explorers meant no harm, they were happy to release them. In fact, they were glad to have met people from a friendly planet.

Appendix 7

Cornell Critical Thinking Skills Test Level X Marking Scheme

Cornell Critical Thinking Test Level X: MARKING SCHEME

1.			24.	B	✓
2.			25.	C	✓
3.	A	✓	26.		
4.	B	✓	27.	A	✓
5.	C	✓	28.	A	✓
6.	A	✓	29.	B	✓
7.	A	✓	30.	B	✓
8.	C	✓	31.	B	✓
9.	B	✓	32.	B	✓
10.	B	✓	33.	C	✓
11.	A	✓	34.	C	✓
12.	A	✓	35.	C	✓
13.	A	✓	36.	A	✓
14.	B	✓	37.	C	✓
15.	B	✓	38.	B	✓
16.	B	✓	39.	A	✓
17.	B	✓	40.	A	✓
18.	B	✓	41.	B	✓
19.	A	✓	42.	A	✓
20.	A	✓	43.	A	✓
21.	B	✓	44.	B	✓
22.	C	✓	45.	B	✓
23.	C	✓	46.	A	✓

47. B ✓
48. B ✓
49. A ✓
50. B ✓
51.
52. A ✓
53. B ✓
54. B ✓
55. A ✓
56. B ✓
57. C ✓
58. C ✓
59. A ✓
60. A ✓
61. C ✓
62. C ✓
63. A ✓
64. C ✓
65. C ✓
66.
67. A ✓
68. A ✓
69. B ✓
70. C ✓
71. B ✓
72. C ✓
73. A ✓
74. B ✓
75. A ✓
76. B ✓

Appendix 8

Interview Schedule

Thank you for agreeing to participate in the interview phase of this study titled Factors Influencing the Development of Critical Thinking Skills in Grade 11 Learners Enrolled in Different Academic Subject Streams. This phase of the study aims to give an in-depth understanding of how numerous factors can influence the development of Grade 11 learners' thinking skills. The interview will take approximately 30 minutes, and I have a list of questions to remind me of the key aspects of this interview. You are reminded that you are free to ask questions about the study and other issues at any given time during the interview, and please do not hesitate to do so.

1. You have just begun Grade 11. Has it started in the way you expected?
2. How did you choose the subjects you are currently doing in Grade 11?
3. Which career expectations in the future influenced your choice of subjects?
4. What is your understanding of what critical thinking skills entail?
5. In your view, which subjects can influence the development of critical thinking skills?
6. How can school activities such as participation in class discussions influence how individuals think?
7. Of the subjects you are enrolled on, are there any that have influenced the development of your thinking skills, and how have they played a part in developing your thinking skills?
8. Should being academically intelligent be equated to being a critical thinker?
9. What is your view on all school subjects taught and assessed using learners' home language?
10. Do you think that your home language and experiences in the societal context influence how you understand concepts that you are taught at school?
11. How would you describe differences if they exist in female learners' thinking skills compared to their male counterparts?

12. In your view, do you think adults are better thinkers than young people?
13. What might influence differences in thinking skills, if any, between adults and younger people?
14. Do you think the community you are raised in influences how you think and solve problems?
15. In your own words, describe an ideal community that influences how people think and solve problems in daily activities.
16. What aspects of using technology in our day-to-day lives can influence the development of thinking skills?
17. How would you feel about your school introducing training activities that influence the development of your critical thinking skills?
18. How can parents or guardians of learners in Grade 11 assist in helping learners develop their thinking skills?
19. How would you describe the connection between wealth and the ability to think critically?
20. Is there something you wish to bring to my attention that you consider vital in influencing how critical thinking skills can be developed?

Appendix 9

Focus Group Interview Transcript

Interviewer Details: Darlington M Gorogodo

Student Number: 212539156

Interview Site: Dawnview High School

Date: 03 June 2023

Interviewees:

25th Percentile			
ID	Gender	Academic Grouping	Score
136	male	Human Sciences and Social Services	22
102	female	Commerce and Business	23
71	female	Science and Technology	31
50th Percentile			
ID	Gender	Academic Grouping	Score
96	male	Human Sciences and Social Services	29
5	female	Commerce and Business	29
18	female	Science and Technology	34
75th Percentile			
ID	Gender	Academic Grouping	Score
65	female	Human Sciences and Social Services	33
135	male	Commerce and Business	35
40	female	Science and Technology	47

1: How have you started your new academic year?

Participant 40:

The experiments we have conducted in the lab have been both eye-opening and hands-on, giving me a deeper understanding of scientific concepts.

Interviewer: What type of work have you done so far in the laboratory, and how has this work been beneficial to your studies?

The practical demonstrations and simulations helped solidify my understanding of these complex ideas. I am constantly amazed by the wonders of the natural world and the knowledge we gain through scientific exploration. I cannot wait to continue expanding my understanding and delving into more advanced topics throughout the year.

1: How have you started your new academic year?

Participant 96:

I am grateful for the knowledge and skills I am gaining in social sciences subjects. In fact, education is a powerful tool that can help break the cycle of poverty, and I am determined to use it to create a better future for myself and my family.

Interviewer: So, you are determined to make a difference in your community?

Yes, the subjects I am currently doing have made me reflect on the inequalities and injustices in our society and inspired me to work towards positive change.

1: How have you started your new academic year?

Participant 102:

The journey may be tough, but I am committed to putting in the effort and seeking assistance when needed. I know perseverance and a positive mindset will ultimately help me succeed in Commerce in my grade 11 academic year.

Interviewer: in your own words, what has been so challenging so far?

The theories and models we have learnt about have sometimes been hard to understand, and I have struggled to apply them to real-world scenarios as required by my teacher. However, I am determined to work hard and develop a deeper understanding of economic principles by seeking clarifications and actively participating in class discussions.

2. How did you choose your subjects and link them to your career?

Participant 18:

I sought advice from my teachers, mentors, and family members, who supported and guided me through the subject selection process. Their insights and experience helped me gain a broader perspective on the benefits and relevance of each science subject.

Interviewer: So, have you always had a passion for science?

Yes, I can say that I have always had a passion for the sciences, and I do find the exploration of the natural world and the understanding of its interconnected parts genuinely fascinating. With this in mind, I knew pursuing science subjects in grade 11 would be my natural choice.

Interviewer: What else did you consider when selecting your subjects for Grade 11?

I also considered my future career aspirations. I have always had a strong interest in pursuing a medical career, making biology an essential subject for me. The foundational knowledge and understanding gained in biology would be crucial for my further studies and potential career opportunities, and I was also told that Mathematics and physical sciences are also important subjects.

2. How did you choose your subjects and link them to your career?

Participant 96:

The potential benefits and relevance of these subjects for my future. I do not have a specific career path in mind now, but I recognise that social science subjects provide a broad range of skills and knowledge that can be valuable in various fields like teaching and nursing. Also, I wanted to do subjects that will improve my thinking, research skills, and understanding of human behaviour and help develop transferable skills that can benefit me in future endeavours. I have also always been fascinated with understanding the past, how societies have evolved, and the impact of historical events. Geography interested me in the lower grade due to its exploration of physical landscapes and the interplay between humans and their environment.

2. How did you choose your subjects and link them to your career?

Participant 136:

Choosing subjects for social sciences was a challenging experience for me, primarily because the school selected them on my behalf. I have been struggling with the content of these subjects, affecting my motivation and engagement in the classroom. However, I have tried to improve the situation and find ways to overcome these difficulties.

Interviewer: Which Subjects were chosen for you, and do you know why?

The subjects chosen for me were history and geography. Although the subjects may not align perfectly with my interests, I have been open to exploring these subjects and finding aspects I can connect with. I have always been undecided about what I want to do in life, and I am just that person.

3. What are your career expectations, and how did this influence the choice of subjects?

Participant 5:

When choosing my social sciences subjects, I considered my personal interests and strengths. History and geography are the two subjects that caught my attention, and I have always done well in the lower grades. Despite my struggles at home, I still found these subjects intriguing and believed they held the potential for personal growth and learning.

I also tried to connect the social sciences subjects to real-life examples and situations. This approach helps me better understand and appreciate the relevance of the content, making it more engaging and relatable. By relating the concepts to my personal experiences and interests, I found overcoming the difficulties I encountered easier.

3. What are your career expectations, and how did this influence the choice of subjects?

Participant 71:

Mathematics and English are often considered foundational subjects that enhance critical thinking, problem-solving, and communication skills. These skills are valuable in almost any profession, and I expect to use these skills when I start working. Choosing a variety of subjects will allow me to explore my interests and passions, which may eventually guide me towards a specific career path. For instance, studying science subjects could open

doors to fields such as engineering or healthcare, while social sciences could lead to careers in psychology or social work. So basically, I can say my choice of subjects in grade 11 was influenced by my focus on building a solid foundation of knowledge, developing transferable skills, and exploring various fields of study. By staying open-minded and actively engaging in different learning experiences, I believe I can be better prepared to make informed decisions about my future career when the time comes.

3. What are your career expectations, and how did this influence the choice of subjects?

Participant 65:

I have decided to pursue a career in medicine, so I had to prioritise subjects like biology, chemistry, and physics. These subjects would provide essential knowledge and understanding of the human body and scientific principles and serve as prerequisites for medical programs in the future. By excelling in these subjects, I think I can lay a strong foundation for my chosen career and increase my chances of getting into a reputable medical school. I also seek out relevant extracurricular activities, volunteer work, or internships that can provide hands-on experience and exposure to my chosen career field. These experiences would not only strengthen my application to future educational programs but also provide a deeper understanding of the industry and help me confirm my passion and commitment to my chosen career, align with my chosen profession, provide a strong foundation for future studies, and enhance the necessary skills for success in my field.

4. What is your understanding of what critical thinking skills mean?

Participant 71:

I think critical thinking skills refer to the ability to objectively analyse, evaluate, and interpret information or situations that you are given anywhere. Critical thinking also involves actively questioning ideas from other people and, of course, your own ideas, considering different perspectives, and making reasoned judgements based on evidence. If you develop critical thinking skills, you become a more effective problem-solver and decision-maker and can think independently. I also think critical thinking is an essential skill that helps us analyse, evaluate, and make informed decisions about the world around us,

even what happens at school. Critical thinking plays a crucial role in problem-solving, scientific inquiry, and decision-making processes in subjects like Science and Technology.

4. What is your understanding of what critical thinking skills mean?

Participant 135:

My teacher once told us that you need to be able to analyse and recognise assumptions to be called a critical thinker. So, I think being aware of the underlying assumptions that shape the information or arguments presented to me in any context. I also think questioning these assumptions helps uncover lies, assess potential risks, and make informed decisions.

Interviewer: So, how do you think all these things that you are saying are part of critical thinking?

We usually spend so much time engaging in discussions with classmates, and Mam (Madam or Teacher) always encourages us to talk about things she says it is good for us, and we should also try to talk to industry professionals to gain diverse perspectives. We also actively participate in debates to defend our opinions and challenge others' ideas constructively. So, I think engaging in dialogue can sharpen your critical thinking skills and expose you to diverse ways of approaching challenges.

5. Which subjects do you think influence the development of critical thinking?

Participant 65:

I think history does help in improving critical thinking skills.

Interviewer: Why do you say that? What is in History that you believe helps in developing critical thinking skills?

Studying history encourages critical thinking as we analyse past events and how some people were cruel to others. We also do activities in interpreting primary and secondary sources, and that is so difficult as we do not think the same people are not the same, and we usually evaluate our different perspectives on the meaning of source-based pictures and cartoons. I do not want to lie; it is so boring and difficult. History also allows us as learners to question the validity of historical narratives that older people usually always boast about,

assess evidence, and draw informed conclusions about the causes and consequences of historical events.

I also think analysing economic systems, decision-making processes, and the allocation of resources in simulated environments, like what we do in economics, helps you to think as learners learn to evaluate the consequences of economic policies, assess the reliability of economic data, and understand the impact of several factors on the economy. Critical thinking skills are essential in understanding economic concepts and making informed judgements about economic phenomena. I also think that without good English, critical thinking becomes difficult. I see it when I sometimes do not understand the question, but it becomes easy when the teacher explains what the question means in my own language. So, my friends and I have decided to take English classes seriously as English promotes critical thinking skills, especially when analysing literature in those books written in some difficult Shakespeare.

5. Which subjects do you think influence the development of critical thinking?

Participant 135:

To me, it is business studies as we directly engage in critical thinking activities by analysing real-world business scenarios, like this load-shedding thing. If I were there at the top, I would solve this issue once. We also evaluate case studies and apply business concepts to solve problems. I will definitely start my own business as I am good at analysing the validity of business strategies, analysing market trends, and making informed decisions based on financial data and ethical considerations. I also think economics helps in developing thinking, especially when examining the principles of supply and demand, analysing economic systems, and exploring the impact of monetary policies. As learners, we are also encouraged to evaluate the consequences of economic decisions, assess the reliability of data, and analyse several factors affecting markets and industries.

Interviewer: What about Mathematics and science subjects?

Basically, all the subjects like accounting, Mathematics and English are essential and help develop critical thinking skills as this is all about solving problems, and your peers and community members will say you are smart. However, it is essential to note that critical thinking skills are not confined to specific subjects alone, like this thing of saying science learners are better thinkers than us. Critical thinking skills can be developed and applied across different subject fields, including commerce.

5. Which subjects do you think influence the development of critical thinking skills?

Participant 65:

Personally, I think Geography helps develop critical thinking skills through the study of spatial relationships, human-environment interactions, and analysis of data. I learn to interpret maps, analyse geographic patterns, and assess the impact of physical and human factors on societies. Geography prompts me to think critically about the consequences of environmental changes, resource distribution, and social inequalities. Source-based questions in history also have helped me develop analysis and evaluation skills, and that is what critical thinking skills are all about.

5. Which subjects do you think influence the development of critical thinking?

Participant 40:

Physical sciences challenge us to understand the fundamental laws that govern the universe. It requires us to analyse complex phenomena, apply mathematical concepts, and make logical connections. I say Physical sciences prompts us to think critically about cause and effect, consider multiple approaches to problem-solving, and evaluate the validity of scientific models and theories. In fact, I think all science subjects are essential in developing critical thinking skills.

Interviewer: Which Science Subjects?

I mean the likes of Life sciences, as well as Chemistry and Mathematics. You see, these subjects deal with theorems that are so difficult to understand and remember. I even wonder where I will use all these things we learn, but my maths teachers always say it is not

about using them, but training your mind is important, so I guess I am now a critical thinker. I also wish we had IT at this school, as my dad always talks about jobs in the future requiring people who can do coding and understand what they do in IT.

6. Do you think academic intelligence is the same as critical thinking skills?

Participant 5:

I think academic intelligence often emphasises the mastery of content, factual recall, and performance on standardised tests or exams, which can be achieved through cramming. It is vital for passing exams and tests and for academic success, as well as demonstrating proficiency in each subject. However, it does not necessarily lead to strong critical thinking skills. As I remember I said, critical thinking competence goes beyond rote memorisation and requires the ability to question assumptions and analyse information from multiple perspectives. Critical thinking involves logical reasoning, problem-solving, evaluating evidence, and making informed judgements. Critical thinking is applicable across various subjects and is valuable for real-life decision-making and problem-solving. Some people are always passing in different subjects, but they do not think.

Interviewer: How do you know that these people do not think?

You see it in what they do when you ask them simple things; they try to show off by explaining a lot instead of just giving you an answer. That is not being a good thinker, but they waste time for nothing. Some learners may excel academically but struggle with critical thinking, while us others with lower academic achievements possess exceptional critical thinking abilities. I am not saying those who are good at maths or science do not think, but it is not about that. It is an advantage to think and be intelligent. I wish I were like that.

6. Do you think academic intelligence is the same as critical thinking skills?

Participant 102:

I think our school should also try to teach us how to think together with our study subjects. Some people there always say we do not think, and we are wasting time coming to school. These days, it is about making money, and we should start thinking about making money, not learning about all those dead people in history and the mountains.

6. Do you think academic intelligence is the same as critical thinking skills?

Participant 71:

I believe critical thinking skills should be considered a form of intelligence and should not be equated solely to academic intelligence. While I agree that academic intelligence focuses on acquiring knowledge and performing well in academic tasks, critical thinking competence involves the ability to analyse, evaluate, and apply that knowledge thoughtfully and creatively. To me, critical thinking skills encompass the ability to think independently, question assumptions like others have said, consider multiple perspectives, and solve complex problems. These skills are not limited to specific academic subjects but are applicable across various areas of life. Critical thinking enables us to approach challenges with a discerning mindset, make informed decisions, and adapt to new situations effectively.

Interviewer: I hear you saying questioning assumptions. What is an assumption?

When people talk about your stories without proof, we say that those people are assuming things, and they should bring the evidence. When they go to look for evidence, that is what I mean by questioning the assumptions they have about you.

7. What is your view of all school subjects taught and assessed using learners' home language?

Participant 18:

That is a good idea, especially for protecting our home language and its easy-to-understand things. I think we think in our home language. The danger is how then do, we collaborate with other learners in other countries, especially when we go to universities. So, even if it is an advantage for those who use English, I think it is better to use English.

7. What is your view of all school subjects taught and assessed using learners' home language?

Participant 136:

Who even chose English? I think in this country, the language we use for learning should be from my kasi. We should vote, and I think IsiZulu would win, and we all learn in that language for a change.

Interviewer: What do you mean by language from my kasi?

Kasi simply means where we stay, like in the locations, and we use our languages. One day, when I become president, all schools will use that language; it will be so cool. So, guys, remember to vote for me.

7. What is your view of all school subjects taught and assessed using learners' home language?

Participant 5:

You see for me, I do not even have one home language; I speak so many languages. When I was in a creche, I spoke Shona, and when my parents came to South Africa, I had to learn Afrikaans and English fast at the school we went to, but most of my friends speak so many other languages, so I really do not mind which language is used in class as I am good at all of them. You can try teaching me in Chinese, and I will understand.

Interviewer: How do you say critical thinking in Chinese?

I am still learning, Sir, but soon I will tell you.

8. Do you think that your home language and experiences in the societal context influence how you understand concepts that you are taught at school?

Participant 71:

Of course, I think my thinking is definitely influenced by things I have been taught and experienced at home and my cultural values. I think this is the same for everyone here; how can you start thinking about things you do not know?

Interviewer: But did we not say that being a critical thinker means being able to analyse and evaluate situations that might be new to us? So, are you saying you are not a critical thinker?

I am a good thinker, but I use what I have been taught and experienced in my life to solve problems. I also have my values that do not allow me to think about some ways to solve problems; like, even if I feel that my mother is doing something wrong, I cannot just tell her she is wrong. I always follow what she says, even if sometimes it does not make sense. However, I have faith in how she solves problems.

8. Do you think that your home language and experiences in the societal context influence how you understand concepts that you are taught at school?

Participant 18:

In my case, there is no relationship between where I stay and what we are taught at school. In my area, you hear a gunshot every night, and people drink until midnight. That does not influence how I understand things in class. I aim to change my life, move away from that house, and start my own thing.

Interviewer: So, your society has made you see the importance of education?

I cannot say that, but I just do not want to live my life the same way as most people in my community. I want a better life.

8. Do you think that your home language and experiences in the societal context influence how you understand concepts that you are taught at school?

Participant 96:

My parents are so supportive and want me to achieve at school, so my parents support me with all that I need, and this influences me, or, I can say, forces me to learn hard and understand all that my teachers say in class. So yes, my experiences at home definitely influence how I understand things or how I try to understand things in class.

9. How would you describe differences if they exist in female learners' thinking skills compared to their male counterparts?

Participant 135:

As boys, we always want to appear as we think a lot, but I do not think we are better than girls. If you look at my science class, there are only 8 or 10 boys who do physical sciences, and there are more than 30 girls in that class, so I think girls are better than boys.

9. How would you describe differences if they exist in female learners' thinking skills compared to their male counterparts?

Participant 136:

We think in the same way, Sir. That is why we are mixed in the classes at this school and write the same type of exams. No one is better at thinking between boys and girls.

9. How would you describe differences if they exist in female learners' thinking skills compared to their male counterparts?

Participant 40:

If you look at some of the things men in this country do, it seems men do not think at all. You see them urinating everywhere, and these days, if you do not respond when they greet you, they beat you. People who think do not do that to others, and most men think that drinking alcohol is cool and do not want to look for jobs. Sir, even coming to school to them is a waste of time, so I think we, as women, are better thinkers.

9. How would you describe differences if they exist in female learners' thinking skills compared to their male counterparts?

Participant 96:

It is not that boys do not think, but look, it is better to forget about school and just become a soccer player and make more money; all girls like money. That is what I think. Am I lying, girls? If I were a smart science teacher and stood next to a soccer player with lots of money, who would you choose? So, we are better at thinking about making money, not using people for their money.

10. In your view, do you think adults are better thinkers than young people?

Participant 102:

Older people do not think better, but they just have life experience, and most never went to school.

Interviewer: Are you saying those who have some form of education are better thinkers?

Yes, sometimes older people with some education are better than those who want to act like they know everything. Besides, things have changed; what is important these days is not what they know about. Some of them cannot even use social media.

10. In your view, do you think adults are better thinkers than young people?

Participant 65:

I think some of them were better thinkers in their time, and some of them are still better thinkers as they do not do funny stuff like us. I have always admired my teachers; they are smart, think a lot and live nice lives.

Interviewer: What do you mean by nice life?

Just look outside the cars teachers drive and how teachers dress so education pays. It pays to be smart in class, but I want to be a better person, definitely not a teacher, maybe a lawyer, and lawyers think more than teachers. Teachers say the same thing all the time, but lawyers save people from going to jail even if these people would have committed the crime, which is being smart.

10. In your view, do you think adults are better thinkers than young people?

Participant 5:

Guys, adults do think. Look at sir; he is at university and doing his masters. I do not think I will ever be able to do that, so some of them think better than we do.

11. Do you think the community you are raised in influences how you think and solve problems?

Participant 135:

I think yes, especially your friends in your area can influence you to think about bad stuff like drinking and smoking.

Interviewer: What about solving problems?

The community sometimes influences how problems are solved; even if the methods might not be nice to others, but the problem will be solved. In my area, the way we solve problems involves burning tyres, and I do not think there is any thinking in that.

11. Do you think the community you are raised in influences how you think and solve problems?

Participant 40:

Sir, you know what? Where I stay the whole street, most of the people have some academic qualifications, which puts pressure on me to work hard at school and become like them. It is like fashionable to have a degree, and they always look smart when they are talking about general stuff and always play on their computers and brag about saving the world. This really influences my desire to be able to solve problems, too, and be a better thinker.

12. In your own words, describe an ideal community that influences how people think and solve problems in daily activities.

Participant 102:

People are generally good at different things and have different ways of solving problems, so I think a community that includes different races and cultures will influence the creation of various methods to solve problems.

12. In your own words, describe an ideal community that influences how people think and solve problems in daily activities.

Participant 96:

I agree with her, and I also think that communication in communities is important. Sometimes, we end up looking as if we do not think because there is a lack of communication, even here at school; if we communicate nicely, everything will be okay.

12. In your own words, describe an ideal community that influences how people think and solve problems in daily activities.

Participant 5:

A community in which everyone is respected and given a chance to at least try or give their ideas will definitely assist in developing thinkers as sometimes some people just ignore you and do not listen to what you have to say.

12. In your own words, describe an ideal community that influences how people think and solve problems in daily activities.

Participant 96:

I also think a community in which the leaders are willing to teach us as young people how things are done is necessary for developing people who can solve problems on their own in the future and improve their thinking skills from learned experiences.

13. What do you consider to be aspects of using technology in our day-to-day lives that can influence the development of thinking skills?

Participant 71:

The internet is a must these days; all the information you want is available, and we now know a lot of things about what is happening, and this helps in our thinking. If teachers do not explain things well, you can always use YouTube to improve how you understand things.

Interviewer: But is this not improving your academic intelligence?

Yes, but no one is academically intelligent without being able to think first. These things are the same. You need to think to be intelligent.

13. What do you consider to be aspects of using technology in our day-to-day lives that can influence the development of thinking skills?

Participant 102:

In our class, we have chat groups and discuss everything, even leaked question papers. Moreover, technology has helped us to solve the problem of always getting low marks. In our group now, no one is failing.

Interviewer: So, the problem you have solved here is the failing problem, not solving real-world problems?

Aibo, to us, failing is a real-world problem, Sir. So, we had to think fast to solve that problem. Plus, everyone is doing it, and if you do not use technology these days, you will look like you do not think. Sometimes, you also need to be careful with the information you get from these social media; there is a lot of fake news and filters.

14. How would you feel about your school introducing training activities that influence the development of your critical thinking skills?

Participant 18:

That is a great idea. I have heard people talking about thinking skills being important in the future when machines and robots take over everything. It will also help improve our performance in tests and exams as we are currently just cramming facts and not really thinking about what we are taught.

14. How would you feel about your school introducing training activities that influence the development of your critical thinking skills?

Participant 136:

Eish, I think it is going to be a problem as some of our teachers also do not think, and some of the things the school makes us do not make any sense.

14. How would you feel about your school introducing training activities that influence the development of your critical thinking skills?

Participant 65:

Is it going to be another subject or what?

Interviewer: It can be a subject, yes or just training sessions on a regular basis, let us say once or twice a term.

I do not think I will manage with another subject, so if it is training from university professionals, I think it will be a good idea. Nevertheless, we will definitely benefit from such training.

14. How would you feel about your school introducing training activities that influence the development of your critical thinking skills?

Participant 40:

I think that it is an excellent idea that we will be able to practice these thinking skills and be able to analyse information effectively.

15. How can parents or guardians of learners in Grade 11 assist in helping learners develop their thinking skills?

Participant 5:

To start with, I think parents should have meaningful discussions with us at home. Sometimes, my mother asks about confusing things that do not make sense to me. When I answer, she does not allow me to give my opinions, and sometimes she even gets angry with me, so sometimes I just keep quiet. Nevertheless, at least my parents buy data for me to access the internet and find information on some important stuff rather than reading books.

15. How can parents or guardians of learners in Grade 11 assist in helping learners develop their thinking skills?

Participant 96:

At home, we debate everything with my parents, and you need to defend your views; otherwise, you always lose and will not get the things you want.

15. How can parents or guardians of learners in Grade 11 assist in helping learners develop their thinking skills?

Participant 71:

Parents always want to fight with us. Parents think that we, as children, do not think. My parents bought us board games, and my parents said if we played games like chess, we would become better thinkers and strategists.

15. How can parents or guardians of learners in Grade 11 assist in helping learners develop their thinking skills?

Participant 136:

I think parents should just let us get into trouble and let us solve our problems on our own. I am talking from experience; if you are in trouble, you will think. Imagine a girl saying I am pregnant and am coming to stay with you when you are just in grade 11. As a man, you need to think fast.

15. How can parents or guardians of learners in Grade 11 assist in helping learners develop their thinking skills?

Participant 135:

Parents need to be exemplary in their thought process, not just punish us for nothing without thinking things through and try to look at things the same way we do and act; sometimes, we make mistakes as we are just kids.

16. How would you describe the connection between wealth and the ability to think critically?

Participant 65:

To me, all rich people think better than other people. Have you ever seen that when rich people say something or give someone advice on solving problems, everyone listens to them and agrees with them?

16. How would you describe the connection between wealth and the ability to think critically?

Participant 136:

I wonder which people she is talking about. Have you seen how most wealthy people cannot even use simple things like a stove as they always have someone to do that for them? They cannot even think about solving their problems and are always suffering from funny things like anxiety, but we people with low incomes think and solve our problems without anyone to help us.

16. How would you describe the connection between wealth and the ability to think critically?

Participant 40:

Obviously, being wealthy has the advantage of allowing people to get whatever they want, and their children will go to good schools where the teachers are qualified to teach them how to think better. Their schools also have subjects like coding, which teaches them how to think; here, we have only CAT (computer application and technology).

I heard some of them even send their children to check their brains and get medication to help them concentrate and think better. That is so cool. I wish we had that money at home so I could also get checked, and maybe my thinking would improve.

16. How would you describe the connection between wealth and the ability to think critically?

Participant 96:

Being wealthy is an advantage. Have you seen some of the things we are asked about in the test? Some of us have never experienced them in tourism; they will ask you about time zones. I do not understand why some places will have their own times. But there is this guy in my class who explained to me that he once went to another country and arrived there the previous day as our times are different or something like that. So, it is better for them to experience many of these things as they have the money to travel everywhere.

17. Is there something you wish to bring to my attention that you consider vital in influencing how critical thinking skills can be developed?

Participant 136:

Next time, we should also talk about some drugs that people use that help in improving thinking. Sir, have you ever heard about weed(marijuana) helping people to think?

Participant 40:

As we do science, I always wonder who taught those old scientists to think about some of the things we learn. I do not think we can just start thinking about them. Maybe they were aliens. Sir, do you believe that there are aliens somewhere in this world?

Appendix 10

Themes Derived from the Focus Group Interview Transcript

Theme 1 Academic subject stream selection and using academic intelligence as a gauge for competence in critical thinking skills
• At times, learners are placed in subject streams chosen by parents and guardians, leading to difficulties in these subjects that subsequently affect skill development. • The presence of social injustices influences subject choices. • Subject selections are not made with the primary aim of fostering the development of critical thinking skills. • Academic intelligence should not be conflated with critical thinking abilities; while the former indicates proficiency in memorising and reproducing facts within standardised tests, it does not necessarily correspond to one's aptitude for critical thinking. • The acquisition of academic knowledge does not necessarily result in the development of critical thinking skills. • The advancement in academics, often seen as the capacity for critical thinking, is positively influenced by factors such as age in the context of developing critical thinking skills. • Participation in formal education can enhance an individual's cognitive abilities by means of the experiences encountered throughout their schooling journey.
Theme 2 Defining critical thinking skills
• Critical thinking skills encompass the capacity to identify implicit assumptions influencing available information, construct arguments, and guide the creation of well-informed decisions. • Engaging in discussions and being exposed to experienced professionals within the industry can significantly impact fostering the growth of critical thinking skills. • In an age characterised by the prevalence of misinformation, the significance of critical thinking skills cannot be overstated.
Theme 3 The influence of economic status on the development of critical thinking skills
• One's economic status affects access to resources, a diverse range of teachers, various subjects, and medical assistance to enhance cognitive abilities. • One's economic status does not indicate their level of critical thinking skills or proficiency in problem-solving. • Engagement of the community in fostering the growth of critical thinking abilities • There is no correlation between community and experiences in relation to the development of critical thinking. • Promoting inclusivity within the community concerning racial diversity can impact the advancement of critical thinking abilities, given that issues are addressed using a variety of problem-solving methodologies.

Theme 4
The Influence of gender individuals critical thinking skills
• Gender does not have an impact on critical thinking. • Gender shapes critical thinking skills, with evidence suggesting that females excel in this area. This is apparent from the enrolment numbers of all genders in subjects that are perceived to demand advanced thinking abilities. • Behaviours such as domestic violence exhibited by males can indicate deficiencies in their critical thinking abilities.
Theme 5
Impact of academic disciplines on the development of critical thinking skills
• Pursuing various subjects contributes to cultivating critical thinking skills, a manifestation of which can be observed in one's adeptness at problem-solving. • Examine the elements related to analysis, assessment, and evaluation within the Human Sciences and Social Services fields, considering their role in fostering the growth of critical thinking abilities. • Thoroughly examine the necessity of problem-solving and the process of evaluation within the realm of physical sciences. • The field of Business Studies facilitates the enhancement of critical thinking skills by analysing real-world challenges. This includes evaluating problem-solving approaches within economic systems and assessing the outcomes of economic policies and decisions. • Challenges in Linking Theory with Reality • Studying history can foster the development of critical thinking. • Enhancing academic knowledge can result in the improvement of critical thinking skills. • Possessing proficiency in academic knowledge and critical thinking skills offers a distinct advantage. • Physical sciences can influence the development of critical thinking skills. • Education is focused on attaining conceptual comprehension. • Subjects related to Science and Information Technology (IT). • Business studies stand out because they involve direct engagement in critical thinking exercises through analysing real-world business situations. For instance, considering challenges like load shedding, I would strive to resolve such issues promptly if I were in a leadership position. Additionally, the subject entails evaluating case studies and applying business theory.

Theme 6
The influence of an Individual's age and parental involvement in the development of critical thinking skills
• Age does not have a direct correlation with the presence of critical thinking skills. Nevertheless, experiences are frequently misconstrued as indicative of one's critical thinking abilities. • Parents and guardians provide guidance to individuals in selecting subjects solely for career-oriented reasons. • Parents can impact skill development by displaying their own thinking abilities to their children.
Theme 7
The use of home language, technology, and pedagogy for the development of critical thinking skills
• In a globalised context, the impact of collaboration is not always guaranteed, leading to a debate about whether the factor of home language profoundly influences critical thinking. • The language used for instruction should align with the participant's home language. • Schools should implement a pedagogy that fosters the development of critical thinking skills. • Certain educators lack proficiency in pedagogy and didactics focused on cultivating critical thinking. • Utilising technology within chat groups to address and resolve issues.
Theme 8
Unanticipated Theme
• The usage of drugs can impact the development of critical thinking abilities. • The potential impact on critical thinking might arise from extraterrestrial entities.

Appendix 11

Participants' Academic Subject Groupings

ID	Subject one	Subject two	Subject three	Subject four	Core Mathematics/Mathematical literacy	Academic Subject Stream
1	Economics	Business Studies	Life Sciences		Mathematical Literacy	Commerce and Business
2	Business Studies	Physical Sciences	Life Sciences	Accounting	Core Mathematics	Science and Technology
3	Economics	Business Studies	Computer Application Technology		Core Mathematics	Commerce and Business
4	Business Studies	Physical Sciences	Computer Application Technology		Core Mathematics	Science and Technology
5	Tourism	History	Business Studies		Mathematical Literacy	Commerce and Business
6	Business Studies	Accounting	Economics		Core Mathematics	Commerce and Business
7	Tourism	History	Geography		Mathematical Literacy	Human Sciences and Social Services
8	Physical Sciences	Life Sciences	Accounting		Core Mathematics	Science and Technology
9	Tourism	History	Computer Application Technology		Mathematical Literacy	Human Sciences and Social Services and Services
10	Tourism	History	Business Studies		Mathematical Literacy	Commerce and Business
11	Business Studies	Physical Sciences	Life Sciences		Core Mathematics	Science and Technology

ID	Subject one	Subject two	Subject three	Subject four	Core Mathematics/Mathematical literacy	Academic Subject Stream
12	Economics	Consumer Studies	Life Sciences		Mathematical Literacy	Commerce and Business
13	Economics	Tourism	History		Mathematical Literacy	Commerce and Business
14	Tourism	History	Geography		Mathematical Literacy	Human Sciences and Social Services and Services
15	Tourism	Consumer Studies	History		Mathematical Literacy	Human Sciences and Social Services and Services
16	Geography	Business Studies	Life Sciences		Mathematical Literacy	Commerce and Business
17	Business Studies	Physical Sciences	Life Sciences	History	Core Mathematics	Science and Technology
18	Business Studies	Physical Sciences	Life Sciences		Core Mathematics	Science and Technology
19	Geography	Life Sciences	Computer Application Technology		Mathematical Literacy	Human Sciences and Social Services and Services
20	Tourism	Business Studies	Geography		Mathematical Literacy	Commerce and Business
21	Tourism	Business Studies	Computer Application Technology		Mathematical Literacy	Commerce and Business
22	Geography	Life Sciences	Physical Sciences		Core Mathematics	Science and Technology
23	History	Geography	Computer Application Technology		Mathematical Literacy	Human Sciences and Social Services and Services

ID	Subject one	Subject two	Subject three	Subject four	Core Mathematics/Mathematical literacy	Academic Subject Stream
24	Tourism	Consumer Studies	Computer Application Technology		Mathematical Literacy	Human Sciences and Social Services and Services
25	Physical Sciences	Life Sciences	Computer Application Technology		Core Mathematics	Science and Technology
26	Tourism	Geography	Computer Application Technology		Mathematical Literacy	Human Sciences and Social Services and Services
27	Tourism	Consumer Studies	Geography		Mathematical Literacy	Human Sciences and Social Services and Services
28	Life Sciences	History	Computer Application Technology		Mathematical Literacy	Human Sciences and Social Services and Services
29	Physical Sciences	Life Sciences	Accounting		Core Mathematics	Science and Technology
30	Geography	Physical Sciences	Life Sciences		Core Mathematics	Science and Technology
31	Consumer Studies	Business Studies	History		Mathematical Literacy	Commerce and Business
32	Life Sciences	Business Studies	Economics		Core Mathematics	Commerce and Business
33	History	Life Sciences	Geography		Mathematical Literacy	Human Sciences and Social Services and Services
34	Computer Application Technology	Geography	Physical Sciences		Core Mathematics	Science and Technology

ID	Subject one	Subject two	Subject three	Subject four	Core Mathematics/Mathematical literacy	Academic Subject Stream
35	History	Geography	Computer Application Technology		Mathematical Literacy	Human Sciences and Social Services and Services
36	Business Studies	Physical Sciences	Life Sciences		Core Mathematics	Science and Technology
37	Economics	Business Studies	History		Mathematical Literacy	Commerce and Business
38	Physical Sciences	Life Sciences	Computer Application Technology		Core Mathematics	Science and Technology
39	Computer Application Technology	Geography	Physical Sciences		Core Mathematics	Science and Technology
40	Computer Application Technology	Business Studies	Physical Sciences		Core Mathematics	Science and Technology
41	Life Sciences	Business Studies	Geography		Mathematical Literacy	Commerce and Business
42	Tourism	Business Studies	History		Mathematical Literacy	Commerce and Business
43	Tourism	Consumer Studies	Geography		Mathematical Literacy	Human Sciences and Social Services and Services
44	Physical Sciences	Life Sciences	Computer Application Technology		Core Mathematics	Science and Technology
45	Physical Sciences	Life Sciences	Geography		Core Mathematics	Science and Technology

ID	Subject one	Subject two	Subject three	Subject four	Core Mathematics/Mathematical literacy	Academic Subject Stream
46	History	Geography	Computer Application Technology		Mathematical Literacy	Human Sciences and Social Services and Services
47	Consumer Studies	Business Studies	History		Mathematical Literacy	Commerce and Business
48	Tourism	History	Geography		Mathematical Literacy	Human Sciences and Social Services and Services
49	Tourism	Consumer Studies	Geography		Mathematical Literacy	Human Sciences and Social Services and Services
50	Tourism	Business Studies	Geography		Mathematical Literacy	Commerce and Business
51	Tourism	Business Studies	Economics		Mathematical Literacy	Commerce and Business
52	Economics	Business Studies	History		Mathematical Literacy	Commerce and Business
53	History	Geography	Life Sciences		Mathematical Literacy	Human Sciences and Social Services and Services
54	Economics	Business Studies	Consumer Studies		Mathematical Literacy	Commerce and Business
55	Life Sciences	Business Studies	Geography		Mathematical Literacy	Commerce and Business
56	Physical Sciences	Life Sciences	Geography		Core Mathematics	Science and Technology
57	Economics	Business Studies	History		Mathematical Literacy	Commerce and Business

ID	Subject one	Subject two	Subject three	Subject four	Core Mathematics/Mathematical literacy	Academic Subject Stream
58	Business Studies	Accounting	Economics		Core Mathematics	Commerce and Business
59	History	Geography	Computer Application Technology		Mathematical Literacy	Human Sciences and Social Services and Services
60	Life Sciences	Business Studies	History		Mathematical Literacy	Commerce and Business
61	Consumer Studies	Business Studies	Computer Application Technology		Mathematical Literacy	Commerce and Business
62	Geography	Computer Application Technology	Physical Sciences		Core Mathematics	Science and Technology
63	Tourism	Business Studies	Geography		Mathematical Literacy	Commerce and Business
64	Economics	Business Studies			Mathematical Literacy	Commerce and Business
65	Tourism	Consumer Studies	Geography		Mathematical Literacy	Human Sciences and Social Services and Services
66	Accounting	Business Studies	Economics		Core Mathematics	Commerce and Business
67	Tourism	Consumer Studies	History		Mathematical Literacy	Human Sciences and Social Services and Services
68	Consumer Studies	History	Life Sciences		Core Mathematics	Science and Technology
69	Tourism	Consumer Studies	History		Mathematical Literacy	Human Sciences and Social Services and Services

ID	Subject one	Subject two	Subject three	Subject four	Core Mathematics/Mathematical literacy	Academic Subject Stream
70	Economics	Business Studies	Computer Application Technology		Mathematical Literacy	Commerce and Business
71	Business Studies	Physical Sciences	Life Sciences		Core Mathematics	Science and Technology
72	Tourism	Accounting	History		Mathematical Literacy	Commerce and Business
73	History	Business Studies			Mathematical Literacy	Commerce and Business
74	Business Studies	Physical Sciences	Computer Application Technology		Core Mathematics	Science and Technology
75	Business Studies	Physical Sciences	Life Sciences		Core Mathematics	Science and Technology
76	Life Sciences	Business Studies	Economics		Mathematical Literacy	Commerce and Business
77	Accounting	Business Studies	Economics		Mathematical Literacy	Commerce and Business
78	Tourism	History	Geography		Mathematical Literacy	Human Sciences and Social Services and Services
79	Tourism	Business Studies	History		Mathematical Literacy	Commerce and Business
80	Tourism	History	Computer Application Technology		Mathematical Literacy	Human Sciences and Social Services and Services
81	Tourism	Business Studies	History		Mathematical Literacy	Commerce and Business

ID	Subject one	Subject two	Subject three	Subject four	Core Mathematics/Mathematical literacy	Academic Subject Stream
82	Geography	Business Studies	Life Sciences		Mathematical Literacy	Commerce and Business
83	Geography	Physical Sciences	Life Sciences		Core Mathematics	Science and Technology
84	History	Geography	Life Sciences		Mathematical Literacy	Human Sciences and Social Services and Services
85	Tourism	Economics	History		Mathematical Literacy	Commerce and Business
86	Consumer Studies	Business Studies	Computer Application Technology		Mathematical Literacy	Commerce and Business
87	Computer Application Technology	Physical Sciences	Life Sciences		Core Mathematics	Science and Technology
88	Tourism	Life Sciences	Geography		Core Mathematics	Science and Technology
89	Physical Sciences	Life Sciences	Geography		Core Mathematics	Science and Technology
90	Tourism	History	Geography		Mathematical Literacy	Human Sciences and Social Services and Services
91	Tourism	Business Studies	Geography		Mathematical Literacy	Commerce and Business
92	Business Studies	Accounting	Economics		Core Mathematics	Commerce and Business
93	Tourism	Consumer Studies	History		Mathematical Literacy	Human Sciences and Social Services and Services

ID	Subject one	Subject two	Subject three	Subject four	Core Mathematics/Mathematical literacy	Academic Subject Stream
94	Tourism	History	Geography		Mathematical Literacy	Human Sciences and Social Services and Services
95	History	Life Sciences	Computer Application Technology		Mathematical Literacy	Human Sciences and Social Services and Services
96	Life Sciences	History	Computer Application Technology		Mathematical Literacy	Human Sciences and Social Services and Services
97	Physical Sciences	Life Sciences	Accounting		Core Mathematics	Science and Technology
98	Tourism	History	Geography		Mathematical Literacy	Human Sciences and Social Services and Services
99	Economics	Business Studies	Computer Application Technology		Mathematical Literacy	Commerce and Business
100	Tourism	History	Geography		Mathematical Literacy	Human Sciences and Social Services and Services
101	Business Studies	Physical Sciences	Life Sciences		Core Mathematics	Science and Technology
102	Economics	Business Studies	Accounting		Mathematical Literacy	Commerce and Business
103	Economics	Business Studies	History		Mathematical Literacy	Commerce and Business
104	Tourism	Business Studies	Geography		Mathematical Literacy	Commerce and Business

ID	Subject one	Subject two	Subject three	Subject four	Core Mathematics/Mathematical literacy	Academic Subject Stream
105	Tourism	Business Studies	Economics		Mathematical Literacy	Commerce and Business
106	Life Sciences	Business Studies	History		Mathematical Literacy	Commerce and Business
107	History	Business Studies	Computer Application Technology		Mathematical Literacy	Commerce and Business
108	Physical Sciences	Life Sciences	History		Core Mathematics	Science and Technology
109	Physical Sciences	Computer Application Technology	History		Core Mathematics	Science and Technology
110	Economics	Business Studies	History		Mathematical Literacy	Commerce and Business
111	Physical Sciences	Life Sciences	Geography		Core Mathematics	Science and Technology
112	Consumer Studies	Business Studies	History		Mathematical Literacy	Commerce and Business
113	Tourism	Business Studies	Geography		Core Mathematics	Commerce and Business
114	Tourism	Consumer Studies	History		Mathematical Literacy	Human Sciences and Social Services and Services
115	Tourism	Business Studies	History		Mathematical Literacy	Commerce and Business
116	Tourism	Economics	History		Mathematical Literacy	Commerce and Business

ID	Subject one	Subject two	Subject three	Subject four	Core Mathematics/Mathematical literacy	Academic Subject Stream
117	Business Studies	Accounting	Economics		Core Mathematics	Commerce and Business
118	Tourism	Consumer Studies	History		Mathematical Literacy	Human Sciences and Social Services and Services
119	Economics	Business Studies	History		Mathematical Literacy	Commerce and Business
120	Life Sciences	Business Studies	Geography		Core Mathematics	Science and Technology
121	Tourism	Business Studies	History		Mathematical Literacy	Commerce and Business
122	Tourism	Life Sciences	Geography		Mathematical Literacy	Human Sciences and Social Services and Services
123	Geography	Business Studies	Computer Application Technology		Mathematical Literacy	Commerce and Business
124	Physical Sciences	Life Sciences	Geography		Core Mathematics	Science and Technology
125	Tourism	Consumer Studies	History		Mathematical Literacy	Human Sciences and Social Services and Services
126	Life Sciences	Geography	Computer Application Technology		Mathematical Literacy	Human Sciences and Social Services and Services
127	Tourism	Business Studies	Economics		Mathematical Literacy	Commerce and Business
128	History	Business Studies	Computer Application Technology		Core Mathematics	Commerce and Business

ID	Subject one	Subject two	Subject three	Subject four	Core Mathematics/Mathematical literacy	Academic Subject Stream
129	Tourism	Business Studies	History		Mathematical Literacy	Commerce and Business
130	Tourism	History	Geography		Mathematical Literacy	Human Sciences and Social Services and Services
131	History	Geography	Life Sciences		Mathematical Literacy	Human Sciences and Social Services and Services
132	Tourism	Consumer Studies	Geography		Mathematical Literacy	Human Sciences and Social Services and Services
133	Life Sciences	Business Studies	Computer Application Technology		Core Mathematics	Science and Technology
134	Life Sciences	Business Studies	Economics		Mathematical Literacy	Commerce and Business
135	Tourism	Business Studies	Geography		Mathematical Literacy	Commerce and Business
136	Tourism	History	Geography		Mathematical Literacy	Human Sciences and Social Services and Services
137	Economics	Business Studies	Computer Application Technology		Mathematical Literacy	Commerce and Business
138	Economics	Business Studies	Computer Application Technology		Mathematical Literacy	Commerce and Business
139	Economics	Business Studies	History		Mathematical Literacy	Commerce and Business

ID	Subject one	Subject two	Subject three	Subject four	Core Mathematics/Mathematical literacy	Academic Subject Stream
140	Tourism	Business Studies	History		Mathematical Literacy	Commerce and Business
141	Accounting	Geography	Life Sciences		Mathematical Literacy	Commerce and Business
142	Life Sciences	Economics	Geography		Core Mathematics	Commerce and Business
143	Tourism	History	Geography		Mathematical Literacy	Human Sciences and Social Services and Services
144	Tourism	Business Studies	Geography		Mathematical Literacy	Commerce and Business
145	Tourism	History	Geography		Mathematical Literacy	Human Sciences and Social Services and Services
146	Economics	Business Studies	Computer Application Technology		Mathematical Literacy	Commerce and Business
147	Economics	Business Studies	History		Mathematical Literacy	Commerce and Business
148	Economics	Business Studies	Computer Application Technology		Mathematical Literacy	Commerce and Business
149	Consumer Studies	Business Studies	Computer Application Technology		Mathematical Literacy	Commerce and Business
150	Tourism	Business Studies	Geography		Mathematical Literacy	Commerce and Business
151	Physical Sciences	Life Sciences	History		Core Mathematics	Science and Technology

ID	Subject one	Subject two	Subject three	Subject four	Core Mathematics/Mathematical literacy	Academic Subject Stream
152	Consumer Studies	Business Studies	Geography		Mathematical Literacy	Commerce and Business

Appendix 12

Turnitin Report

Turnitin Originality Report

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Factors Influencing the Development of Critic... By Darlington M Gorogodo